STRATEGIES FOR THE PREVENTION OF TYPE 2 DIABETES MELLITUS AMONG ADULTS IN BALE ZONE, SOUTH EAST ETHIOPIA

BY

TESFAYE ASSEFA TADESSE

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SUPERVISOR:

PROF. ZODWA MARGARET MANYISA

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DECLARATION

Student number: 58552286

I declare that **STRATEGIES FOR THE PREVENTION OF TYPE 2 DIABETES MELLITUS AMONG ADULTS IN BALE ZONE, SOUTH EAST ETHIOPIA** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete reference and that this work has not been submitted before for any others degree at other institutions.

10 NOVEMBER 2023

SIGNATURE **DATE**

TESFAYE ASSEFA TADESSE

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This thesis work is dedicated to my late brother, Girmaye. May his soul rest in peace. This thesis is also dedicated to all Ethiopian adults who have lost their lives due to diabetes mellitus and are currently suffering from the sequel due to DM-related preventable diseases and complications.

STRATEGIES FOR THE PREVENTION OF TYPE 2 DIABETES MELLITUS AMONG ADULTS IN BALE ZONE, SOUTH EAST ETHIOPIA

Student number : 58552286

Student : Tesfaye Assefa Tadesse

Doctor : Public Health

Department : Health Studies

Supervisor : Prof Zodwa Margarert Manyisa

ABSTRACT

The purpose of this study was to develop strategies to prevent type 2 diabetes mellitus (T2DM) among adults in the Bale Zone, south-east Ethiopia.

The study was organised into three phases. Phase I involved a population-based quantitative descriptive cross-sectional design to determine the prevalence of T2DM, analyse its risk factors, and describe adults' knowledge and perceptions towards T2DM risky behaviours and their prevention among adults in the Bale Zone administrative towns. It involved 557 adults aged 18 and above. The data was collected using a structured questionnaire for the interview, physical measurements, and fasting blood glucose testing. Phase II focused on an unmatched case-control study to identify determinants of T2DM and involved 182 T2DM patients and 362 control adults without diabetes from selected hospitals in the Bale Zone using a structured questionnaire, physical measurements, mental stress, and food insecurity. The data were processed using the statistical package for social sciences (SPSS) version 25 and STATA software version 14 for both phases 1 and 2 of the study. The validity and reliability of the data were ensured. The rigour of the data in phases 1 and 2 of the study was ensured through validity and reliability. Simple descriptive statistics and multivariate logistic regression were used to analyse the data. The study was conducted with consideration for ethical principles of research such as beneficence, justice, informed consent, respect for individuals, privacy and confidentiality, and scientific integrity.

In phase III, based on the findings of the two phases of the study, an extensive literature review, and expert opinions, the researcher developed strategies for the prevention of T2DM in adults.

In Phase I, the prevalence of T2DM was found to be 6.7%, with only 8.2% aware of their status. Factors such as not eating fruit, eating animal fat, not engaging in vigourous-intensity physical activity related to work, having a higher BMI, and having high blood pressure (hypertension) have all been significantly associated with T2DM.

In terms of knowledge about T2DM risky behaviours and prevention, 42.6% of respondents had a "low" level, 38.3% had a "medium" level, and 19.1% had a "high" level. The majority of respondents demonstrated high perceptions of susceptibility, severity, and the benefits of applying preventative activity to T2DM.

In phase II, the determinants of T2DM were age over 50 years, male sex, primary and secondary education, medium wealth index ,ever smoking, current alcohol use, food insecurity, and mental stress.

The prevalence of T2DM in the study area was higher than the national prevalence in Ethiopia and has become a significant public health problem, yet there are limited efforts or activities to prevent it. The developed strategies from this research, if implemented, will help reduce the burden of T2DM among adults in Ethiopia.

Key words: Adult, food insecurity, knowledge , mental stress, perception,prevention, prevalence, risk factors ,type 2 Diabetes mellitus, strategies, Ethiopia.

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LIST OF ABBREVIATIONS AND ACRONYMS

AOR	Adjusted Odds Ratio
BMI	Body Mass Index
BP	Blood Pressure
BSc	Bachelor of Science
CDC	Center of Disease Control
CI	Confidence Interval
Cm	Centimeter
COR	Crude Odds Ratio
CSA	Central Statistics Agency
CVD	Cardiovascular Disease
DBP	Diastolic Blood Pressure
DM	Diabetes Mellitus
DPP	Diabetes Prevention Program
DPPOS	Diabetes Prevention Program and Outcomes Study
ETB	Ethiopian Birr
FBG	Fasting Blood Glucose
FMoH	Federal Minister of Health
GBD	Global Diabetes Burden
HBM	Health Belief Model
Hg	Mercury
HH	Household
HIV	Human Immunodeficiency Virus
HR	Hazard Risk
ICT	Information Communication Technology
IDF	International Diabetes Federation
IDPP-1	Indian Diabetes Prevention Program
IQR	Interquartile Range
Kg	Kilogram
LMIC	Low and Middle-Income Countries

Mm	Millimeter
mmHg	Millimeter of mercury
MPH	Master of public health
MSc	Master of Science
NCDs	Non-Communicable Diseases
NGO	Non- Government Organization
OPD	Outpatient department
OR	Odds Ratio
P-value	Probability value
RCT	Randomized Control Trial
RHB	Regional Health Bureau
RRR	Relative Risk Ratio
SA	South Africa
SBP	Systolic Blood Pressure
SD	Standard Deviation
SPSS	Statistical Package for the Social Sciences
SSA	Sub-Saharan Africa
SRQ	Stress Related Question
UDM	Undiagnosed of Diabetes
UK	United Kingdom
Unisa	University of South Africa
USA	United States of America
USD	American dollar
WC	Waist Circumference
WHO	World Health Organization
WHR	Waist to Hip Ratio
WHtR	Waist to Height Ratio
WI	Wealth Index
X2	Chi-square

CHAPTER 1 - ORIENTATION TO THE STUDY

1.1 INTRODUCTION

This chapter describes the research problems, purpose, and questions that the study seeks to answer. The significance of the study, important concepts and definitions, the research paradigm and theoretical framework, as well as the research design and methodology, are all covered in this chapter. Furthermore, it provides a description of the scope of the study and the overall structure of the thesis.

1.2 BACKGROUND TO THE RESEARCH PROBLEM

Diabetes Mellitus (DM) is defined as a serious, long-term condition that develops when the body cannot produce any or enough amounts or cannot effectively use the insulin that is produced (Saeedi, Petersohn, Salpea, Malanda, Karuranga, Unwin, Colagiuri, Guariguata, Motala, Ogurtsova &Shaw 2019:107843).

Diabetes Mellitus is categorised as a major non-communicable disease (NCD), addressed by the World Health Organization (WHO) in the global action plan for the prevention and control of NCD (WHO 2013). The WHO report from 2016 states that DM is a group of metabolic diseases characterised by chronically high blood sugar levels brought on by a deficiency of insulin secretion, insulin action, or both (WHO 2016:11).The three main types of DM are type 1 DM, T2DM and gestational DM, and the less common types of DM are monogenic DM and secondary DM (Cho, Kirigia, Mbanya, Ogurstova, Guariguata, & Rathmann 2017: 1-150).

Type 2 diabetes mellitus (T2DM) is characterised by abnormally elevated blood glucose caused by decreased function of the insulin-secreting beta cells of the pancreas and insulin resistance in the body's insulin-sensitive tissues (Kahn, Cooper & Del Prato 2014:1068-1083). When insulin resistance is present, larger amounts of insulin are required in order for the resistant tissue to respond; however, the dysfunctional beta cells are not able to meet this need (Kahn, Cooper & Del Prato 2014:1068-1083). Furthermore,

evidence suggests that advancing age, family history, and ethnicity are non-modifiable factors that influence beta cell function decline. On the other hand, increased adiposity as a result of obesity, sedentary lifestyle, and a poor-quality diet has been linked to the development of insulin resistance (Kahn, Cooper & Del Prato 2014:1068-1083). Thus, the development of T2DM is influenced by a combination of non-modifiable risk factors and modifiable lifestyle factors.

T2DM is one of the most common non-communicable diseases in the world, and its rate is progressively increasing, particularly in developing countries (Whiting, Guariguata , Weil & Shaw 2011: 311), and it accounts for 90% to 95 % of DM (WHO 2016:8). The causes of T2DM are not completely understood but are widely believed to result from a combination of genetic predisposition and lifestyle factors and is characterized by insulin resistance and/or decreased insulin secretion (Cho et al 2017:1-150). Prior to the disease actually manifesting itself there is a phase of impaired glucose regulation during which the risk to the cardiovascular system has already risen. Poor dietary practises, insufficient physical exercise, and rising obesity are significant lifestyle factors that either facilitate or accelerate the manifestation of T2DM (Schulze & Hu 2005:445).

T2DM is the most common form of DM worldwide, accounting for more than 90 % of cases (Saeedi et al 2019:107843). The estimates do not distinguish between type 1 DM and T2DM; however, the majority, over 90%, of DM cases are T2DM. Thus, the greater concern related to DM and its complication is associated with T2DM. To this end, therefore identification of modifiable risk factors and the adoption of an appropriate lifestyle are essential in preventing T2DM.

As one of the fastest-growing global health emergencies of the 21st century DM is an illness that kills silently (Whiting et al 2011:311–21). It is a chronic progressive condition that results in significant morbidity, premature death, and is an economic burden to any healthcare system.

According to the International Diabetes Federation (IDF) report of 2019, an estimated 463 million adults aged 20–79 years worldwide have DM, which accounted for 9.3% of the globally, and this figure is projected to be 578.4 million, and 700 .2 million by 2030 and 2045 respectively (Saeedi et al 2019:107843). In the same year, it reported that DM killed 4.2 million people. More than 79% of morbidity and 88% of mortality in adults (Saeedi et al 2019:107843) resulting from DM occurred in low- and middle-income

countries (LMIC) in 2019. In 2017, as many as five million people aged 20 to 99 years died from DM-related mortality worldwide (Saeedi et al 2019:107843). This makes DM more lethal than the combined death toll from HIV/AIDS (1.5 million), tuberculosis (1.5 million), and malaria (0.6 million), with almost half (46.6%) of the deaths under 60 years of age (International DM Federation; 2015). By the end of 2045, it is expected that the DM scourge will have affected nearly 10.9% (700 million) people worldwide (Saeedi et al 2019:107843).

Diabetes mellitus is a major public health problem in Africa today (Kengne et al 2013:302-313). According to the 2019 IDF Africa report, approximately 19 million adults (20-79 years) live with DM, reflecting a regional prevalence of 3.9%; it is projected that this will rise to 47 million by 2045. Additionally, the current proportion of all deaths due to DM occurring before the age of 60 in Africa is 73%, compared to 31% in Europe (Saeedi et al 2019:107843). This implies that DM is already a major burden in Sub-Saharan Africa (SSA). Nonetheless, health expenditure for DM in SSA in 2017 equalled only 1% of the total global expenditure on DM (Saeedi et al 2019:107843). As of 2019 there were about 17.2 million more men than women in Africa living with DM (Aschner 2017:169 ; Saeedi et al 2019:107843). Among DM adults, 79% lived in LMIC where 1 in 5 has DM between the ages of 65 and above. In addition, scholars suggest that individuals with DM have higher morbidity and mortality rates, as well as higher healthcare cost, than the general population. Thus, in 2019, it accounted for at least $760 billion in health expenditure, 10% of total adult spending (Aschner 2017:169-170; Saeedi et al 2019:107843).

The burden of DM among adults aged 20-79 years was estimated at 10.8 million in sub-Saharan Africa, from these more than 50% live in four highly populated countries namely: South Africa (12.8 %), the Democratic Republic of Congo (4.8%), Nigeria (3%) and Ethiopia (3.2%) (Ogurtsova, da Rocha Fernandes, Huang, Linnenkamp, Guariguata, Cho, Cavan, Shaw, & Makaroff 2017: 40-50).

Ethiopia, as one of the developing countries, has been showing changes particularly in recent decades, that change the lifestyle of the people towards urbanisation, dietary change, and reduced physical activity,. These rapid changes have led to the emergency of non-communicable diseases (NCDs) such as DM (Cho, Yue, & Leung 2005:29–38). Ethiopia is one of the SSA countries with the highest prevalence of DM. Ethiopia is placed fourth among the top five African member countries of the IDF (32 countries), having 1.7 million people with DM (age 18–99) (Saeedi et al 2019:107843). In 2017, according to

the IDF report, national DM prevalence among individuals aged 20–79 was estimated to be 5.2% in Ethiopia; there are 2.6 million DM cases in the country (Federation ID 2017:905–911), and the total number of DM-related deaths was 31,536. Further, it has been reported that in the country, about two-thirds of adults with DM are undiagnosed (Ogurtsova et al 2017:40–50). Ethiopia is the leading country in the number of DM among IDF regions in Africa (Cho et al 2017:1-150).

The main factors that contribute to the rise of DM in SSA are epidemiological transition, population, and lifestyle changes (Kengne, Amoah, & Mbanya 2005:3592–3601). A recent systematic review conducted in Ethiopia shows that the prevalence of DM varies from 0.3 to 7.0% (Bishu, Jenkins, Yebyo, Atsbha, Wubayehu, & Gebregziabher 2019: 100132).

T2DM has become a major public health challenge in both developed and developing countries as one of the four major NCDs. T2DM is prevalent and increasing throughout the world. According to the recent Global Burden of Disease Study, over half a billion people worldwide had T2DM in 2017, with 22 million new cases being reported each year (James, Abate D, Abate K, Abay Abbafati, ,Abbasi, Abbastabar, Abd-Allah, Abdela, Abdelalim & Abdollahpour 2018:1789). This rise is attributed to increasing life expectancy, economic development, and urbanisation, which has led to more sedentary lifestyles and increased consumption of unhealthy foods linked to obesity (Basu, Yoffe ,Hills &Lustig 2013:1-7).

The burden of DM is reflected in several ways, which includes premature mortality, morbidity, psychologic distress and depression, and economic loss (Leon & Maddox 2015:1246). Evidence shows that multiple risk factors, including behavioural, biological, metabolic, and environmental factors, are linked to the development of pre-diabetes and DM. Some risk factors are modifiable and some are non-modifiable (Arokiasamy, Salvia & Selvamani 2020:1-44). Overall, DM significantly increases the risk of costly problems such as emotional distress, heart attack, kidney damage, blindness, neural damage leading to amputation, and decreased quality of life (Mbanya, Motala, Sobngwi, Assah & Enoru 2010:2254–2266).

Several studies have established a strong relationship between risk factors and the development of T2DM. Obesity and being overweight are the most significant risk factors for T2DM (WHO 2016). Body mass index (BMI) and waist-to-hip ratio (WHR) are also important predictors of T2DM (Arokiasamy, Salvia & Selvamani 2020:1-44). Excess body

fat, an overall measure of multiple types of diet and physical activity, is the strongest risk factor for T2DM, both in terms of the clearest evidence base and the highest relative risk. It is projected that overweight and obesity account for a large proportion of the global diabetes burden, along with physical inactivity (GBD 2015:2287–323). The increased risk of T2DM is associated with a higher waist circumference (WC) and a higher BMI, although the relationship may vary across different populations.

In Ethiopia, the prevalence of DM varies from region to region. Studies in Ethiopia report the prevalence of DM in the range from 0.5 to 8.3% (Asmelash & Asmelash 2019:1–6; Worede, Alemu, Gelaw & Abebe 2017:251; Wondemagegn, Bizuayehu, Abie , Ayalneh, Tiruye & Tessema 2017:18 ; Gebreyes, Goshu, Geletew , Argefa, Zemedu, Lemu, Waka, Mengesha, Degefu, Deghebo & Wubie 2018 :6- 7, Aynalem & Zeleke 2018:4 and Workneh, Bjune& Yimer 2016: 1-11). Likewise, the prevalence of undiagnosed diabetes mellitus (UDM), defined as those who are unaware of raised blood sugar levels and are not taking DM medication, was high in Ethiopia (Asmelash & Asmelash 2019:1–6; Worede et al 2017:251; Wondemagegn et al 2017:18-21, Gebreyes et al :6–7; Aynalem & Zeleke 2018:4; Bantie, Wondaye, Arike, Melaku, Ejigu, Lule, Lingerew & Tamirat 2019 : 3-5).

Previous community-based studies conducted elsewhere indicate that T2DM prevalence ranges from 1.4% to 19.1% (Animaw &Seyoum 2017:6; Ebrahimi, Emamian,Shariati, Hashemi & Fotouhi 2016:189; Gatimu, Milimo & Sebastian 2016:9), with concomitant factors associated such as age, educational attainment, work status, fruit and vegetable consumption, physical activity, smoking, and alcohol intake, as well as a positive family history of diabetes mellitus. Animaw &Seyoum 2017:6, Gatimu, Milimo, & Sebastian 2016:9. For instance, the study Increasing prevalence of diabetes mellitus in a developing country and its related factors by Animaw and Seyoum (2017:7) revealed that the prevalence of DM was 3.3%. Another cross-sectional study undertaken among adults in Dessie town, northern Ethiopia, found that the adult population had a prevalence of type 2 diabetes (6.8%) and pre-diabetes (15.7%), respectively. Diabetes mellitus (DM) was found to be significantly associated with systolic hypertension, overweight, smoking, a positive family history of diabetes mellitus (PFHDM), and hypercholesterolemia (Endris, Worede, & Asmelas 2019:2803).

A cross-sectional survey conducted in urban north-west Ethiopia showed the prevalence of DM and pre-diabetes to be 6.34% and 9.31%, respectively. Being over 30 years old was found to be significantly associated with DM, whereas eating vegetables one to three days per week was found to be a protective factor for DM (Wolde, Derso & Biks 2020:3). Another study conducted on T2DM among government employees in Harar, eastern Ethiopia, identified factors associated with T2DM. A ten-point increase in systolic blood pressure raises the risk of T2DM by 6% and was shown to be strongly correlated with hypertension, while consuming fruit and vegetables for 3 days was found as a protective factor for T2DM (Ayana, Bacha , Roba & Kebede: 2015. 71:77).

T2DM risk factors for Ethiopia in 2019 were cigarette smoking (2.7%), inadequate physical inactivity (33.3%), a higher BMI (≥ 25 kg/m2) (20.2%), alcohol use (14.6%), and khat (chat) chewing (10.7%) (Kassa & Woldesemayat 2019:1–7).

Diabetes mellitus complications, particularly cardiovascular disease (CVD), are the leading cause of morbidity and mortality among individuals with T2DM (Chatterjee, Khunti & Davies 2017:2239-2251; Zheng, Ley, & Hu 2018:88–98). Moreover, DM is one of the most expensive chronic diseases in the world (Care 2018:917). Despite spending large amounts of resources, management of DM remains challenging (Bahrami et al 2016:1594–1608; Stanton 2014:S1–S2; Widyahening et al 2017:121–127; Shaw, Sicree & Zimmet 2010:4–14). Prevention of T2DM and reduction of risk factors for T2DM among adults and diabetic patients are still a few of the main priorities of DM. The WHO planned to halt the rise in DM and obesity by acting on modifiable factors such as unhealthy diets and physical inactivity (WHO 2015). Therefore, prevention of T2DM and its long-term adverse outcomes is urgently needed to meet the Sustainable Development Goal target (Zamperetti, Bellomo, Piccinni & Ronco 2011:632).

Different studies across the globe indicate that T2DM is a lifestyle disease that may and should be prevented through lifestyle interventions characterised by changes in dietary habits and increased physical activity. Several studies, for example, have found that lifestyle interventions at the pre-diabetic stage reduce the incidence of T2DM by 28.5% to 58% in China (Da Qing Diabetes Prevention Outcome Study), India (Indian Diabetes Prevention Programme), Finland (Diabetes Prevention Programme, DPP), and the United States (Diabetes Prevention Programme and Outcomes Study, DPPOS) (Gong et al 2011:300-307; Ramachandran et al 2006:289-297: Orchard et al 2013:46-55).

The WHO also recommends that T2DM and its complications are preventable through regular exercise, a healthy diet (of between three and five servings of fruit and vegetables a day, reduced sugar and saturated fat intake and exercising daily for at least 30 minutes), smoking cessation, and blood pressure and lipid control. An approach involving the government and the general population is needed for effective prevention (WHO 2016). Moreover, the WHO identified a package of 16 NCD management and lifestyle "best buy" interventions that are cost-effective, affordable, feasible, and scalable in all settings (Alwan 2011:66-69; WHO 2017; Zheng, Ley, & Hu 2018:88–98).

Furthermore, previous studies suggest that lifestyle interventions such as regular physical activity and weight loss have been shown to be more effective than medicines in preventing or delaying the development of T2DM in people at high risk of developing the disease (Yamaoka & Tango 2005:2780–86). Nevertheless, transferring such evidence into an effective community intervention program requires an understanding of the specific needs of the communities before introducing any sort of intervention (Bowman et al 2003:S8–S14; Venkat Narayan et al 2004:958–963). The first step in prevention is knowing about DM risk factors and preventive measures, as this will enable the public to make informed decisions to adopt a healthier lifestyle (Bowman et al 2003:8–14; Glasgow et al 1999:159). Evidence on lifestyle interventions to prevent T2DM and risk factors is essential, but despite such importance, to the best of the researcher's knowledge, there has been no study conducted on the prevention of T2DM in the adult population in Ethiopia, specifically in the Bale Zone, south-east Ethiopia.

In developed countries such as the USA, the Centre for Disease Control (CDC) established the National Diabetes Prevention program (NDPP), which provides the framework for T2DM prevention strategies (ACA 2010). They outline the Patient Protection and Affordable Care Act 2010 (ACA), which included multiple provisions to stimulate healthier lifestyle behaviours leading to diabetes prevention, as well as access to availability and participation in individual and group programs based upon the NDPP. Unfortunately, there are no T2DM prevention strategies for adults in Ethiopia; hence, the researcher decided to develop one.

1.3 STATEMENT OF THE RESEARCH PROBLEM

“The research problem statement is intended to express a research problem that describes the necessity for research through the development of a logical argument” (Polit & Beck 2012:73).

There are a number of factors that have contributed to the high rate of undiagnosed T2DM for many years, including inadequate health systems, a lack of knowledge among the general public and healthcare providers, and the delayed onset of diagnosis (Beagley, Guariguata, Weil, & Motala, 2014:150). Increased rates of acute and chronic problems are associated with delays in T2DM diagnosis and treatment (Ismail, Omar, Aris, Ambak, Hisham, & Kuay 2016:677). As a result, the quality of life of patients is impacted, households incur higher expenses, and health care systems are overburdened (World Health Organisation, 2010). Therefore, routine screening and early identification are current global strategies to delay the growth of type 2 diabetes (T2DM) (Mohamed et al 2018:2).

For the past 20 years, Ethiopia has been one of East Africa's fastest-growing economies. Currently, the country is going through an epidemiological transition that is mainly initiated by changes in demographics and lifestyle. Many people from rural areas have moved to cities because of rapid urbanisation. Natural sedentary lifestyles are promoted by urban living, which increases the chance of NCDs, including T2DM (Ali, Misganaw, Worku, Destaw et al 2021: 318-326) These facts suggest that Ethiopia may have an even greater prevalence of T2DM than was previously thought, but this is not exceptional for such a study area.

The study area covers Bale Robe administrative town and Goba administrative town, which are situated in Bale Zone, south-east Ethiopia, which are known for their rapid urbanisation and population growth due to the in-migration of the surrounding rural people. When these rural residents relocate to towns, their lifestyles alter, increasing their risk of NCDs such as T2DM.

In Ethiopia, as indicated by the national WHO STEPS survey of 2017, the prevalence of diabetes mellitus was 5.2% (Federation ID 2017:905–911). Different studies in Ethiopia report the prevalence of T2DM in the range of 0.5% to 8.3% (Asmelash & Asmelash 2019:6; Worede, Alemu, Gelaw & Abebe 2017:25; Ayana, Bacha, Roba & Kebede: 2015.

71:771; Wondemagegn, Bizuayehu, Abie, Ayalneh, Tiruye & Tessema 2017:18; Gebreyes, Goshu, Geletew, Argefa, Zemedu, Lemu, Waka, Mengesha, Degefu, Deghebo & Wubie 2018:6–7; Aynalem & Zeleke 2018:4; and Workneh, Bjune& Yimer 2016: 1–11). Furthermore, T2DM among those who are neither aware of raised blood sugar nor taking any anti-diabetic medications was very high in Ethiopia(Asmelash & Asmelash 2019: 6; Worede, Alemu, Gelaw & Abebe 2017: 5; Wondemagegn et al. 201:20; Aynalem & Zeleke 2018:4). If diabetes is not recognised early and treated, it may pose serious health complications as it progresses to affect multiple organs (Asmelash & Asmelash 2019:6, Bailey et al. 2016:7, Abebe, Berhane, Worku, & Assefa 2014:4). However, the prevalence of T2DM (diagnosed and undiagnosed) and factors associated with it among the adult population of Bale Zone administration are unknown. Not only the prevalence but also adults' knowledge and perceptions of the risky behaviours of T2DM and its prevention are not known in the two administrative towns of Bale Zone.

Moreover, the relationship between T2DM and mental stress and food insecurity among adults in Bale Zone, south-east Ethiopia, has not been explored, and previously conducted studies in other parts of Ethiopia have reported inconsistent and inconclusive findings with regard to risk factors for T2DM (Asmelash & Asmelash 2019: 6; Worede, Alemu, Gelaw & Abebe 2017: 5; Wondemagegn et al. 2017:18:20). Even though the prevalence and incidence of T2DM have increased, attention has not been given by health care practitioners and policymakers to the prevention of T2DM and its risk factors in Ethiopia. Further, to the researcher’s knowledge, no study on the prevention of T2DM and its risk factors in the Bale Zone has been conducted in adults older than 18 years. Moreover, prior studies were limited in assessing mental stress risk factors and food insecurity as factors associated with T2DM. Understanding the risk factors of T2DM and the people affected now and in the future is important for the development of prevention strategies for T2DM by modifying the lifestyle of individuals.

Therefore, this study aims to assess the prevalence of T2DM, identify factors associated with T2DM, describe adult knowledge and perceptions of the community regarding the prevention of T2DM risky behaviour, and examine the determinants of T2DM, such as mental stress risk factors and food insecurity.

Limited studies were conducted on the prevalence of T2DM and its risk factors for T2DM in the Bale Zone, Oromia region, and south-eastern Ethiopia. Hence, this study was conducted to address the following:

- Lack of information on the burden of T2 DM,
- Inadequate information on the distribution of risk factors for T2DM.
- Lack of information on knowledge, perception , risky behaviours, and prevention of T2DM in the community; and
- Lack of information on the determinants of T2DM

The generation of evidence in these areas will contribute to developing appropriate preventive strategies that can help prevent and reduce the burden of T2DM and its impact.

1.3.1 Rationale of the study

Various studies conducted in different countries have identified a wide range of DM prevalences, factors associated with DM, and knowledge of DM. Most of the studies conducted in Ethiopia to assess the prevalence of DM and factors associated with it are cross-sectional studies. However, they did not use a case-control study design to explore some important risk factors, such as the relationship between food insecurity and mental stress as risk factors for T2DM. This study also arose out of the need to explore the relationship between food insecurity and mental stress as risk factors for T2DM through a case-control study design and, thereby, develop strategies that will prevent T2DM in adults.

1.4 RESEARCH AIM/ PURPOSE

The purpose of this study was to develop strategies for the prevention of T2DM among adults in Bale Zone South-east, Ethiopia.

1.4.1 Research objectives

According to Burns and Grove (2011:146), a research objective is clear, concise, or declarative that is developed from the research problem and purpose. The research

objectives in a quantitative study would help to clarify the variables and population that will be studied.

This study was conducted in three main phases. Therefore, the objectives of the study are depicted in this phase.

Phase I

- To determine the prevalence of T2DM among adults in the Bale Zone, south-east Ethiopia.
- To identify factors associated with T2DM among adults in the Bale Zone, south-east Ethiopia
- To describe adults' knowledge and perceptions of T2DM risky behaviour and prevention among in the Bale Zone, south-east Ethiopia

Phase II

- To examine the determinants of T2DM among the adults attending selected public hospitals in the Bale Zone, south-east Ethiopia

Phase II

- To develop strategies that contribute to the prevention of T2DM among the adult population of the Bale Zone, South-east Ethiopia.

1.4.2 Research questions

Polit and Beck (2012:765) define a research question as a succinct interrogative statement of the specific questions that a researcher seeks to answer in the context of the study problem. A research question guides the data that should be collected during a study. The PICO (Respondents, Intervention, Control, and Outcome) approach was used in formulating the research questions (Bettany-Saltikov 2012:2).

The research questions of this study were as follows:

- What is the prevalence of T2DM in adults in the Bale Zone, south-east Ethiopia?
- What are the factors associated with T2DM in adults in the Bale Zone, south-east Ethiopia?

- What is the level of knowledge and perception of adults in the Bale Zone regarding T2DM risk behaviour and its prevention?
- What are the determinants of T2DM among the adult population of the Bale Zone, south-east Ethiopia?
- What strategies can be developed to prevent T2DM among the adult population of the Bale Zone, south-east Ethiopia?

1.5 SIGNIFICANCE OF THE STUDY

The significance of a study will convince the reader why the study was necessary in the first place; it gives the study's rationale, contribution, and importance (De Vos et al 2011:107).

The findings from this study will provide knowledge and perception of risky behaviours of adults towards T2DM and the major risk factors for T2DM in the Bale Zone, southeastern Ethiopia, which will be used to develop prevention strategies for T2DM among adults in Ethiopia. Secondly, the findings will contribute significantly to the foundation of analytical epidemiological research and guide future T2DM research projects. Furthermore, the findings on different prevention strategies that are recommended for implementation in the country could advise policymakers.

1.6 DEFINITIONS OF KEY CONCEPTS

1.6.1 Conceptual Definitions

A conceptual definition provides the theoretical or abstract meaning of the concepts being researched (Polit & Beck 2017:47).

The following are the conceptual and operational definitions of the key concepts used in this study:

Diabetes Mellitus

Diabetes mellitus (DM) is defined as a chronic metabolic disease characterised by high blood glucose levels resulting from defects in insulin secretion and/or action (American Diabetes Association 2013:S11-S61). Based on aetiology and pathophysiology, there are two main forms of diabetes: type 1 diabetes mellitus (T1DM) and type 2 diabetes mellitus (T2DM), with the latter accounting for more than 90% of cases. In this study, the researcher has decided to focus on type 2 diabetes mellitus (T2DM).

The WHO diagnostic standard for DM is applied in this study. When fasting plasma or capillary glucose is greater than 7.0 mmol/l (126 mg/dl) or when 2-hour plasma glucose is greater than 11.1 mmol/l (200 mg/dl) (WHO 2006:1).

In this study, T2DM is acknowledged as a disease that occurs due to uncontrolled blood sugar levels and affects mostly adults from the two administrative towns of Bale Zone in Oromia regional state, patients with T2DM who visit the clinic for chronic conditions, and adults without DM who visit hospitals for other care services.

Prevention

Prevention according to Freshwater and Maslin-Prothero (2005:478), is the action of rendering it impossible for a particular event to occur, stopping something from happening or arising.

In this study, prevention refers to developing strategies to prevent T2DM through modification of the major risk factors related to T2DM from undermining the quality of life for the adult population of the Bale Zone in Ethiopia.

Strategy is defined by Freshwater and Maslin-Prothero (2005:478) as a plan of action designed to achieve a long-term or overall aim.

In this study, strategies refer to a plan of action that will be designed based on the study results to achieve a long-term plan to prevent T2DM and reduce the major risk factors related to T2DM from undermining the quality of life for T2DM patients as well as the adult population of Bale Zone in Ethiopia.

Adult

The Oxford Advanced Learner's Dictionary (2010) defines an adult as a person who has attained full growth and development, which usually signifies reaching legally mature age. In the context of this study, an adult refers to a person who is 18 years of age or older;

based on their age, the study intends to show the actual scope of the problem under investigation in the country.

Prevalence

A prevalence study, or cross-sectional study, is the most common population-based epidemiological study designed to measure the incidence of a health event in a population at a moment in time or over a short period of time.

A prevalence rate(P) is valued by:

$$P = \frac{\text{Sum of individuals with a disease}}{\text{The inhabitants at risk of developing the disease in a give time}}$$

The population at risk may be defined as those who reside in the study area or as individuals who meet specific criteria related to geography, administration, demography, occupation, or other areas, like those who use health services (Springk, Korevaar, Davids, Hilderink, Schellevis, Verheij, and Nielen 2019:11-2). The prevalence rate is expressed as five cases of a disease per 100 individuals, or 5% of the population.

Knowledge

Knowledge is defined as "facts, information, and skills acquired through education or experience of a subject" (Oxford Dictionary, 2012:402). In the context of this study, it refers to the sum of what is known about adults' ability to correctly identify the causes, signs, and symptoms, risk factors, and prevention of T2DM.

Perception

Perception is the ability of someone to notice and understand things that are not apparent to others (Oxford Mini Dictionary 2015:22). In the context of this study, perception refers to knowledge, understanding, attitudes, perceptions, and feelings about the risky behaviours of T2DM and its prevention in adults residing in two administrative towns of the Bale Zone, south-east Ethiopia.

Risk factors

Risk factors are behaviours that increase the likelihood of developing NCDs like T2DM (WHO 2005:17).

Behavioural risk factors: According to the WHO, these are the major (preventable) risks that include smoking, the harmful use of alcohol, eating an unhealthy diet (a few fruits and vegetables), and physical inactivity (WHO 2005:23).

Biological risk factors: The World Health Organisation has recognised these variables, which include being overweight or obese, having high blood pressure, and having high blood sugar (WHO, 2005:23-55).

Food security is defined as a state in which "all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life" (USAID, 1992).

1.6.2 Operational Defination

Knowledge level

In the context of this study, the level of knowledge was measured through the knowledge questionnaires, and a single knowledge variable with three possible ordinal responses was calculated from 26 knowledge questions to indicate the respondents' overall level of knowledge regarding T2DM risky behaviour and prevention. Incorrect responses score 0, and correct responses score 1. The minimum score is 0, and the maximum score is 26. Adults classified as "having low knowledge of the risky behaviours of T2DM and its prevention" would be those who correctly answered 0–13 of these questions. Adults with scores between 14 and 18 were classified as having a medium level of knowledge of the risky behaviours of T2DM and its prevention, while those with scores between 19 and 26 were classified as having a high level of knowledge.

Perception of adults towards the risky behaviours of T2DM and its prevention

Adults' perceptions towards risky behaviours of T2DM and prevention were assessed based on six constructs of the health belief model HMB, which were a 5-point Likert scale item (1 = strongly disagree, 5 = strongly agree) computed as strongly disagree and disagree mereged to disagree and strongly agree and agree merege to agree. Additionally, cues to action are one of the HMB constructs for the level of adults' engagement in T2DM prevention behaviours, which were 5-likert scale items (1 = never, 2 = rarely, 3 = sometimes, 4 = often, and 5 = always). Based on these questions, the

mean scores of perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and perceived self-efficacy were computed to classify the respondents into two groups: above the mean and below the mean. Moreover, the overall mean score for each HBM construct was computed independently. Thus, those who scored above the mean were considered adults with ‘high perception (i.e., high perceived severity, susceptibility, benefits, barriers,cue-to-action, and self-efficacy) towards risky behaviours of T2DM and its prevention, and those who scored below the mean had “low perception (low perceived severity, susceptibility, benefits, barriers,cue-to-action, and self-efficacy) towards risky behaviours of T2DM and its prevention.

Risk factors for T2DM

In this study, the risk factors for T2DM were: evere/current tobacco and alcohol use, Khat chew, serving fruits and vegetables less than five times per day, low physical activity, being overweight or obese, hypertension, mental stress, and food insecurity.

Current smoking was defined as smoking every day or some days prior to the month of the data collection period. The respondent's smoking status was categorised as "yes" if they had smoked during the last month prior to the survey period and "no" if they had never smoked(WHO 2005:23).

Smoking cigaratte and chewing khat were defined as based on self-reported current behaviours, such as using smokeless or smoked tobacco products or chewing khat.

Use of alcohol : Respondents who had alcoholic drinks within the 30 days preceding the study were asked if they had any alcohol consumption history (beer, wine, spirits, and locally produced alcoholic beverages like areke or katikala and tella and teji). Those who responded 'yes' were classified as current alcohol drinkers (Getachew et al 2017: 312–319). However, respondents who drank only a few sips of alcohol during the past month were categorised as "no users." The researcher also asked about the frequency of one standard alcohol drink (1-2, 3-4, 5-6 days per week) (Getachew et al 2017: 314).

Low fruit and/or vegetable consumption: The number of days the respondents ate fruits and vegetables in a typical week before the data collection time was used to assess their fruit and vegetable intake. When the researcher asked, on average, how many servings of fruits or vegetables they typically eat on those days in a typical week, eating

less than five servings of fruit and vegetables per day was considered low fruit and/or vegetable consumption (WHO 2005:23; & Gelibo et al: 356).

Physical activity level

The purpose of the data collection on physical activity was to seek out more information about the respondents' experiences with the different types of physical activity (work, leisure, and travel) and the different intensity levels (low, moderate, and high). High-level physical activity items were included in the three categories of activity at work, travel, and leisure activities in a typical week on the data collection or questionnaire tool. Physical activity is measured using the global recommendation for physical activity established by the WHO. Accordingly, physical activity, defined as a combination of moderate- and vigorous-intensity activity adding up to at least 600 MET minutes per week, was used as the cut-off to distinguish between physically active individuals (achieving 600 or more MET minutes per week) and physically inactive individuals (achieving fewer than 600 MET minutes per week) (WHO, 2017).

The **body mass index (BMI**) was computed as follows: weight (kg) divided by height (m) squared. Based on the WHO definition, there were four categories of BMI: underweight (BMI<18.5 kg/m2), normal weight (BMI = 18.5–24.9 kg/m), overweight (BMI = 25.0–29.9 kg/m), and obese (BMI ≥ 30.0 kg/m) (WHO,2005:55).

Hypertension was defined as sustained high blood pressure (systolic BP ≥ 140 mmHg or diastolic BP ≥ 90 mmHg) or as reported antihypertensive medication use on a regular basis(WHO,2005:47).

Food insecurity refers to the uncertainty of having adequate food or the inability to obtain food due to a lack of money or other resources (Zekeri & Diabate 2014:1). The main components of food insecurity include insufficient food intake, the inability to access foods of suitable nutritional quality, worry or anxiety over food supplies, and having to obtain food in ways that are socially unacceptable (Bickel, Nord, Price, Hamilton, & Cook 2000, cited in Ivers 2015:24). In this study, the term "food insecurity" describes the state in which adults do not have access to enough food for themselves and their households because of a lack of money or production. Coates, Swindale, and Bilinsky (2007:16) classify household food insecurity into four categories: food secure, mild food insecure, moderate food insecure, and severe food insecure. The FANTA food access scale is used to

categorise food insecurity into two categories: (0) food secure or (1) food insecure (rarely, sometimes, and often). In this study, household food insecurity was measured using the FANTA food access scale.

Mental stress was examined using a self-reporting questionnaire (SQR-20) comprising 20 variables. Mental stress was categorised into three levels: mild, moderate, and severe (Beusenberg, Orley & World Health Organization 1994).

1.7 THEORETICAL FOUNDATION OF THE STUDY

The theoretical foundations of a study provide the rationale for enhancing its utility (Polit & Beck 2012:132). This section presents the research paradigm and theoretical framework of the study which guided the study.

1.7.1 Research paradigm

A paradigm is a worldview or a wide understanding of the complexity of the world (Polit & Beck 2012:11). It is also defined as a theoretical viewpoint made up of a set of assumptions that serve as the basis for a scientific enquiry (Bowling 2014:132). According to Polit and Beck (2017:14), research paradigms indicate the framework incorporating the fundamental assumptions, modes of thought, and techniques that are widely accepted by members of the scientific community. This study employed a positivist philosophy or approach via the application of quantitative research methods. The approach makes the assumption that there is a single objective reality that can be determined using tools such as surveys and statistical analysis techniques, and that conditions and human behaviour can be measured (Bowling 2014:139–148). A positivist paradigm was used in this study because positivists contend that phenomena (observable facts and happenings) are not random or haphazard but rather have prior causes (Polit & Beck 2017:14).

According to Eichelberger (1989) cited in Chilisa and Kawulich (2012:8), positivism is a point of view or truth that can be experimentally analysed, validated or verified, or disproven based on concepts such as data values, projected results, study objectives, and tested theories. It may also find the strength of associations between variables or a

cause-and-effect relationship. The positivist paradigm was used by the researcher to determine the prevalence of T2DM, factors associated with T2DM, and explore and describe adult knowledge and perceptions regarding T2DM risky behaviour and its prevention in adults in the Bale Zone, south-east Ethiopia.

Furthermore, the study sought to investigate the determinants of T2DM among the adult population attending selected public hospitals in the Bale Zone, South-east Ethiopia. This positivism paradigm is discussed in more detail in Chapter 3.

1.7.2 Theoretical framework of the study

According to Lysaght (2011:572), a theoretical framework is the "blueprint" for the entire dissertation investigation. It serves as a guide for building and supporting the study. The theoretical framework also offers a foundation for articulating the researcher's understanding of the problem, purpose, significance, and research questions, all of which are closely related and intimately guide the research design and data analysis (Grant & Osanloo 2014:12-24).

To develop strategies for the prevention of T2DM in the adult population, it is crucial to understand the factors that predict the occurrence of appropriate risk factor modification or reduction behaviour.

In this study, the researcher used the Health Belief Model (HBM) as a theoretical framework to recognise the predictors that impact people's decisions to adopt preventive measures to lower their risk of contracting disease (Becker 1974:324–473). This is a social cognitive model that focuses specifically on health and makes predictions about and seeks to explain why individuals adopt or continue to engage in particular health behaviours (Laranjo 2016:83–111). The HBM is a comprehensive model that demonstrates the relationships between beliefs and behaviours and plays a crucial role in disease prevention (Khiyali, Manoochri, Khani, Babaei Heydarabadi & Mobasheri 2017:4821-4831). It is a framework for value expectations that predicts and explains the preventative actions individuals take when engaging in specific health behaviours. It is also regarded as one of the most well-known public health frameworks for comprehending why people act or do not act in the face of a threat to their personal or the community's

health. Health belief models are widely used to study human behaviour related to preventing or mitigating diseases.

This model focuses on the ways in which individual perceptions and beliefs about the fear of health problems, as well as evaluations of the benefits and barriers of preventive behaviours, result in the adoption of behaviours (Azadi et al 2021:69). Notably, individuals are more likely to take preventative action if they perceive the health threat to be serious, find themselves personally susceptible, and feel there are fewer benefits than barriers to engaging in such action (Laranjo 2016:83–111).

Further, this model suggests that people's participation in the prevention, early detection, and treatment of a particular health problem depends on their perception of their susceptibility to the disease even if they do not exhibit any symptoms (perceived susceptibility), as well as their understanding of its depth and seriousness (perceived severity) (Costa 2020:47 & Zareipour, Ardakani Moradali, Jadgal & Movahed 2020:646–650), and their perception of the benefits of preventive behaviours (perceived benefits), which should be considered to be great. People must be aware of their capacity to choose a healthy lifestyle and engage in protective behaviours (Zareipour et al 2020:646–650). Additionally, the model suggests that when the proper beliefs are held, cues to action can activate healthy behaviour (Costa 2020:47). The theoretical framework in Figure 1.1 below shows how different elements came together in relation to HBM.

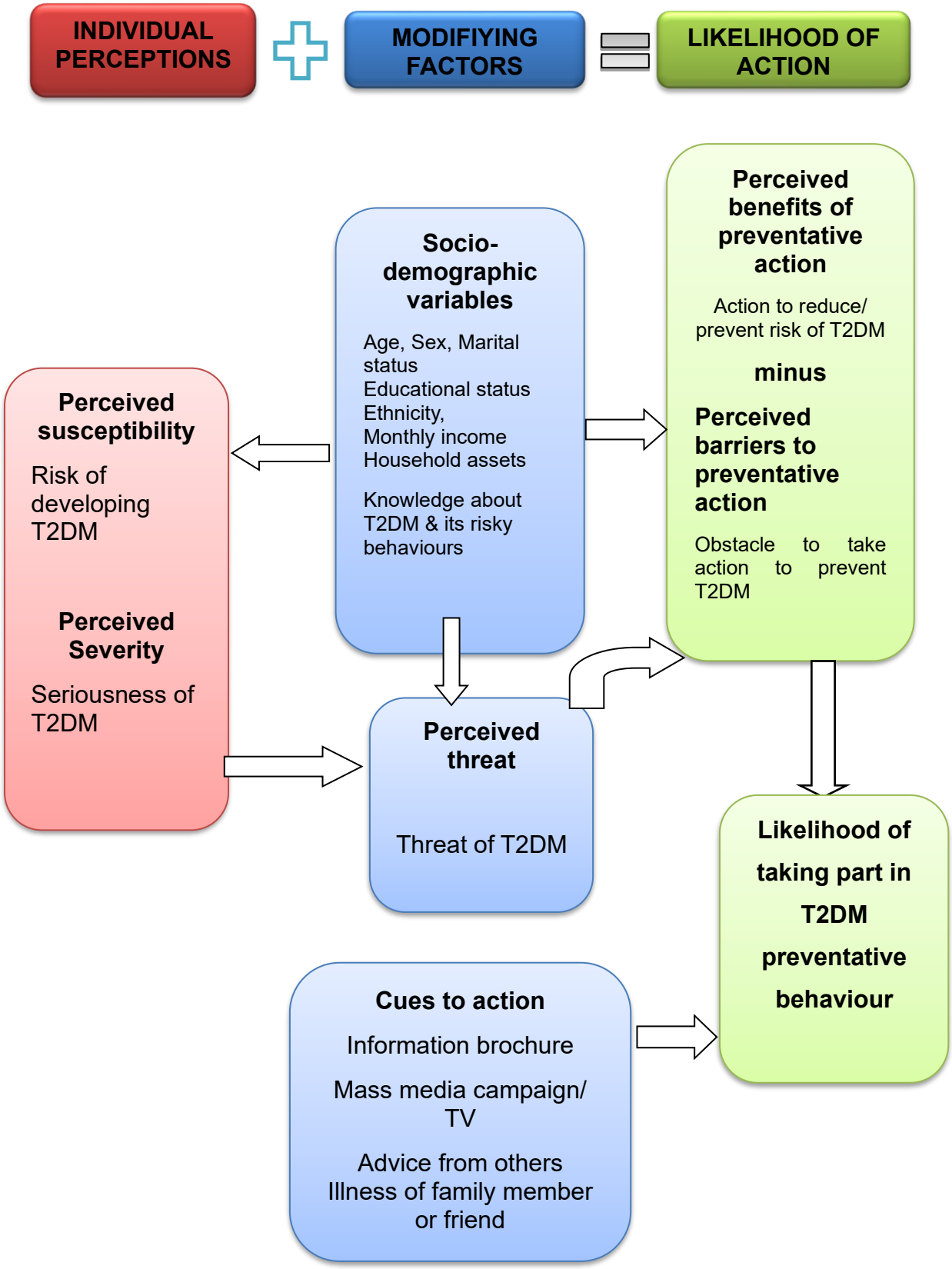

Figure 1.1: Concepts of the Health Belief Model (HBM) and risk factors of T2DM adapted from (Champion, & Skinner 2008).

1.7.2 1 Application of HBM constructs in the study

The Becker's Health Belief Model (HBM) 1974 by Tarkang and Zotor (2015) was introduced with the aim of providing a framework to guide the study. The significance of this theory in the design of the strategies was acknowledged in this chapter of the study.

The researcher was interested in understanding the perceived susceptibility, severity, benefits, and barriers of type 2 diabetes and preventive behaviours for type 2 diabetes among adults in the two administrative towns of Bale Zone, south-east Ethiopia. If individuals consider themselves at risk for type 2 diabetes, they can be motivated to adopt a behavioural change or lifestyle. If they perceive that type 2 diabetes will have a negative impact on their lives, they might take steps to prevent it. Studies affirm that individuals take action if they believe adopting this new lifestyle will reduce their risk of illness. They may have adopted a new code of behaviour for health because they too believe that the benefits of adopting new habits far outweigh the costs. (Jeihooni, Hidarnia, Kaveh, Hajizadeh, &Askari 2016:7).

This theory suggests that change of behaviour is a key component that directs health promotion in health research. This theory explains the behaviours that individuals use as disease prevention measures. This thereby assisted the study in the description of individuals knowledge and perceptions of risky behaviours associated with T2DM and its prevention. DM is not a transmittable disease and is a preventable disease. Individuals need to engage in behavioural activities to prevent the disease. T2DM is not a transmittable disease and is a preventable disease. Individuals need to engage in behavioural activities to prevent the disease. Therefore, the HBM theory was relevant for this study.

Moreover, adults are more likely to act if they see that they can perform a set action successfully (Tarkang & Zotor 2015: 3). Therefore, this model has been well used to guide the development of strategies to prevent T2DM by describing adults' knowledge and perceptions of the risky behaviours of T2DM and its prevention.

The HBM in this study assisted in providing a framework to understanding the factors that facilitated the benefits of engaging in health preventive behaviours and those that hindered (barriers) engagement of T2DM prevention measures in order to reduce their risk of contracting T2DM amongst adults in the study setting.

Furthermore, this model states that a person's decision and motivation to engage in a healthy behaviour are determined by three factors: personal perception (individual perceptions of health), moderating factors including demography, and the likelihood of engaging in that behaviour (the benefits of preventative measures) (Najarkolaei et al 2009:349–359; Tarkang & Zotor 2015:3). The HBM also includes the following six key concepts: perceived susceptibility, severity, benefits and barriers, cues for action, and self-efficacy. These concepts and propositions were helpful to the study in reviewing the literature review, questionnaire design, and data organisation. Figure 1.1 illustrates the constructs in the health belief model as the theoretical framework used to guide this study.

The HBM describes activities that support preventive health behaviour rather than behaviour during illness. The health belief model is depicted in Figure 1.1. The HBM helps explain why people accept or reject preventative healthcare treatments or choose not to adopt healthy behaviours (Abraham & Sheeran 2015:32).

1.7.2.1 Health belief model propositions and their focus

Individual perceptions are a person's beliefs about how likely they are to get a disease and how seriously they consider the perceived threat of the illness (Tarkang & Zotor 2015:3–4). The HBM in this study assisted in identifying what individuals needed in order to understand and engage in healthy behaviours in order to prevent T2DM. When individuals understand the newly acquired knowledge, their risk of developing the disease will reduce, and they will be more likely to adopt behaviours that will help them prevent T2DM.

The likelihood of action refers to the benefits of prevention for the individual (Tarkang & Zotor 2015:3–4). This hypothesis made it easier to find characteristics that were seen as benefits for adopting health behaviours to prevent T2DM and those seen as obstacles to changing behaviour.

Modifying variables

Modifying variables might indirectly affect behaviours related to one's health by mediating or moderating the key HBM construct by affecting perceived severity, susceptibility, benefits and barriers (Glanz, Rimer & Viswanath 2015:75). Hence, socio-demographic

factors may indirectly influence individuals' behaviour towards T2DM prevention by influencing their perception of susceptibility to the disease, the severity of the disease, and the benefits of taking action.

1.7.2.2 Health belief model concepts and their meaning

The health belief model (HBM), the theoretical framework used in this study, is used to assess adults' ability to adapt to behaviours related to their health. This model incorporates six significant constructs that affect health behaviours: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy (Sharifirad et al 2006:231-239).

1.7.2.2.1 Perceived susceptibility

Perceived susceptibility refers to a person's perception of their risk of developing a condition (Joseph 2018:2). In accordance with this model, if people perceive they have a particular health problem, they will engage to reduce their risk of developing it. Conversely, individuals with low perceived susceptibility might not think they are at risk of contracting a certain illness (Onoruoiza, Musa,Umar & Kunle 2015:14). People who perceive themselves as susceptible to T2DM are more likely to adopt healthy behaviours in an effort to prevent the condition. The HBM was used in this study to help determine if adults understood they had a risk of T2DM and would adopt behaviours that would change their behaviour. Adults will adopt behaviours to prevent T2DM; if followed properly this would help in the development of prevention strategies.

1.7.2.2.2 Perceived severity

Perceived severity is a person's perception of how severe a condition's outcomes would be if the condition actually occurred (Joseph 2018:2). According to the HBM, individuals are more likely to adopt behaviours that either prevent health problems from occurring or lower their severity if they perceive a particular health problem to be serious (Tarkang &

Zotor 2015:5). Thus, perceptions of a disease's seriousness include beliefs about the disease itself, such as whether it constitutes a threat to life or may cause pain or disability (Onoruoiza et al 2015:14). In this study, the model helped explain how one can be susceptible to the T2DM disease. If not properly explained, unless there were severe physical and social implications, an individual would not be motivated to change their behaviour. Adults must understand that T2DM is a serious disease with severe consequences for their lives before adopting behaviours to prevent it. Further, people must perceive T2DM as a serious non-communicable disease with severe consequences and implications for their physical and social lives before adopting preventative actions (such as regular physical activity, quitting smoking, etc.) against T2DM.

1.7.2.2.3 Perceived benefits

According to Onoruoiza et al (2015:14), perceived benefits are an individual's assessment of the benefit or efficacy of adopting health behaviours that promote health in order to lower their risk of disease. In this study, this concept of the mode helped uncover a number of benefits, including incentives, living longer, and others. Adults are more likely to adopt healthy behaviours if they perceive that a particular action would minimise their risk of getting a disease or decrease its seriousness. It was this belief that gives an adult confidence to take action because of the expected health outcomes. Perceived benefits are beliefs regarding how well recommended preventative health actions, such as regular physical activity and quitting smoking, prevent T2DM.

1.7.2.2.4 Perceived barriers

Perceived barriers are those that an individual perceives will prevent them from changing their behaviour (Onoruoiza et al 2015:14). Numerous factors, such as barriers to taking medication such as cost, frequency, side effects, etc., may have an impact on people's decisions to engage in particular activities (Tarkang & Zotor 2015:5). The model revealed whether individuals understood the risks and barriers that could obstruct T2DM-related

actions. It also helped clarify a number of actions that could lessen barriers to adherence, namely disclosing negative effects. In other words, for behaviour to change, the perceived benefits must outweigh the perceived barriers. The next stage is not achievable until the person knows they have the capacity to surmount these challenges. Further, perceived barriers to taking health-related action include phobias, physical and psychological impediments, accessibility problems, personal characteristics, and potential blocks or obstacles to engaging in preventive behaviours, including expense, inconveniences, and unpleasantness (Rosenstock, Strecher & Becker 1988:175-183; Agha, Karlyn & Meekers 2001:144-151; Tarkang & Zotor,2015:1-8).

1.7.2.2.5 Cues to action

Cues to action are factors that may prompt an individual to act, such as the passing of a loved one from the same illness (Onoruoiza et al 2015:14). A person may be motivated to act by experiences, physical symptoms of a health condition, or social or environmental influences (such as media attention) (Tarkang & Zotor 2015:5). Cues to action occur when an individual desires to act after believing they are capable of doing so. A benefit of completing the necessary activities is understanding how to overcome the anticipated barriers. This requires motivation on the part of the individual and a desire to adhere to the recommended course of action or treatment, to be concerned about their health, to be willing to seek out and accept health care, and to engage in positive health activities.

1.7.2.2.6 Self-efficacy

Self-efficacy is the term used to describe an individual's understanding of and confidence in their ability to carry out behaviour (Joseph 2018:2). It is the strength of a person's belief in their own ability to respond to difficult situations and to handle any related obstacles or setbacks (Tarkang & Zotor 2015:5). According to this model, an individual may feel confident in their ability to overcome obstacles and perform the desired behaviour (Jones, Jensen, Scherr, Brown, Christy & Weaver 2015:3). In this study, the HBM assisted in determining individuals' confidence in their ability to adopt behaviours that might prevent

T2DM. Adults might believe that they could engage in behaviour without defaulting, regardless of obstacles that hindered T2DM prevention activities.

1.8 RESEARCH DESIGN AND METHODOLOGY

1.8.1 Research design

According to Creswell (2015:20), the research design refers to the specific steps taken during the research process. Burns and Grove (2012:49) indicate that a research design is a blueprint for how a study is conducted. In this study, the researcher used quantitative, descriptive cross-sectional, and unmatched case-control study designs in different study populations and study settings. The details of the design will be described in Chapter 3, Section 3.2.

The study was implemented in three phases, as follows:

Phase I: Population-based descriptive cross-sectional design

Phase II: Hospital-based unmatched case-control study design

Phase III: Strategies development

As stated above, the researcher used descriptive cross-sectional, and unmatched case-control study designs for this study in distinct study populations and study settings. The researcher conducted the study in three phases. For Phase I, a population-based descriptive cross-sectional research design was conducted to address research objectives 1, 2, and 3. For Phase II, a hospital-based, unmatched case-control research design was implemented to address research objective 4. In both phases, quantitative data was collected and analysed separately. The researcher then developed strategies in Phase III to prevent the burden of T2DM in adults based on the findings from Phases 1 and 2, an extensive review of relevant literature ,researcher insight , and expert opinion. Further detail about the research design in each phase of the study is discussed in Chapter 3.

1.8.2 Research methodology

Research methodology is a technique for organising a study, gathering data, and analysing that data in a systematic manner to achieve a specific aim (Polit & Beck 2012:422). According to Creswell (2014:3), a research approach is a plan and set of principles that includes all the stages from the core idea of the research design to the data collection, analysis, and interpretation. In this study, the researcher utilised a quantitative research approach. Further detail can be found in Chapter 3.

1.8.2.1 Research methods for Phase I

1.8.2.1.1 Study setting

Polit and Beck (2012:27, 423), determine that the study setting is the specific location where data gathering takes place.

This study was conducted in two administrative towns in the Bale Zone of the Oromia region of southeast, Ethiopia. Bale Zone is located 430 kilometres south-east of Ethiopia's capital city, Addis Ababa. There are 18 rural districts in the Zone, as well as two town administrations, namely Robe and Goba. According to the Central Statistical Agency in 2017, the Bale Zone had a total population of approximately 1,840,746 people, comprised of 932,224 men and 908,522 women. Robe and Goba towns have populations of 73,152 and 52,785 people, respectively (Town Administrative Reports, 2021).

1.8.2.1.2 Study population

The population for this phase was comprised of all adults who were 18 years of age or older and resided in the two administrative towns of the Bale Zone, south-eastern Ethiopia. More information regarding the study population is provided in Chapter 3. More details on the study population are provided in Chapter 3.

1.8.2.1.3 Sample and sampling procedure

The sample was composed of 557 randomly selected adults from two administrative towns in Bale Zone. The adults were further randomly assigned relevant study groups. A thorough explanation of sampling and sample size is provided in Chapter 3.

1.8.2.1.4 Data collection method and procedure

To meet the objectives of the study for Phase I, the data was collected from June 1 to August 2021 through a structured questionnaire that was developed and included all pertinent variables. Thus, through an interviewer-administered questionnaire, physical measurements and biochemical measurements (fasting blood glucose test) were conducted with 557 adults 18 years of age and older who were living in two administrative towns in Bale Zone, south-east Ethiopia, during the study period. A structured questionnaire was used for the interview. Then the data collectors recruited, interviewed, and conducted physical measurements and fasting blood glucose on all the sampled adults who were eligible and available for the study during the study period with informed consent.

1.8.2.1.4.1 Pre-testing

The questionnaires were pretested by the researcher outside of the study areas. Based on the feedback, the researcher modified the questionnaire. To ensure the quality of the data, the questionnaire were primary prepared in English and then translated into the local languages of Afan Oromo and Amharic and then translated back into English by an expert. The consent form was included with the final questionnaires (see Annexures N & O).

1.8.2.1.5 Data validity and Reliability

Construct, content, and criterion approaches were employed in this Phase to ensure the study's validity, and reliability was ensured by pre-testing the questionnaires in a setting

apart from where the actual data collection commenced. Each time, anthropometric, blood pressure, and blood glucose measuring devices were checked.

1.8.2.1.6 Data analysis

Data was entered into EPI Data (version 4.6.0.0), then exported to the Statistical Package for Social Science (SPSS) version 25.0 and Stata (version 14.0) for analysis. Steps for data collection and analysis are provided in Chapter 3.

1.8.2.2 Research method for Phase II - an unmatched case-control study

This Phase uses a quantitative research method. Accordingly, quantitative data was collected from newly diagnosed T2DM patients (aged ≥ 18 years) and adults (aged ≥ 18 years) without T2DM or any other type of DM who attended the two selected public hospitals in Bale Zone, south-east Ethiopia, from September 1, 2021, to November 30, 2021.

The case-control research design requires that a comparison be conducted between data from patients with the desired outcome and those who underwent comparable exposures in Phase two but did not produce the desired outcome for this study. The later groups are referred to as controls. Therefore, this study selected suitable control groups of individuals who had visited the two selected hospitals in Bale Zone during the study period.

Study setting

This study was conducted in two hospitals in the Bale Zone, namely, Goba Referral Hospital, which is in Goba town, and Bale Robe General Hospital, which is in Robe town.

Population

The target population of the study in Phase II was all newly diagnosed T2DM patients (duration of diagnosis less than 6 months) aged ≥ 18 years old and adults without T2DM or any other types of DM aged 18 years and over who attended two selected hospitals in Bale Zone, south-east Ethiopia, during the study period (September 1, 2021 to November 30, 2021) and met the eligibility criteria for this study.

Sample and sampling procedure

Sample size

The sample size for the case-control study was determined using Open EPI INFO Software Version 7 to satisfy the requirements of the study. With a prevalence exposure of controls of 6.3%, an OR of 2.44 was detected with a 95% confidence level and 80% power. As an exposure variable, the use of tobacco was used (Giday, Aseffa & Kidanemariam 2014:7). Adults with follow-ups in the study area who were sampled as cases and controls comprised the population for this study. The final estimated sample size for cases was 165 and for controls was 329, totalling 494. The cases-to-controls ratio was 1:2. A total sample size of 182 cases and 362 controls was calculated after 10% of the non-response rate was added. As a result, the final sample size was 544.

Sampling procedure

The study participants were selected and enrolled in the study using consecutive sampling for the case respondents and systematic random sampling techniques for the control respondents. More detail on this is explained in the sections on sampling and case control studies in Chapter 3.

Data collection methods and procedures

For Phase II, quantitative data was collected from September 1, 2021, to November 30, 2021, from two selected hospitals in the Bale Zone using structured, pre-tested questionnaires, and interviewers administered questionnaires to both cases (T2DM) and controls in areas where the privacy of the clients was maintained. Data was collected using a structured questionnaire that was prepared in English, translated to Amharic and Afan Oromo (eligible participants may prefer either Amharic or Afan Oromo but may only choose one language), and translated back to English to ensure language consistency and clarity. Information on data collection is provided in Chapter 3.

Validity and reliability of the instrument

A number of steps were taken to ensure validity and reliability, including the use of a standard questionnaire, expert consultation, pre-testing of data collection instruments,

identification of variables, and the application of techniques that have been successfully utilised in other research. This section has been explained in detail in Chapter 3 of this study in Phase II (see Section 3.5.2.11).

Data analysis

The data was checked for completeness. Completed questionnaires were coded and entered into Epi-Data Version 4.6.0 and cleaned, processed, and analysed using SPSS Version 25 and STATA Version 14 software for analysis. A frequency of each variable was calculated to check for accuracy, outliers, consistency, and missed values. Variables entered into the first unadjusted model were age, marital status, educational and occupational status, drinking of alcohol and coffee, physical activity and BMI, food insecurity, and mental stress. Crude and adjusted odds ratios were done for each explanatory variable at a 95% confidence level. All covariates with a p-value ≤ 0.25 were selection criteria during bivariate analysis to control all possible confounders to identify true predictors of T2DM to consider for further multivariate analysis. Finally those variables with a p-value less than 0.05 were considered statistically significant in the final model.

In general, for this study, three phases were conducted at different times. Phase I was a cross-sectional community-based household survey that met research objectives 1, 2, and 3 and was conducted in the first phase of the research work. Phase II was a hospital-based, unmatched case-control study implemented to address Research Objective 4. Finally, Phase III of the study for Research Objective 5 was undertaken to develop strategies for the prevention of type 2 diabetes mellitus in adults. Table 1.1 below further shows the summary of the objectives and research methodology used in each phase of the current study.

Table 1.1: Summary of the research design used in this research

Phases of the study	Research objectives	Target population	Research design	Sample size	Sampling method	Data collection tool	Data analysis
Phase I	To determine the prevalence of T2DM	Adults aged ≥ 18 years, who live in the two Bale Zone administrative towns	Descriptive Cross-sectional study (Community-based)	557	Multistage sampling	• Structured interview administered - questionnaire • Physical Measurements • Fasting Blood sugar	Descriptive analysis
	To indentify factors associated with T2DM	Adults aged ≥ 18 years, who live in the two Bale Zone administrative towns	Descriptive Cross-sectional study design (Community-based)	557	Multistage sampling	• Structured interview administered - questionnaire • Physical Measurements • Fasting Blood sugar	Descriptive analysis and Multivariable logistic regression
	To describe the knowledge, perception and T2DM risky behaviors its prevention	Adults aged ≥ 18 years, who live in the two Bale Zone administrative towns	Descriptive Cross-sectional study design (Community-based)	557	Multistage sampling	• Structured interview administered - questionnaire	Descriptive analysis
Phase II	To examine the determinants of T2DM	Adult population attending selected public hospitals i.e., (Case= newly-diagnosed T2DM patients (aged ≥ 18 years	Unmatched Case- control study design. (Hospital-based)	Case to control ratio was 1.2 Cases=**182,** Controls=**362,** Total =**544**	Consecutive sampling for the case group and Systematic sampling techniques for	• Structured interview administered - questionnaire • Physical Measurements	Descriptive analysis and Multivariable logistic regression

		and duration of diagnosis less than 6 months) and Control =adults who visit the two hospitals and without DM)			the control group	• Fasting Blood sugar and Random blood glucose.	
Phase III	To develop a strategy that contribute to the prevention of T2DM.	For adult population in Ethiopia	Evidence from findings of both Phase I and Phase II -From reviewing the literature - Expert opinion				

1.8.3 Development of strategies and validation (Phase III)

In Phase III, strategies were developed by researchers based on the results of both Phases I and II, reviewing the literature, and involving experts on DM and other NCDs for validation.

1.9 ETHICAL CONSIDERATIONS

According to Polit & Beck (2014:381), ethics is associated with the researcher's moral commitment to uphold the respondent's legal values and professional obligation to behave ethically towards the research respondent. Maximising benefits while minimising harm to study respondents is the aim of ethical research. To achieve this, the research should adhere to research procedures, legal, ethical, social, and professional obligations, and ensure that the client's human rights are protected (Polit & Beck 2021:727). In both phases of the study, the researcher observed the ethical principles of informed consent, confidentiality and privacy, self-determination, and beneficence (De Vos et al 2011:119).

Ethical clearance was obtained from the Research and Ethics Committee, Department of Health Studies at Unisa, to conduct the study. The Regional Learning Centre for Ethiopia at Unisa Addis Ababa wrote a letter of support indicating the study objective and addressing it to the Oromia Health Bureau. A letter of permission was then secured from the Oromia Health Bureau, Bale Zone Town Administration Health Department, Goba Referral Hospital, and the Bale Robe Hospital Manager. All the respondents were informed of the purpose of the study, that participation was voluntary, and that their privacy, anonymity, and confidentiality would be assured. Written and verbal informed consent was obtained from all the respondents (see Annexures N and O). Chapter 3 discusses the ethical considerations in detail.

1.10 SCOPE OF THE STUDY

Due to the researcher's financial constraints, only Goba and Bale Robe towns were selected from the Bale Zone for conducting the research, which limits the generalizability of the study findings to the Oromia National Regional State.

1.11 STRUCTURE OF THE THESIS

Chapter 1: An orientation to the study is provided.

Chapter 2: Literature Review: The results of the literature review on the research topic in terms of the sources consulted and the research methods employed are discussed.

Chapter 3: Research Methodology: The research design and method used in the study are explained. Discussion and justification of the type of design, the population and sample, the sampling procedure, data collection and analysis, and the instrument employed.

Chapter 4: Data analysis and presentation of the study findings: Presents the process used for data analysis, sample realisation, data management, and analysis, the presentation and description of the research findings, and a summary of the findings.

Chapter 5: Discussion of the Research Results: The summary and interpretation of the research findings are explained in detail.

Chapter 6: Develop a strategy for type 2 prevention through modification of major risk factors among adults in Ethiopia.

Chapter 7: Conclusion, Recommendation, and Limitations: based on the findings, conclusions drawn, recommendations, and contributions, and highlighting the limitations of the study.

1.12 CONCLUSION

An overview of the study was presented in this chapter. The chapter addresses the introduction, background data, problem statement, study objectives, the HBM as the study's theoretical foundation, research methodology, and thesis structure. Introduction, background data, problem statement, study objectives, HBM as a theoretical underpinning, research technique, and thesis structure were all covered in the chapter.

CHAPTER 2 - LITERATURE REVIEW

2.1 INTRODUCTION

This chapter presents relevant literature that has been reviewed from both national and international sources. The viewpoints of numerous scholars, researchers, and organisations were carefully examined and analysed in an effort to find a viable solution to the problem.

The organisation of the literature review is such that Section 2.1 provides an introduction, Section 2.2 describes the literature search strategy, Section 2.3 details general global and Diabetes Mellitus (DM) trends, Section 2.4 contains the epidemiology of T2DM mellitus in Ethiopia, Section 2.5 is T2DM risk factors, Section 2.5 is about knowledge, attitude, and risky behaviour prevention of T2DM and its risk factors, and Section 2.6 is the constructs of HMB.

2.1.1 General overview about literature review

Grove, Burns and Gray (2013:708) define literature review as the analysis and utilisation of research materials to create a picture of what is known and not known concerning a particular phenomenon or research problem. According to Creswell (2015:80), the literature review is a written summary of journal articles, books, and other documents that explain the past and present status of information on the subject under study. Reviewing sources that are relevant or important for supplying in-depth knowledge required for changing clinical, educational, or advanced research, or to study a particular research problem. A study's literature review offers context for the study and emphasises the necessity for newer, more recent research (Polit & Beck 2012:95).

According to Grove, Gray and Burns (2015:163), literature reviews of published research reports give background for the problem being studied. These reviews describe the current knowledge of a practise issue, point out any gaps in this knowledge, and explain how the study under review adds to the body of knowledge in this area. In the current chapter, relevant studies conducted on the burden of DM and its associated factors,

knowledge on T2DM, attitudes and risky behaviours on prevention of T2DM, and its determinants are all thoroughly explored.

2.1.2 Purpose of literature review

Creswell (2014:27–28) asserts that the literature review provides several purposes. It provides the reader with information on studies that are closely linked to the phenomena being investigated. Additionally, it relates the study to the larger, ongoing dialogue in the literature and has the potential to fill in gaps and extend earlier studies. The literature review has the characteristic of offering a framework for determining the importance of the research as well as a being a benchmark for comparing the findings with other scholarly literature in the study for a more in-depth discussion.

The purpose of this study's literature review was to provide the researcher with information on the burden of DM, the risk factors for T2DM, the knowledge of T2DM, and the perception of adults towards T2DM and its risk behaviours for prevention of DM. This knowledge was gathered from available and previously published sources.

Machi and McEvoy (2012:135-161) describe the steps for conducting a literature review as follows:

- Searching for and finding publications that are pertinent to the research topic
- Arranging the selected articles in order of relevance after categorising and classifying the publications based on their relevance to the topic.
- Reading and analysing the articles that are deemed relevant in depth. Each article that was searched had its methodology, adequacy of sample size, data analysis techniques, and ethical issues examined.
- Extensively reading and analysing the articles that are deemed pertinent. For each article that was searched, the researcher examined the methodology, sample size adequacy, data analysis techniques, and ethical guidelines applied.
- A critical appraisal was carried out based on the main ideas and arguments mentioned. With a thorough explanation of the issue, the major findings are summarised.

- Finally, the knowledge gaps in the fields of DM, attitude, and perception of risky behaviour on preventative risk factors of T2DM and determinants of T2DM were identified and documented. This has assisted the researcher in developing workable strategies of action to deal with the problem under study.

2.1.3 Literature review/ search strategy

A systematic approach of gathering, evaluating, and summarising the literature is referred to as a literature strategy (Creswell 2014:31; Machi & McEvoy 2012:5). The peer-reviewed articles that constituted this literature review were published over the past five to ten years (mostly within the last five years), with certain justifiable exceptions made for ideas and definitions that required original sources. These articles provide information on the current social, economic, and public health impacts of DM, particularly in developing countries like Ethiopia. In addition to peer-reviewed articles, the literature review included contemporary textbooks, government documents, and scholarly presentations at academic and professional conferences. In the literature study, the researcher highlighted the challenges that most developing countries face in their efforts to raise awareness of T2DM among vulnerable populations. The analysis also includes research from other parts of the world. This provides a foundation for comparing the impact of T2DM in such settings.

For the purposes of this study, the researcher started the search using electronic search engines like Google Scholar, PubMed, and Scopus. Other search engines from the online resources of the UNISA Library included AJOL (African Journals Online), Science Direct, a number of eBooks, the internet, and relevant clinical data bases. The specific webpages are https://www.researchgate.net/publication and https://www.who.org.

The major thematic areas covered in this chapter are as follows: a selection of theories that are related to the study worldwide, nationally, and regionally. The literature that the study reviewed is discussed in this chapter. Commencing with the basic concept of DM, the literature review also discusses T2DM.

It also covers the global burden of T2DM among the adult population; public health significance of T2DM and its risk factors. The chapter also discusses the review's risk factors in relation to T2DM, which are demographic factors, family factors, anthropometric parameters, dietary factors, hypertension, cigarette smoking, physical activity,

knowledge, perception, and risky behaviours towards T2DM, perception of body size and shape, food insecurity, and mental stress.

2.2 DEFINITION AND CLASSIFICATION OF DIABETES MELLITUS

2.2.1 Definition and classification of Diabetes Mellitus and other abnormalities of glucose metabolism

Diabetes mellitus (DM) is a chronic disease brought on by a deficiency in the production of insulin by the pancreas that can be either hereditary or acquired, or by the ineffectiveness of insulin production (WHO 2006; WHO 2018). According to the American Diabetes Association and the World Health Organization (WHO), the definition of DM is a chronic metabolic condition that is characterised by sustained elevated plasma glucose levels brought on by abnormalities in insulin secretion, insulin action, or both (American Diabetes Association 2014:S81-S90; WHO1999 99.2).

All of the pathologic processes involved in the development of DM, centre on an insulin deficiency or a defect in insulin secretion. The beta cells of the pancreatic islets of Langerhans secrete the hormone insulin. It is the body's main regulator of glucose metabolism and is secreted or degraded in response to hormonal or nutritional conditions. The pancreatic islets' cells detect high plasma glucose in the fed state, and in reaction, the pancreatic islets primarily produce and release the important peptide hormone insulin in response to glucose. With the help of insulin, the body's cells are now able to take up glucose. Adenosine triphosphate, the body's primary source of energy, is produced from glucose through the glycolytic process (Park & Ahima 2011:139). Hyperglycaemia, a main feature of DM that occurs when there is insufficient or no insulin production to allow for glucose uptake into the cells from the circulation.

Sustained hyperglycaemia affects the primary macromolecular metabolic pathways of carbohydrate, lipids, proteins, and fats, which in turn causes long-term harm, organ failure, or malfunction in a number of organs (American Diabetes Association 2014:S81–S90; WHO 1999: 2). Although DM manifests itself in many different ways the American Diabetes Association (ADA) and a study from a WHO committee have divided it into two

general groups based on clinical symptoms. There are many other kinds or presentations of DM.

Type 1 Diabetes Mellitus (type 1 DM) and type 2 Diabetes Mellitus (T2DM) are the two main types. In addition to these, there is gestational diabetes (GDM) and "other specific forms" of DM, which are distinguishable from type 1 DM, T2DM, or GDM. These "other specific types" are excluded mostly because of the mechanism that leads to the specific type of DM and its clinical presentation (American Diabetes Association 2014:S81-S90; WHO1999 99.2).

In type 1 DM, the pancreatic islet -cells are completely destroyed, resulting in a complete lack of insulin secretion. Anti-glutamic acid decarboxylase (GAD), islet cell, or insulin antibodies, which recognize the autoimmune mechanisms that result in beta-cell damage and require insulin for survival, are typically present in patients with this kind of diabetes. Although the causes of type 1 DM are not fully understood, environmental and genetic factors frequently cause autoimmune T cell death, which results in complete insulin deficiency. This often develops between childhood and adolescence (Kozak, Brown & Close 2012:113–126).

Individuals with T2DM, on the other hand, have a mainly secretory defect with or without insulin resistance and are mostly insulin resistant with a relative insulin shortage. Here, the degree of hyperglycaemia sufficient to cause pathologic and functional changes in various target tissues, but without clinical symptoms, may be present for an extended period before diabetes is detected. Due to its gradual course and the fact that it accounts for 90% of all diabetes globally, it is often diagnosed during the fourth decade of life (Kozak et al 2012:113-126; Zimmet et al 2016:616–622). Gestational diabetes occurs whenever any degree of glucose intolerance shows during pregnancy, regardless of the type of medication used or whether the condition continues after pregnancy.

In addition, many types of DM have been found and can be linked to other conditions. For instance, pancreatic disorders, drug use, and other endocrinopathies can all cause DM (Evans &Vora 2012). Depending on the pancreas' capacity to make insulin, individuals may need to take oral medications or insulin for this disease. Maturity-onset diabetes of the youth (MODY), a form of diabetes characterised by hyperglycaemia at a young age (25 years), reduced insulin production, and little to no defects in insulin action, can also be caused by monogenic flaws in beta cells.

2.3 GLOBAL TREND AND BURDEN OF DIABETES MELLITUS AND TYPE 2 DIABETES MELLITUS

Diabetes mellitus (DM) is now more prevalent than ever before in the world. The International Diabetes Federation (IDF) estimates that 463 million (9.3%) adults between the ages of 20 and 79 had DM in 2019. The number is anticipated to rise to 578 million (10.2%) and 700 million (10.9%) in 2030 and 2045, respectively. Unfortunately, the majority of people with DM (84.3%) live in low- and middle-income countries, and more than half of them (50.1%) are either unaware of or have not yet been diagnosed with the disease (Saeedi et al 2019:107843).

According to estimates on the global burden of diseases, DM may be responsible for 4.2 million deaths among people aged 20 to 79 in 2019 (Saeedi et al 2019:107843). Over the past few decades, the prevalence of T2DM has been increasing rapidly globally (Zheng, Ley & Hu 2018:88; Smolen, Burmester & Combeet 2016:1513–30). Further, according to IDF projections from 2017, there were 451 million adults (ages 18 to 99) worldwide who had DM in 2017, and that number is expected to rise to 693 million by 2045 if no prevention and control strategies are implemented (Cho, Shaw, Karuranga, Huang, da Rocha Fernandes, Ohlrogge & Malanda 2018:271).

Type 2 Diabetes Mellitus (T2DM) is a condition where there is a progressive loss of insulin secretion and varying degrees of insulin resistance (DeFronzo 2004:787; Care 2019:S13-S28). This reflects an increase in associated risk factors, such as being overweight or obese. T2DM accounts for the vast majority (around 90%) of DM worldwide. The number of deaths resulting from DM and its complications is estimated at 4.2 million. With more than 500 million cases and 1.6 million adult deaths in 2016, it is one of the greatest global health challenges (Bommer, Sagalova, Heesemann, Manne-Goehler, Atun, Bärnighausen, Davies & Vollmer 2018: 963, American Diabetes Association 2004: 1047–1053). The WHO has made efforts to minimise the burden of DM, but its prevalence is increasing and might lead to more premature deaths, with an estimated $2.1 trillion (2.2 percent of the global GDP) in economic costs in 2030 (Bommer et al 2018:963).

In the African region, an estimated 19.4 million adults aged 20–79 years have DM, representing a prevalence of 3.9%. Because the proportion of undiagnosed DM is highest

in the region, the prevalence is higher in urban (5.9%) than rural (2.4%) areas (IDF 2019). In the Africa region, an estimated 19.4 million adults aged 20–79 years have DM, representing a regional prevalence of 3.9%; this is currently the lowest prevalence among all the IDF regions, likely due to lower levels of urbanisation, undernutrition, and underreporting. The proportion of undiagnosed DM is highest in the African region.

T2DM, which accounts for 90% of all cases of the disease globally, mostly affects adults but can also affect children, adolescents, and younger people due to poor nutrition. There are growing rates of obesity and physical inactivity, which could be effectively controlled via education, encouragement, and adoption of healthy lifestyles, along with medication if needed (IDF 2017). The incidence of T2DM in teenagers has grown 15 to 20 times since 1982, with the average age of onset decreasing (American Diabetes Association 2014:S81-S90; WHO 1999:99.2).

The growing incidence of T2DM has been attributed to a number of factors. Urbanisation, economic growth, population ageing, unhealthy eating habits, and sedentary lifestyles are but a few of these (IDF 2017). Urban regions have a 5.9% prevalence compared to rural areas (2.4%) (IDF 2019:9).

Because T2DM is a chronic disease, as it progresses individuals have multiple system complications. The complications of disease have a significant impact on patients and the healthcare system. When individuals with T2DM develop complications, the quality of life is drastically diminished.

The often-seen complications are more susceptible to different forms of both short- and long-term complications diabetes causes, including macrovascular diseases (hypertension, hyperlipidaemia, heart attacks, coronary artery disease, strokes, cerebral vascular disease, and peripheral vascular disease), and microvascular diseases. To others (retinopathy, nephropathy, and neuropathy) and cancers. Diabetes mellitus (DM) is a recognised risk factor for cardiovascular disease (CVD). People with T2DM have higher rates of cardiovascular morbidity and mortality when compared to non-diabetics (Gu, Cowie & Harris 1999:1291). Patients with T2DM are about two to four times more likely to develop CVD than the general population (Gu et al 1999:1291; Martín-Timón et al 2014:444) and have a five-fold greater risk of dying from this condition. Seemingly, complications of T2DM not only add to the burden but also increase the mortality rate of this disease (IDF 2015; Wu, Ding, Tanaka & Zhang 2014: 1185).

2.4 BURDEN OF DIABETES MELLITUS IN AFRICA

Despite the fact that Sub-Saharan Africa had a lower reported prevalence of DM in 2016 (3.3%) compared to the global prevalence (8.5%), there has been an increasing trend in recent decades due to the effects of rapid urbanisation, globalisation, and lifestyle change (Getachew, Defar, Teklie, Gonfa, Bekele, Bekele, Gelibo, Amenu, Taddele, Taye & Getinet 2017 :312). It is alarming that more than two thirds of DM cases in sub-Saharan Africa went untreated (American Diabetes Association 2004:1047–1053, Animaw & Seyoum 2017:10; Asmelash & Asmelash 2019:1-9; Worede et al 2017:251; Amsalu et al 2016:18).

An estimated 19.4 million persons in the 20 to 79-year age range are expected to develop T2DM, which translates to a prevalence rate of 3.9 % in the African region. The prevalence is higher in urban areas (5.9%) than in rural regions (2.4%), because the percentage of undiagnosed diabetes is highest in the rural areas (IDF 2019). According to a meta-analysis study, the pooled prevalence of undiagnosed DM (UDM) in the adult African population was 5.37 % (95 % CI: 4.57–6.81). Additionally, their analysis revealed that the prevalence of undiagnosed DM in the urban population is twice as high as that in the rural population (8.68%, 95 % CI: 5.33, 12.03) vs. 3.93%, 95 %CI: 2.91, 4.95; (Asmelash & Asmelash 2019:1–9).

Globally, DM is a rapidly expanding public health problem, and it is a serious issue in several African countries, including Ethiopia (Gerada et al 2017:28). DM is acknowledged as the fourth most common cause of mortality in the world (IDF 2017).

2.5 BURDEN OF DIABETES MELLITUS AND TYPE 2 DIABETES MELLITUS IN ETHIOPIA

Initially, T2DM was considered a disease of affluent countries, but now it has also become a public health priority for developing countries. Currently, Ethiopia is one of four Sub-Saharan African countries with the highest adult diabetic population. Diabetes-related patient attendance and medical admissions are on the rise in major hospitals. This necessitates a shift in healthcare priorities as well as the latest data on the prevalence

and complications of diabetes in Ethiopia to help in the planning and prioritisation of health programs (Abebe et al 2017 1-6). Furthermore, about 3.6 million patients die annually from DM-related causes in this region (IDF 2015). In Ethiopia, epidemiology characteristic of T2DM is a little research conducted.

Ethiopia is one of the 32 countries in the IDF's African region, with a prevalence of 5.2% and more than 2.5 million DM cases. In the IDF region of Africa, Ethiopia is the country with the highest percentage of DM patients, followed by South Africa and the Democratic Republic of the Congo (IDF 2017). However, according to predictions made by two sources, 3.2% of Ethiopians between the ages of 20 and 79 were expected to have diabetes in 2019 (Saeedi et al 2019:107843; Sinclair et al 2020:108078).

It is estimated that, in 2019, 5.2% of the adult population in Ethiopia (286,534 people) had been diagnosed with DM. Some other studies in Ethiopia report the prevalence of DM in a range from 0.5% to 6.5% (Gebreyes et al 2018:5; Endriyas et al 2018:520; Gizaw et al 2015:74–78; Abebe et al 2014:97; Habtewold, Tsega & Wale 2016:2; Tesfaye et al 2016:68; Zekewos et al 2018:455).

A more recent systematic review and meta-analysis by Zeru and his colleagues indicated that the pooled prevalence of DM in Ethiopia was 6.5% (Zeru, Tesfa, Mitiku, Seyoum & Bokoro 2021:5). In their review, the subgroup analysis of the prevalence of DM by region indicated that the highest prevalence was found in the Dire Dawa city administration (14%), followed by 9% in Addis Ababa, and conversely, the lowest prevalence was reported in the Tigray region, which was 2%. On the other hand, the pooled prevalence of DM was higher among the studies conducted in health facilities, which were reported at 8% (Zeru et al 2021:5).

The prevalence of UDM in adults differs among research studies. For instance, research on the hidden burden of DM in an urban population in south-west Ethiopia found a prevalence of 3.1 % which was comparable to studies in north-west Nigeria (4.3 %) (Sabir et al 2017:168), Gilgel Gibe Field Research Centre, Ethiopia (3.8%) (Seifu, Woldemichael & Tsehaineh 2015 :136-143), and Dire Dawa town (3.3%) (Ayele et al 2019:4). The prevalence of UDM was found to be lower in Kenya (2.4%) (Mohamed et al 2018:1-11), Benin (1.4%) (Kpozehouen et al 2015:163), rural Koladiba town (2.3%) (Worede et al 2017:3), and the Sidama Zone in southern Ethiopia (1.9%) (Zekewos et al 2018:455).

According to a meta-analysis study carried out on an adult African population, the pooled prevalence of UDM was 5.37%. Also, in their analysis, the pooled prevalence from subgroup analyses showed that UDM in the urban population was twice as common (8.68%) as it was in the rural population (3.93%) (Asmelash & Asmelash 2019:1-9). Moreover, a most recent meta-analysis study on UDM and associated factors among adults in Ethiopia revealed that the pooled prevalence of UDM and impaired fasting blood sugar in Ethiopia was found to be 5.75% and 8.94%, respectively (Yitbarek, Ayehu, Asnakew, Chanie, Bayih, Feleke, Amare, Teshome, Teshome, Arage, &Ayele 2021:7).

2.6 RISK FACTORS FOR TYPE 2 DIABETES MELLITUS

Several risks have the potential to increase an individual's likelihood of developing T2DM (Zaccardi et al 2015:131-137). According to the American Heart Association (AHA), (2015), T2DM risk factors are divided into two major categories, such as modifiable risk factors such as being overweight and obesity, high blood pressure (hypertension), abnormal cholesterol (lipid levels) , physical inactivity, and dietary factors or risks. Non-modifiable risk factors include socioeconomic and demographic characteristics as well as genetics, age, mental health, and a history of gestational DM.

2.6.1 Non-modifiable risk factors for Type 2 Diabetes mellitus

2.6.1.1 Demographic Factors

Age

T2DM is a chronic disease that is accelerated by the ageing population. A large and growing body of literature has investigated the relationship between the prevalence of type DM and advanced age. As such, evidence indicates that increasing prevalence and incidences of T2DM are associated with advancing age (WHO 2010b). Several studies in different parts of the world, including Ethiopia, show that the prevalence of T2DM increased with age and that the highest prevalence was among older adults, especially those over 65 years old. Indeed, in most populations, the incidence of T2DM is low before

age 30 years but increases rapidly and continuously with older age (Bailey et al 2016:1-11: Miyakawa et al 2017:298; Abebe et al 2014:97; Ebrahimi et al 2016:189; Gatimu, Milimo & Sebastian 2016:4; Ayah et al 2013:371; Bahendeka et al 2016:405; Bahijri et al 2016:3; Rajput et al 2012:443). The other study likewise found that T2DM highly affected by people between the ages of 61 and 65 (14.4%), 13 (65%), and 7 (35%); P (0.698, 1.048) (Asiimwe, Mauti, & Kiconco 2020:1–5). The study conducted in Bangladesh reported that study subjects with an age range of 55–59 years had higher odds of having DM (odds ratios (OR) = 2.37, 95 % confidence interval (CI):1.76–3.21) than the age group of 35–39 years (Chowdhury et al 2015:1070). In this context, Abas (2019:488-489) have further reported that the prevalence of T2DM was significantly associated with age group (greater than or equal to 60 years old) (AOR:3.41; CI:1.05, 11.05) and also reported that females were more prevalent than males.

A study carried out in Ethiopia also reported that older age (AOR = 4.86; 1.99, 11.9) was significantly associated with DM among the population (Abebe et al 2014:97). As such, the results showed that as people aged, the prevalence of T2DM increased (OR (95% CI) among subjects aged greater than or equal to 45 compared to the group of people under 45 years old (=1.04(0.57-1.50) (p-value 0.001) (Zekewos et al 2018:456).

Further, a case-control study by Demilew and Firew (2019:5) in the Mecha area of north-western Ethiopia and a meta-analysis by Zeru et al (2021: 7) show a strong association of T2DM increasing with age.

Gender

In a population-based study conducted in Bangladesh, women were slightly more likely than men to have T2DM (11.2%). This study also reported that respondents with higher social status (OR = 2.01, 95% CI:1.50-2.70) and higher educational attainment (OR = 1.67, 95% CI:1.18-2.36) had higher risks of having DM than respondents with lower social status and no education, respectively (Chowdhury et al 2015:1070). Indeed, Asiimwe et al (2020:1-5) reported that females were more affected by T2DM when compared to males.

Genetic risk factors/ Family History

It is well known that T2DM is, in part, inherited. T2DM is strongly inherited genetically. The chance of developing T2DM is significantly increased by having relatives with T2DM particularly first-degree relatives. Studies have reported that having first-degree relatives

with a positive family history increases the risk of having T2DM (Adhikary et al 2017:1005–1010; Asiimwe et al 2020:1-5). For instance, a prior study found that those with T2DM in the first degree were around three times more likely to develop the disease than those without such a family history (Florez, Hirschhorn & Altshuler 2003:257). Additionally, some twin studies have found that monozygotic twin concordance rates are significantly higher for T2DM inheritance than those of dizygotic twins (Gale, Bingley, Eisenbarth, Redondo, Kyvik & Petersen 2001:997). According to research on twins, concordance among monozygotic twins is about 100%, and roughly 25% of individuals who have the disease have a history of DM (Rother 2007:1499).

A study conducted reported that a parental history of DM was significantly associated with the presence of DM in men (S = 2.4, 95% CI: 1.1–5.1). This relationship was lower in women. Furthermore, a synergistic interaction between obesity and the presence of a family history of DMs was seen in males but not in women (Wikner , Gigante, Hellenius, de Faire &Leander 2013:4). A study from a rural area of Delhi showed that a positive family history of DM was present in 14.4% of the study population (Adhikary et al 2017:1005–1010). In another by Asiimwe et al (2020:1–5), family history was found to be significantly associated with T2DM at a P value < 0.05.

Similarly, another study conducted in Ethiopia revealed that there is a statistically significant association between DM and a positive family history (AOR: 2.90 (CI: 1.37, 6.11) (Abas 2019:488-489). A population-based study conducted in Ethiopia showed that family history of diabetes (AOR = 5.05; 2.43, 10.51) was significantly associated with DM (Abebe et al 2014:97). Therefore, there is a strong association between the genetic factors and T2DM. Notably, based on the recent metal-analysis data by Yitbarek et al in Ethiopia, positive family history was the only significant factor associated with DM (Yitbarek et al 2021:8). Other risk factors, such as less education, residence (urban versus rural), and lower income, are associated with T2DM (Saydah, Imperatore& Beckles 2013:49–55).

2.6.2 Modifiable risk factors for Type 2 Diabetes mellitus

Fortunately, T2DM can be prevented and controlled by avoiding risky behaviours and unhealthy lifestyles. The modifiable shared risk factors for T2DM include smoking

cigarettes, harmful alcohol use, an unhealthy diet (such as excessive consumption of animal fat meat and inadequate consumption of a fibre-rich diet, vegetables, and fruits), physical inactivity, food insecurity, and mental stress that lead to obesity and T2DM.

Anthropometric Parameters

Anthropometric characteristics of T2DM differ between countries and races. Due to its simplicity and minimal cost of operation, anthropometry, which is based on the clinical assessment of body fatness, has unquestionably shown to be the most helpful method (Mei , Grummer-Strawn, Pietrobelli, et al 2002:978–985, Cornier 2011:1996–2019; WHO 2009). Typical anthropometry-based tools used in determining body fatness and anthropometric parameters reviewed in this chapter are body mass index (BMI), waist circumference (WC), hip circumference, and waist-to-hip ratio (WHR).

As stated by the WHO (1998), BMI is determined mathematically by weight in kilogrammes divided by the square of height in metres. The WHO defines an obese individual as a patient whose measurement is higher than or equal to 30 kg/m2, which is one of the clinically acceptable methods of determining total body fat. Likewise, BMI measurement values between 25 and 29.9 kg/m2, 18.5-24.9 kg/m2, and less than 18.5 kg/m2 are considered to be overweight, normal weight, and underweight, respectively.

Despite the fact that BMI may be a simple and easy technique for assessing obesity in the clinical environment, there are other measurements of adiposity that may be used to describe obesity in a more accurate and specific way than BMI. The WHR is defined as waist circumference divided by hip circumference, with the hip circumference being the largest circumference around the buttocks. It has been demonstrated that WC and WHR independently predict the incidence of CVD, T2DM, and mortality (De Koning, Merchant, Pogue & Anand et al 2007:850).

Being overweight or obesity is well-recognised as one of the major and independent T2DM risk factors. For example, a study from South India, identified WC and BMI as being more associated with T2DM than WHR. A diabetic individual's chances of having a high WC were 3.56 times greater as compared to those of a non-diabetic person (Awasthi, Rao & Hegde 2017:56). Another study from the Kilimanjaro region also showed that being overweight or obese was independently associated with the prevalence risk ratio for glucose impairment (2.16; 95% CI 1.39–3.36) (Stanifer , Cleland, Makuka 2016:10). Similarly, in a study conducted by Endris, Worede and Asmelash (2019:2799), overweight

and obese study respondents had a 22 times higher risk of developing DM than normal-weight ones (AOR = 21.95, 95% CI: 6.731–71.603)

A study found that obesity and being overweight are associated with an increased prevalence of T2DM. Among the subjects, obesity (71%) and overweight (21.6%) were both significant risk factors for T2DM (Okonta, Ikombele & Ogunbanj 2014:1-6). In their study, the sedentary lifestyle and a low level of physical activity appears to contribute to the large proportion of overweight and obese were among the study respondents (Okonta et al 2014:1-6).

In Ghana, a cross-sectional study of people with T2DM established that abdominal obesity was prevalent (77.0%) and that factors such as female gender, age, and fasting plasma glucose were associated with rising WHR and WC (95.99 cm) (Mogre, Abedandi & Salifu 2014:1–7). Another study found that overweight and obese respondents had considerably greater risk ratios for T2DM than their normal-weight counterparts, with relative risks (RRs) of 1.167 and 1.181, respectively, for BMI and WHR (Paul & Ojah 2015:89–93).

A randomised controlled trial study comparing the mean BMI among the control group and the intervention group revealed considerably greater chances of T2DM among the control group respondents than among those in the intervention group: 31.04 ± 3.39 versus 27.45 ± 3.29. (P value <0.001) and 1.6 (1.1 to 2.0) using a cut-off point of ≥23 and ≥25 (kg/m2, respectively. In their study, WC (91.17 5.89 vs. 88.65 6.26, P value 0.013), median skin fold thickness (241 (IQR 236 to 248.25 vs. 235 (IQR 230 to 242), and WHR (1.01 0.07 vs. 0.98 0.045, P-value 0.003) were the parameters that indicated a statistically significant difference between the intervention and control groups (Kour, Goudar & Kothiwale 2019:279).

According to a study conducted in Ethiopia, people who reside in urban areas are 3.4 times more likely to be overweight than people who do not [AOR = 3.4, 95% CI (1.26, 9.4)]. Respondents who had T2DM for 3 to 6 years had 2.8 times the chances of being overweight compared to those who had it for less than 3 years [AOR = 2.8, 95% CI (1-78.85)]. The study also revealed that those with T2DM who engaged in a low level of vigorous physical activity were 4 times more likely to be overweight than those who engaged in an adequate level of vigorous physical activity (Kiros , Abyu, Belay, Goyteom & Welegebriel 2019:762). Likewise, in a cross-sectional study performed by Endris et al

(2019:2799–2809) in Ethiopia, respondents who were overweight or obese had a 22-fold higher likelihood of having DM than those who were of normal weight (AOR = 21.95, 95% CI: 6.731–71.603).

Studies have shown that the WC, as compared to BMI, is the best predictor of T2DM, for instance, it was revealed that the WHR was statistically associated with the prevalence of DM (AOR = 4.6, 95% CI, 1.9–10.9). Though the study respondents' BMI was investigated, no statistically significant results were found (Tesfaye et al 2016:88). On the obesity index that best reflects the risk of developing DM, conflicting evidence can be found in some research. For instance, a Venezuelan study indicated that respondents who were overweight or obese did not have a higher risk of developing DM than those who were normal weight. Conversely, among women having abdominal obesity was associated with a 77% higher chance of developing DM (AOR = 1.77; 95% CI, 1.1%, 2.9%). This draws attention to the potential complexity of mechanisms that can underpin gender disparities in DM. While there were similar BMIs in both groups, men had higher WC and higher blood sugar levels than women (Nieto-Martnez , Mechanick, Brajkovich, Ugel, Risques, Florez & González-Rivas 2018: 126).

In some studies, WC and WHR are better BMI; for instance, a study conducted in a Cameroonian population reported that the prevalence of T2DM was significantly associated with WC [1.30 (1.16–1.46)], HC [1.18 (1.05–1.34)], and waist height ratio (WHtR) [1.26 (1.11–1.39)], respectively. Where BMI [1.05 (0.98–1.13)] and WHR [1.05 (1.00–1.16)] were less effective (Mbanya, Kengne, Mbanya &Akhtar 2015:23), and in others, neither was significantly better. The study by Lotfi, Saadati and Afzali (2014:2-3) reported that BMI and WHR were not significantly associated with DM in either sexes. Furthermore, both types of obesity (centre and general obesity) may be independent predictors of diabetic risk. In a case-control study conducted on anthropometric measurements among T2DM and non-diabetic women, the authors found that increased risk for type 2 DM was related to both general and central obesity. Women with a BMI of 30 kg/m2 (95% CI:2.09–10.49) had a 4.7 times higher risk of T2DM compared with women with a BMI <25 kg/m2. They also reported that higher WC >88 cm (AOR =6.99; 95% CI, 1.60 e 30.42) and WHtR 0.5 (AOR = 3.15; 95% CI, 1.91 e 15.81) were more strongly related to T2DM (Radzeviien & Ostrauskas 2013:241-246)

The obesity paradox has been seen in T2DM patients. However, there has been considerable controversy concerning the results. The obesity paradox is supported by

certain studies, such as Carnethon et al 2012:317–325; Thomas et al 2014: 317–325; Zhao et al 2014:214–2151; Badrick et al 2017:4-8), but others did not. Similarly, non-obese people's mortality rates have been documented.

According to a number of studies looking at the association between BMI and mortality in diabetic people, the paradoxical BMI category with reduced associated mortality risk (overweight or obese) is greater than it is for non-diabetic people (normal weight) (Carnethon, Rasmussen-Torvik & Palaniappan 2014:1-4; Lajous et al 2014:1-10; Logue et al 2013:887). Despite appearing contradictory, the BMI mortality paradox in DM may be explained by genetic and physiological differences between slimmer and heavier diabetic people, notably in those with T2DM, which makes up the majority of cases in adults (Carnethon et al 2014:1-4; Lajos et al 2014:10; Coleman et al 2014:500–505; Kao & Chen 2013:255–259).

Evidence shows that both generalised and abdominal obesity are independently linked with DM (Anjana, Pradeepa, Deepa 2011:3022–3027; Barik et al 2016:1-8). Several studies indicated the relationship was consistent across adult people, despite the differences in measurement techniques for the diagnostic criteria and fatness for T2DM, which demonstrates the robustness of the association. Apparently, the risk factors for T2DM increase with increasing obesity. Many researchers who studied the association between obesity and T2DM in adults confirmed that general obesity and abdominal obesity are important risk factors for T2DM. Thus, differences in obesity may be due to differences in the methods of data collection and the inappropriate use of statistical methods.

Cigarette smoking

A study from Spijkerman et al (2014:3164), reports smoking is strongly associated with T2DM development and quitting is encouraged to prevent T2DM. Cigarette smoking has been established as an independent risk factor for developing T2DM. As a smoker, the level of nicotine in the body increases. The reduction in muscle glucose uptake results in insulin resistance and T2DM.

Several studies have identified that cigarette smoking increases the likelihood that a person will develop T2DM and a large number of other illnesses (Luo et al 2015:240–243). Smoking habits come in two types: active smoking and passive smoking (Luo et al., 2015:240–243; Zhu et al 2014:226-237). Active smokers are those who smoke cigarettes

regularly, whereas passive smokers are those who involuntarily come into contact with tobacco users (Panet al 2015:958–967). Smoking, both passive and active, is substantially and independently associated with a higher risk of T2DM (Zhang et al 2011:892–897). It has been demonstrated that exposure to passive smoking increases the risk of T2DM in individuals (Zhu et al 2014:226-237). According to Luo et al (2015:240–243), active smokers had a twofold increased risk of T2DM as compared to non-smokers. Indeed, both active and passive smoking are strongly associated with the risk of T2DM. Men are more likely than women to be associated.

A study on Japanese adults found that 2,441 (4.5%) developed T2DM after a median follow-up of 3.9 years. The multivariate-adjusted hazard ratios (95% CI) for DM were 1.16 (1.04 to 1.30) and 1.34 (1.22 to 1.48) for never smokers, former smokers, and current smokers, respectively (Akter, Okazaki, Kuwahara, Miyamoto, Murakami, Shimizu, Tomita, Nagahama, Eguchi & Kochi 2015: 7). Among current smokers, the chance of developing DM increased as cigarette consumption increased (P for trend = 0.001). Even though respondents with lower BMIs (<23 kg/m2) had a higher relative risk of DM, those with higher BMIs (>23 kg/m2) had a higher attributable risk. Former smokers who had quit for less than five years, five to nine years, or ten years had DM hazard ratios of 1.36 (1.14 to 1.62), 1.23 (1.01 to 1.51), and 1.02 (0.85 to 1.23), respectively, compared to those who had never smoked (Akter et al. 2015:7).

Notably, based on meta-analysis data from 20 cohorts with 5,077,289 respondents and 223,084 incidents cases of T2DM, an average estimated pooled relative risk ratio (RRR) of 0.96–1.01 was documented for the association of cigarette smoking with incidents of T2DM in women compared with men, indicating that cigarette smoking is a key predictor of incidents of T2DM with no significant sex difference in the RRR being found between former smokers and those who had never smoked (RRR:0.98, 95% CI:0.92–1.01) (Yuan et al 2019:e169).

According to a cross-sectional study carried out in China, people with DM who smoke had a 3.5-fold higher risk of having a stroke than those without DM who did not smoke (OR 1.83, 95% CI 1.59 to 2.14, P<0.001). The study also indicated that smoking increased the risk of both ischemic and haemorrhagic stroke after controlling for confounders; the ORs were 1.32 (95% CI 1.12 to 2.53) and 1.95 (95% CI 1.40 to 3.41), respectively. Smoking and DM together exhibited a positive connection with stroke (Lou et al 2018:4).

An investigation of a prospective cohort of 7,124 males who had no prior history of DM, coronary heart disease, or stroke at the baseline demonstrated that smoking was substantially associated with an increased risk of T2DM after controlling for age, BMI, and other potential confounding factors. After five years of quitting, the benefits of quitting were obvious, and it took 20 years for the risk to return to that of never-smokers. The risk of developing T2DM was comparable for those who switched from smoking cigarettes to pipes or cigars or vice versa. In comparison to never smokers, their meta-analysis found that the risk was higher for newly quitting smokers; however, after five and 10 years, the risk was significantly lower (Pan et al 2015:958–967).

Alcohol consumption

Numerous pieces of epidemiological evidence show a link between alcohol intake and the risk of T2DM. Nevertheless, inconsistent and contradictory findings were found in the studies. Certain studies have linked heavy alcohol use to an increased risk of T2DM. In some research, moderate alcohol use was found to lower the risk of T2DM, whereas in other studies, there was no association between alcohol consumption and T2DM risk.

For example, two meta-analysis studies examining a potential dose-response relationship between alcohol consumption and T2DM risk in men found contradictory results. One observed a U-shaped association indicating a protective effect of moderate alcohol consumption on T2DM risk (Li et al 2016:818–829), while the other found an almost linear association with no reduction in T2DM risk (Knott, Bell & Britton 2015:1804). However, the findings of the two investigations were in agreement with a U-shaped association with a protective effect of alcohol use on the incidence of T2DM in women (Knott et al 2015:1809; Li et al 2016:818). Conversely, there is still research that demonstrates that drinking alcohol increases the risk of T2DM regardless of the amount consumed (Griswold, Fullman, Hawley, Arian, Zimsen & Tymeson 2018:1015).

Even though the terms "low", moderate," and "high" alcohol consumption have been defined differently in various research studies, risk drinking levels are linked to beneficial health effects, according to the WHO (Gowing et al 2015:904 & Hasin et al 2017:469–476). Results of a recent Chinese study indicated that abstaining from alcohol use and lowering alcohol consumption are both effective ways to lower the risk of developing T2DM (Wu et al 2021:4-5).

According to prospective research, among initially infrequent and light drinkers, increased alcohol use over time was related to a decreased incidence of T2DM. In their study, persons who were normal weight or overweight and had used low to moderate amounts of alcohol over the previous three months had a lower risk of T2DM, while there was no statistically significant correlation between alcohol use and impaired glucose tolerance (IGT). The authors concluded that alcohol use reduced the risk of T2DM diagnosis in normal and overweight people, but not in obese people (Metcalf, Scragg & Jackson 2014:4). Research suggests that consuming alcohol more frequently is linked to a lower risk of developing DM and that consumption of alcohol throughout 3–4 days per week is linked to a lower risk of developing DM, even after adjusting for average weekly alcohol use (Holst et al 2017:1941).

A large systematic review and dose-response meta-analysis conducted on the association between alcohol consumption and the risk of incident T2DM reported that light (RR: 0.83; 95% CI: 0.73, 0.95; P = 0.005) and moderate (RR: 0.74; 95% CI: 0.67, 0.82; P< 0.001) alcohol consumption were associated with a lower risk of T2DM. However, heavy alcohol consumption had little or no effect on subsequent T2DM risk. Furthermore, in their study, the summary relative risk ratio(RRR) (RRR; male to female) of the comparison between moderate alcohol consumption and the minimal alcohol categories for type DM was significantly higher, and the pooled RRR (current smoker to never smoker) of light alcohol consumption was significantly reduced (Li et al 2016:818).

An umbrella review of meta-analyses by Bellou et al (2018:17) found that moderate alcohol use had a protective impact against T2DM. However, the results of the previous studies indicated that alcohol use was positively related to T2DM regardless of the amount consumed (Griswold et al 2018:1015; Kim & Kim 2012:108–115; Dreje et al 2020:3).

Ethiopia's population is different from those of other countries, as it has a distinct "drinking culture". In Ethiopia, drinking alcohol is particularly prevalent during significant holidays, business occasions, ceremonies, and special events.

Hypertension

Several studies have shown that the hypertensive population and those with a history of hypertension have a higher risk of suffering T2DM compared with those without DM.

Hypertension, commonly referred to as high blood pressure, is a medical condition in which the blood pressure in the arteries is persistently increased. Insulin resistance and eventually T2DM are brought on by this. Increased sympathetic nervous system activity in hypertension causes skeletal muscle vasodilation to be impaired. Thus, as T2DM eventually develops, muscle glucose uptake decreases(Duplain et al 2001: 342-34 & Moreno et al 2018: 910-917).

According to a study by Chaudhary et al (2019:1-7), hypertension was substantially related to every indication of obesity ($p< 0.001$). Patients with high WHR were more likely to develop hypertension (75% versus 65%, odds ratio (OR) 1.6, $p = 0.001$) as compared to T2DM patients with normal WHR. Additionally, substantially correlated with hypertension was a higher-than-normal WC (79% versus 56%, OR 2.9, $p<0.001$). Likewise, obese T2DM patients with a BMI >27 kg/m2 had a higher likelihood of having hypertension than those with a BMI in the normal range (18.5 to 22.9 kg/m2) (83.1 versus 64.4%, OR 2.7, $p <0.001$).

In a study carried out by Tesfaye et al (2016:88) in Ethiopia, it was found that those with hypertension had a 6.7-fold higher risk of DM than respondents with normal blood pressure (AOR = 6.7, 95% CI, 2.6–17.2). Another study from eastern Ethiopia identified those CVD risk factors for DM. For instance, the prevalence of hypertension was high (62.7%) among DM patients, and the study identified that patients over 65 had considerably higher blood pressure (hypertension) than those under 65 ($p <0.023$). In addition, females were found to be substantially less physically active than males ($p <0.001$) (Abdosh et al 2019:3-5).

A study conducted in Jimma University Specialised Hospital found that isolated systolic hypertension (ISH) was present in 27.6% (95% CI: 22.7–32.5%)] of T2DM patients. The study also identified that respondents with an age range of 47–55 years were 2.6 times more likely to develop isolated systolic hypertension than those aged 22–46 years (Dagnew & Yeshaw 2019:510). Likewise, the results of research by Endris et al (2019:2799–2809) showed that people with systolic hypertension were 4.6 times more likely to have DM than respondents without hypertension (AOR = 4.61, 95% CI: 1.088, 19.50).

A meta-analysis study conducted in Ethiopia has shown that the pooled prevalence of DM was 4.99% (95% CI: 3.86%–6.11%). Additionally, their investigation found that DM

and recognised hypertension were substantially associated (OR: 8.32; 95% CI: 3.05, 22.71) (Tesfaye et al 2019 :1). A study has identified that the use of anti-hypertension medication may increase the risk of T2DM (Everett, Frithsen & Player 2011:241).

Physical Activity

Multiple studies have shown that unhealthy diet habits, a sedentary lifestyle, and a lack of physical activity are strongly linked to a higher risk of developing T2DM, both directly and indirectly, by fostering obesity and other components of the metabolic syndrome (Khetan & Rajagopalan 2018:615; Weisman et al 2018:552; Zheng et al 2018:88-98).

Regular physical activity (PA) is recognised as a cornerstone in the prevention and treatment of T2DM because it has a number of positive effects on cardiometabolic health (Care 2020:S135). Individuals with pre-diabetes and T2DM may benefit from regular physical exercise by improving their emotional well-being, managing their blood sugar levels, and lowering their risk factors for CVD.

Physical activity also enhances lipids, blood pressure, and insulin sensitivity, and reducing sitting time may enhance postprandial glucose and insulin levels (Kanaley et al 2022:353; Liubaoerjijin et al 2016:769; Pan et al 2018:1–4). Thus, the cornerstone of T2DM preventive strategies is lifestyle change that attempts to enhance dietary practises and increase levels of physical activity (Khetan & Rajagopalan 2018:615–623).

Physical activity is the major determinant of energy expenditure, which is significant for energy balance and weight (WHO, 2010). According to the WHO, moderate physical activity (approximately 150 minutes per week) reduces the risk of T2DM by 27%, colon cancer by 21-25%, and ischemic heart disease by 30% (WHO, 2010). Several studies were conducted regarding the relationship between physical inactivity and the risk factors for developing T2DM. Being physically inactive contributes to an individual’s likelihood of developing T2DM (Liese et al 2013:21; Aune et al 2015:529).

Evidence suggests that moderate- to high-intensity exercise has beneficial effects on T2DM prevention, Furthermore, aerobic exercise such as brisk walking, jogging, running, bicycling, swimming, tennis, squash, and rowing, as well as weight training, has been associated with lowering the risk of developing T2DM (Grontved et al 2012:1306). Likewise, another meta-analysis study identified that higher television viewing time was

associated with increased risk for T2DM (RR per 2 hours: 1.20, 95% CI: 1.14–1.27) (Grøntved & Hu 2011:2448).

Dietary Factors

Diet is a key factor in maintaining human health. However, the quality of the diet and excessive calorie consumption may be the key factors contributing to the epidemics of adiposity (overweight, obesity, and T2DM) around the world (Allison & Mattes 2009:318; Hu 2011:1249). It has been suggested that diet significantly contributes to the development of DM (Ezzati & Riboli 2013:954).

It is well established that high-sugar foods and beverages with high energy density increase the risk of T2DM and CVD (Ventura, Davis & Goran 2011:868–74; Imamura et al 2015:1-10). Studies suggest that there is a lot of dietary fibre in fruits, vegetables, and grains. Hence, consuming a significant amount of fruits and vegetables may benefit in the prevention of T2DM (Consortium 2015:1394; Yao et al 2014:79). Research on dietary habits in urban Ghana found a relationship between a lack of fruit and vegetable consumption and an increased risk of T2DM (Frank et al 2014:89). According to another study from Egypt, key diets consist primarily of foods with a high glycaemic index and load, such as white bread and polished rice. Such a study reported that trans-fat consumption was clearly prevalent in African countries, specifically in Egyptian populations at the time of the study. The study also indicated the consumption of these unhealthy fats was highest in Egypt (Hegazi, El-Gamal, Abdel-Hady, & Hamdy 2015:814).

Vegetables are rich sources of antioxidant compounds such as carotenoids, vitamin C, vitamin E, and flavonoids, as well as fibre, and may have a protective effect against the development of diabetes by relieving oxidative stress that interferes with the glucose uptake by cells (Bazzano , Li, Joshipura & Hu 2008:1311). A meta-analysis found that only vegetables with green leaves or roots were linked to a lower risk of T2DM (Cooper et al 2012:1082). A study that examined diversity within specific food groups (fruits and vegetables) showed that people who reported consuming 12 different fruit and vegetable items per week had a 39% lower risk of developing T2DM (Cooper et al 2012:1293–1300).

According to a meta-analysis study by Maghsoudi, Ghiasvand and Salehi-Abargouei (2016:230–241), adhering to a healthy diet pattern significantly lowers the risk of T2DM (RR = 0.86; 95% CI 0.82, 0.90), while eating a diet that is considered to be unhealthy has

adverse effects on DM risk (RR = 1.30; 95% CI 1.18, 1.43). In their study, subgroup analysis revealed that poor dietary patterns that loaded up on items with high phytochemical content did not substantially increase the incidence of T2DM (RR = 1.06; 95% CI 0.87, 1.30).

Multiple meta-analyses studies and other studies have examined the connection between fruits and vegetable intake and the risk of T2DM (Li et al 2014:1-8; Li et al 2015:454; Wang et al 2016:56; Schwingshackl et al 2017:363). Conversely, there have been inconsistent findings between consumption of fruits and/ or vegetables and the risk of T2DM. For instance, a study by Schwedhelm et al (2017:363) indicated that consuming more fruits and vegetables was substantially associated with a lower risk of developing T2DM, whereas other studies only noticed this association with fruit intake (Li et al 2014:1–9; Wang et al 2016:56). Conversely, a cohort of populations in Europe and the United States found no correlation between fruit and vegetable intake and the incidence of T2DM (Mamluk et al 2017:89).

A case-control study conducted in Shahreza, Iran, on 300 respondents, 150 subjects with normal fasting blood glucose (FBG), and 150 pre-diabetic respondents who were matched for sex and age, found that increasing fruit and vegetable intake and fruit consumption overall may lower the odds ratio (OR) of pre-diabetes (Koohdani et al 2018:295). In a recent cross-sectional study conducted in China on the relationship between fruit and vegetable intake and T2 DM, fruit and vegetable intake was found to be negatively associated with T2DM in women (AOR = 0.45; 95% CI:0.28, 0.71), while being inversely associated with pre-diabetes risk in both genders (Wu, Liu, & Yuan 2021:208).

A Chinese cross-sectional study suggested that a diet rich in fruits and vegetables was linked to a lower risk of developing impaired fasting glucose (IFG) (Zhang et al 2015:8072). Further, numerous earlier studies revealed that higher adherence to a Mediterranean diet highlighted by rich fruit and a considerable decline in the risk of DM were linked to high vegetable intake and little meat eating (Schwingshackl et al 2015:1292). On the other hand, Western diets with a high meat intake are notably linked to a higher risk of T2DM (Jannasch, Kröger & Schulze 2017:1174).

According to a recent meta-analysis, consuming a large amount of fruit and vegetables together may reduce your risk of developing T2DM by a small amount. However, some

specific fruit varieties, like apples and pears, blueberries, grapes, and raisins, were more strongly linked to a lower risk of T2DM (Halvorsen, Elvestad , Molin & Aune 2021:519).

A 4-year longitudinal study of Swedish individuals found that men who consumed fewer vegetables than they should had a 62% higher likelihood of acquiring T2DM during that time, even after adjusting for characteristics including age, education, BMI, smoking, alcohol intake, and physical activity (Ahmed, Lager, Fredlund & Elinder 2020:1-6).

While food market globalisation has the potential to increase the availability of fruits and vegetables, easy access is significantly correlated with higher socioeconomic positions in most nations and ultimately decides their intake (Rasmussen et al 2006:22). Fruit and vegetables are only available seasonally in many African countries. As a result, most Africans' fruit and vegetable eating is not included in their typical daily dietary patterns (Peer et al 2012:9).

2.6.3 Perception of body size and shape in relation to Type 2 Diabetes mellitus risk

As physical activity, nutrition, and other behaviours are crucial parts of T2DM management and prevention, perceptions about one's body image may affect behaviours related to one's health. An individual who is overweight may be less aware of the need to lose weight if they believe they are disproportionately thinner than their actual BMI. There is a widespread misperception that being obese or overweight is a sign of good health, according to a study. Another common misperception was that those who were overweight or obese were most likely wealthy.

In several populations, the relationship between the perception of physical size or weight and obesity has been studied (Flynn & Fitzgibbon 1998:13; Goedecke & Jennings 2006:33; & Sonneville, Calzo, Horton, Haines, Austin, & Field 2012:944). Body image perception has been associated with obesity, particularly among black African women in South Africa who were dissatisfied with their current body size but perceived larger body sizes as the ideal body size (Micklesfield et al 2013:369 & Mciza et al 2005:509-519). According to reports, black African adults' perceptions of their bodies are negatively associated with their nutrition behaviours and attempts to maintain a healthy weight (Draper, Davidowitz & Goedecke 2015:548 ; Faber & Kruger 2005:238; & Case & Menendez 2010:271). Furthermore, eating disorders and weight control behaviours have been linked to body image perceptions in Sub-Saharan Africa (Scott , Ejikeme Clottey &

2013:4; & Draper ; Davidowitz & Goedecke 2015:548), the United States (Sonneville et al 2012:944), and other populations (Alwan ; Viswanathan, Paccaud, & Bovet 2011:6).

For example, a study carried out in rural South Africa found that obese and overweight black women were unwilling to lose weight and that very few of them associated their diet with disorders like DM, heart attacks, strokes, cancer, or hypertension (Faber & Kruger 2005:238). Studies have shown that being overweight or obese does not have a negative effect on one's health, which highlights how significant the misperception about the risks associated with aspects connected to body shape and size are. The perceived health problems associated with obesity and being overweight were non-communicable diseases, including T2DM.

2.6.4 Mental stress relationship with Type 2 Diabetes mellitus

There are several important relationships between stress and DM, including the possibility that stress can both cause and worsen DM. Additionally, studies linked a lifetime of high stress to an increased risk of developing T2DM. Psychological distress appears to significantly increase the incidence of T2DM, according to several studies (Toshihiro, Saito, Takikawa, Takebe, Onoda, & Satoh 2008: 1211; Brunner & Kivimäki 2013:449 & Mommersteeg, Herr, Zijlstra, Schneider & Pouwer 2012:1–10).

Research indicates that those with depression and anxiety are more likely to develop T2DM. For instance, evidence suggests that experiencing depression at the baseline increases the risk of subsequently developing T2DM (Golden et al 2004:429; Anderson, Cohen & Naumova 2006:285 & Carnethon et al 2008:2383). A growing body of evidence, according to a review by Hackett and Steptoe, indicates that stress may play a part in the aetiology of T2DM, both as a predictor of T2DM that develops at new onset and as a prognostic factor for those who already have T2DM (Hackett & Steptoe 2017:547).

Another prospective cohort study on Chinese policemen found that T2DM was more prevalent among those who experienced psychological distress than in those who did not, with a 4.43 % prevalence difference. In their study, the researchers came to the conclusion that psychological distress is an independent risk factor for T2DM (Li et al 2017:4-6).

2.6.5 Food Insecurity related with Type 2 Diabetes mellitus

Researchers have identified and highlighted the link between T2DM and food insecurity findings from previous research studies.

According to many researchers, food insecurity is an independent risk factor for a poor intermediate health outcome (Melchior et al 2009:e564 & Seligman et al 2011:1204). It is also associated with chronic disease in adults with low income, including obesity, insulin resistance, and T2DM (Najibi et al 2016:3). Whether food insecurity contributes to the development of chronic diseases has been the subject of speculation. Numerous studies show a link between food insecurity in the household and chronic diseases. In particular, T2DM is significantly associated with food insecurity, even after controlling a number of covariates (Holben & Pheley 2006:1–9; Seligman et al 2007:1018 & Seligman, Laraia & Kushel 2010:304).

Researchers have shown that food insecurity may worsen inflammation in the body, which can result from dietary-related obesity and excess abdominal fat. Stress caused by food insecurity, which frequently results in mental distress, triggers the release of cortisol and other stress hormones. These hormones could foster the development of insulin (Kaufman et al 2007:1382 & Seligman et al 2010:308).

Researchers claim that food insecurity is associated with a reduction in the consumption of a number of food groups (fruits and vegetables, whole grains, meats, and dairy products) (Panigassi et al 2008:135s). Such factors may lead to inadequate nutrient intake, which can have negative impacts on an individual's health status (Ramsey , Giskes, Turrell, &Gallegos 2012:227), including nutritional deficiencies (Kirkpatrick et al 2015:1596) and non-communicable chronic diseases (NCDs) like T2DM (Gowda, Hadley & Aiello. 2012:1579). On the other hand, there are indications that adulthood food insecurity may also be linked to NCDs (Laraia 2013:203). This association could be explained by a qualitative and quantitative diet restriction (Nguyen, Shuval, Bertmann & Yaroch 2015:1453) with increased consumption of inexpensive energy from foods with a high caloric density (de Bem Lignani et al 2011:785), which would lead to a positive energy balance and trigger obesity and other chronic diseases like T2DM (Ramsey et al 2012:227 & Laraia 2013:208).

A cross-sectional study on adults over 20 years old in the USA found a link between food insecurity and DM, with prevalence rates of 11.7, 10.3, and 16.1%, respectively, among

respondents who reported being food secure, low food secure, and severely food insecure. Further, even after controlling for potential confounders, the study indicated that the prevalence of DM was considerably higher among respondents who reported severe food insecurity than among those who reported low food insecurity. In their investigation, they came to the conclusion that one risk factor for T2DM was food insecurity (Seligman et al 2007:1018). According to another study on the "Exploration of the relationship between household food insecurity and DM in Canada", people with DM were more likely to experience food insecurity (9.3% [8.2-10.4]) than people without DM (6.8% [6.5-7.0]) (Gucciardi , Vogt, DeMelo &Stewart 2009:2218).

A case-control study involving 201 Latin Americans (101 controls and 100 T2DM patients) who were between the ages of 35 and 60 and resided in urban areas established that very low food-insecure respondents had a 3.3 times higher likelihood of developing T2DM than other respondents (Fitzgerald, Hromi-Fiedler, Segura-Pérez, & Pérez-Escamilla 2011:328). Likewise, a case-control study of new referrals to university clinics was undertaken in Shiraz, southern Iran. On 135 people with T2DM as cases and 135 people without DM as controls, "food insecurity is a major risk factor for T2DM." In their study, there were 66.7 % of cases and 41.5 % of controls with food insecurity. According to the authors, T2DM patients had a considerably higher prevalence of food insecurity than did the controls. Even after controlling for potential confounders, food insecurity remained a significant risk factor for T2DM. The authors also suggested that further studies are needed with regard to this (Najibi et al 2019:3).

Furthermore, a recent systematic review and meta-analysis on the association between household food insecurity and the risk of T2DM in adults conducted by Abdurrahman and colleagues found a significantly positive association between household food insecurity and the likelihood of T2DM. OR 1.27; 95% CI: 1.11, 1.42; I 2 = 61.1%) (Abdurahman, Chaka, Nedjat, Dorosty & Majdzadeh 2019:1341–1350).

There is a knowledge gap regarding the relationship between T2DM and food insecurity in Ethiopia. As a result, the current study examines the relationship between T2DM mellitus and food insecurity in adults in the Bale Zone in south-east Ethiopia.

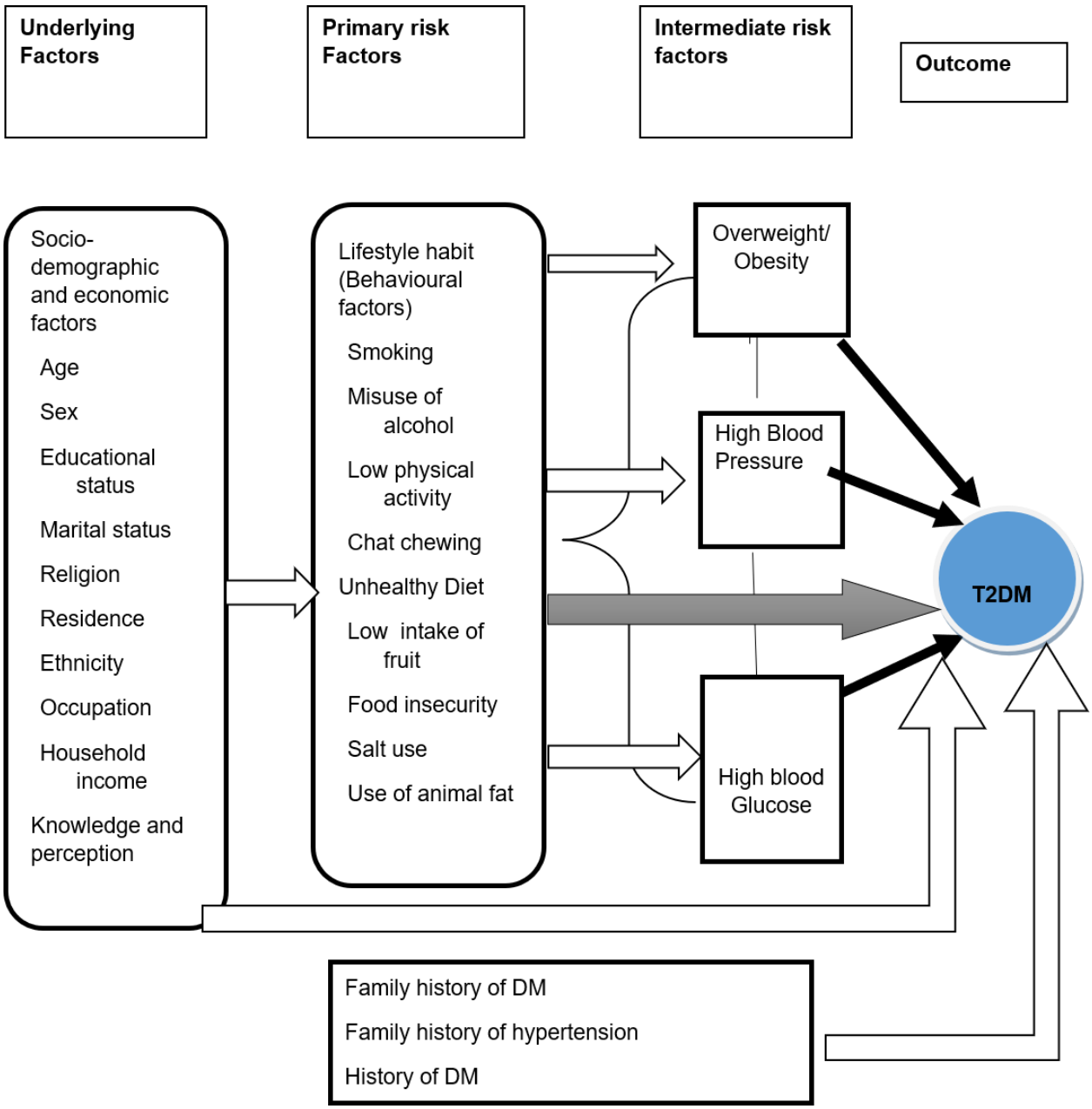

Figure 2.2: Conceptual Frame work of Type 2 Diabetes mellitus and its risk factors
Source: adapted from different literatures

2.7 KNOWLEDGE, PERCEPTION, AND BEHAVIOURS TOWARD TYPE 2 DIABETES MELLITUS AND ITS PREVENTION

Several studies from differing parts of the world on knowledge and attitudes related to DM and its risk factors among the general population report that majority had either moderate or good knowledge on DM, for instance in Malaysia (41.9%) (Minhat & Hamedon 2014:217–21), Tarlai (43%) (Ulvi et al 2009:798 and Debre Tabor town, Ethiopia (49%) (Asmamaw , Asres , Negese , Fekadu & Assefa 2015:199) reported the knowledge level of respondents as moderate and good. Unlike studies, which reported that levels of knowledge were poor in Sudan (15%) (Balla, Ahmed & Awadelkareem 2014:356), Mangalore (35%) (Moira et al 2015:4–7), and Kenya (27%) (Maina et al 2011:15). According to a study conducted in southern Sri Lanka, it was reported that 97% of respondents had heard about DM before (Herath et al 2017:4-5). However, a study that was carried out in Gondar city, north-west Ethiopia, determined that 9.6% of respondents had never heard of DM (Alemayehu, Dagne & Dagnew 2020:5-8).

According to a study done in southern Sri Lanka, it was reported that 97% of respondents had heard about DM before (Herath et al 2017:4-5). However, a study was done in Gondar city, north-west Ethiopia, where 9.6% of respondents had never heard of DM (Alemayehu, Dagne & Dagnew 2020:5-8).

A cross-sectional study undertaken in Nigeria found that 18.2% of respondents were aware of the symptoms of DM and 19.0% of respondents were aware of the risk factors for developing DM (Ndibuagu et al 2016:1-7). A survey conducted in Debre Tabor town revealed that 60.3% of respondents recognised the definition, 39.1% were very familiar with the symptoms of DM, 49% were aware of the risk factors, and 44% were knowledgeable about how to manage and control the condition (Asmamaw et al 2015:199). In a similar vein, in a study carried out in the town of Debre Berhan, Northeast Ethiopia, about 40.5% of study respondents knew the definition of DM, with 60.7% having good knowledge about symptoms of DM, 57.4% correctly identified the risk factors, and 65.7% showing good knowledge on control and management of DM.

A cross-sectional survey conducted on residents of Debre Tabor town in Northwest Ethiopia to assess their attitudes and knowledge revealed that 49% of them had good attitudes. The study's findings showed that the knowledge score was 9.86 (±4.28) with a

maximum possible score of 25. In their study, respondents correctly identified frequent thirst, frequent hunger, and frequent fatigue as symptoms of DM, 78%, 48%, and 12%, respectively. The study also identified risk factors for DM, the correct answer on risk factors for DM is that they include being obese (35.9%), leading a sedentary lifestyle (33.7%), having a family history of the disease (32.6%), being older (26%) and being pregnant (21.9%) (Asmamaw et al 2015:199).

Regarding awareness of the normal fasting blood glucose level of adults, a study from southern Benin found that 64.7% of respondents were aware of the normal fasting blood glucose level (Alaofè , Hounkpatin, Djrolo, Ehiri & Rosales 2021:4).

When it comes to other risks, 19% of diabetics and 40% of non-diabetics are aware of hypertension and a lack of physical activity; 27 % of diabetics and 24% of non-diabetics are aware of hypertension and a lack of physical activity. Smoking is another factor, which was discovered in 19% of diabetics and 28% of non-diabetic subjects (Asmamaw et al 2015:206).

A study on the knowledge of the risk factors for DM conducted in India and in accordance with the risk factors found, 78% of patients who were not diabetic and 63% of diabetic patients thought inherited factors were significant contributors to the development of DM. Forty eight percent of diabetics and 45% of non-diabetics were aware that obesity can cause DM. Other important risk factors for diabetes were hypertension and a lack of physical activity, which were identified by 19% of diabetic patients and 40% of non-diabetics, respectively. In their investigation, it was observed that 28% of diabetic patients and 8% of non-diabetic patients were unaware of any DM risk factors. Regarding risk factors, diabetic and non-diabetic individuals' respective means and standard deviations were found to be 23.1 ± 20.73 and 27.5 ±24.5 (Konduru, Ranjan, Karthik, Shaik & Vakkapatla 2017: 1-7).

:5). They found that 28% of diabetic patients and 8% of non-diabetic patients in their study were unaware of any risk factors for DM. In terms of risk factors, diabetic and non-diabetic patients' mean and standard deviations were found to be 23.1 20.73, and 27.5 24.5, respectively (Konduru et al 2017:5).

It was established the majority of respondents from an East-Coast Peninsular Malaysia study recognised that DM was a chronic health concern (82.7%), that it was prevalent in

the world (92.3%), and that it could be prevented (84.6%). Genetics (62.5%), obesity (83.7%), inactivity (96.2%), poor eating habits (84.6%), and race (8.7%) were the risk factors most frequently mentioned by respondents as being associated with DM. The respondents correctly identified the following early signs of T2DM: extreme hunger (43.3%), unusual thirst (72.15%), frequent urination, especially at night (75.0%), numbness in the hands or feet (76.0%), blurred vision (35.6%), increased fatigue (84.6%), frequent infections (55.8%), and slow wound healing (85.6%). The respondents also mentioned kidney disease (69.2%), amputation (71.2%), CVDs (53.8%), and blindness (57.7%) as complications of T2DM (Salleh, Rahman & Haque 2019:208–13). The study also showed that more than half of the respondents correctly identified DM as an incurable disease (68.1%), a chronic disease (79.2%), and causing sudden death (70.3%).

Similarly, a study from the Red River Delta region of Vietnam observed that 63.4% of respondents knew that T2DM can lead to death (Binh, Phuong & Nhung 2015:1–12). Another study conducted in Riyadh, Saudi Arabia, found that 48.6% of respondents who were aware that DM is not curable had high levels of knowledge (Alqahtani, Almutairi, Albasseet & Almutairi 2020:1–14).

A cross-sectional study was carried out in the Galle district of southern Sri Lanka to ascertain the general public's knowledge, attitudes, and practises about DM. In accordance with the findings, most respondents (77%) had either moderate or good knowledge of DM (Herath et al 2017:1–7). Similarly, a cross-sectional study on DM knowledge, attitudes, and practise in the general public was conducted in Pakistan. The authors found that 85.9% of respondents had heard of DM, and 30.1% were familiar with the glucose tolerance test. The authors also found that 2.3% of respondents scored zero on the knowledge test for DM indicating inadequate understanding of DM; 11.3% scored 9; and 47.4% scored greater than or equal to 6 (adequate knowledge) (Gillani et al 2018:1906).

A cross-sectional survey was conducted among Jordanian university students who did not have DM to assess knowledge, risk perception, and practises related to DM. The study found that the overall knowledge scores were low. The overall level of knowledge was 41.9%. With respect to DM-related sub-items, knowledge levels ranged from very

low in diet (36%), to moderate in physical activity (56.1%) (Khlaifat, Al-Hadid, Dabbour & Shoqirat 2020: 849–858).

A study on the knowledge, attitudes, and practises of school teachers in Riyadh, Saudi Arabia regarding DM was conducted that established that 57% of the teachers who participated in the study had general knowledge of DM. A sizeable percentage of respondents (98.1%) were aware that a healthy diet and exercise such as sports can prevent T2DM, and a significant portion of them (96.1%) also recognised that pancreatic dysfunction is a major contributing factor for the development of DM. With regard to diabetic complications, 76% of the respondents stated retinopathy as the condition about which they had the most knowledge, whereas stroke had the lowest awareness (18.6%). Respondents reported that obesity (85.5%) was the risk factor they knew most well-known, while smoking had the lowest knowledge among respondents (27.3%) (Aldekhayel 2020:132).

A cross-sectional study conducted at three government homoeopathic hospitals in West Bengal, India, was designed to assess DM-related knowledge, attitude, and practise among 273 diabetics and 355 non-diabetics. The researchers employed a self-administered survey. The study found that 17.5% to 29% of respondents knew the normal blood sugar level. The study also identified insulin deficiency, frequent urination, hypertension, and slow wound healing as the most frequent causes, symptoms, associations, and complications of DM. According to their investigation, a total of 35.5% to 46.5% of respondents said that DM was preventable, while 14.1% to 31.9 % of respondents knew that DM was controlled rather than cured. The study further underlined that consuming a planned diet, avoiding sugar, and monitoring blood sugar were the most frequently identified components of a healthy lifestyle, a diabetic diet, and a diagnostic domain (Koley et al 2016:39).

2.8 LEVEL OF PREVENTION OF TYPE 2 DIABETES MELLITUS

The axiom "prevention is better than cure" is a universal principle that also applies to the field of diabetology. Diseases have a natural history, and prevention strategies that can be introduced at different stages of the disease. The aims of prevention include reduced

morbidity and mortality at the individual level as well as reduced disease burden at the population level. Different categories of preventative measures include primordial, primary, secondary, tertiary, and quaternary (Pandve 2014:309).

Primordial prevention entails taking measures to minimise prospective health hazards in the future, thereby inhibiting the establishment of situations that are known to increase the risk of disease. Instead of preventing individual exposure to risk factors, which is the goal of primary prevention, it deals with broader aspects of health determinants. For instance, it is believed that good maternal health is a primordial factor in preventing DM in the unborn child later in life.

The goal of primary prevention is to prevent the onset of specific diseases by reducing risk. This is accomplished by changing behaviours or exposures that can lead to disease or by boosting resistance to the effects of exposure to a disease agent. Primary prevention of T2DM involves measures such as calorie reduction, weight loss, ensuring physical activity, quitting smoking, high fruit and vegetable intake, and avoiding heavy alcohol consumption. It is also thought of as a sort of primary prevention to prevent pre-diabetes from developing into T2DM (Warburton, Nicol & Bredin 2006:801).

Secondary prevention treating the disease as early as possible, preferably before it manifests or reaches preclinical stage. It focuses on maintaining a person's health and preventing the complications of a serious disease. Once the disease has developed and has undergone acute clinical phase treatment, for example, secondary prevention approaches in a patient with DM include optimal glycaemic control, lifestyle changes, adequate blood pressure control, and dyslipidaemia control(Pandve 2014:310).

Tertiary prevention is targeted to lessen the disease's negative impacts on a patient's ability to function, longevity, and quality of life. Tertiary prevention measures are focused on rehabilitation and disability adjustment. In this case, the focus is on post-amputation patients, diabetic nephropathy patients, and patients with various issues to make sure they receive the optimal care possible and enhance their quality of life(Pandve 2014:310).

Quaternary prevention is a relatively recent concept that has ethical implications for medicine. *Primum non nocere*, which translates to "above all, do no harm," is the basis for this concept (Pandve 2014:310).

T2DM can be prevented when modifiable risk factors are avoided. Evidence suggests that lifestyle intervention in combination with healthy eating and weight loss could lower

the risk of T2DM (Galaviz , Venkat, Narayan, Lobelo, & Weber 2018:4). According to research from the Diabetes Education Prevention Program, there is sufficient evidence to demonstrate that losing weight can considerably lower the chance of getting T2DM (Galaviz et al 2018:4).

It has been demonstrated that modifying one's lifestyle can reduce the risk of T2DM. In a study by Amuta. Jacobs, Barry, Popoola & Crosslin (2016:315), women exhibited a more favourable attitude towards eating healthy foods than men. To the contrary, men were more physically active than women. The results of this research show that there is a need to raise people's knowledge and awareness of the risk of T2DM in young adults.

2.9 HEALTH BELIEF MODEL AND TYPE 2 DIABETES MELLITUS PREVENTION

Several studies have investigated the application of HBM to several public health behaviours, particularly those aimed at the prevention of a disease or risk. For instance, the prevention of HIV/AIDS (Tarkang& Zotor 2015), the prevention of alcohol consumption (De Leon et al 2023:3), COVID-19 prevention (Shewasinad et al 2021:3), and the prevention of health risks for tourists (Huang, Dai, & H 2020:2). Based on some prior studies, HBM has a significant effect on preventive behaviour.

In this study, the Health Belief Model (HBM) is the behavioural framework that best explains why individuals participate in or do not participate in T2DM prevention activities (Abraham & Sheeran 2014:92–102). The HBM was developed in the 1950s to explain why people decide to adopt or forego certain preventative behaviours when they are at risk of contracting a disease (Abraham & Sheeran 2014:92–102; Taylor et al 2006:1.125; Harrison, Mullen & Green 1992:107–116). According to this model, individuals are more likely to take preventive action for T2DM if they believe there is a serious risk of developing the condition, believe they personally are at risk, are confident in their ability to carry out the recommended preventive actions, and believe there are fewer risks than benefits to taking preventive action (Araban, Baharzadeh & Karimy 2017:287–292). Evidence indicates that a high perceived risk of disease, or perceived susceptibility and perceived severity, are important factors in predicting whether a person would have the

confidence to adopt healthy behaviours and reduce their risk of disease (Orji, Vassileva, & Mandryk 2012:1–31).

Understanding the interrelatedness among theory, research, and practise is necessary for understanding health behaviour and health behaviour change. The best theory should inform the best practises, and vice versa (Glanz, Rimer & Viswanath 2015:101–105). The HBM is one of several health behaviour models that have shown promise in guiding behaviour change interventions in a range of contexts (Rakhshanderou et al 2020:1–8; Iranagh, Rahman & Motalebi 2016:352–8). This model may also help researchers in this study understand why adults decide to or do not select to take T2DM preventative measures by taking into account adults' perceptions of T2DM as a serious condition and the recommended activities.

The researcher was interested in understanding the perceived susceptibility, severity, barriers, and benefits of T2DM among adults in the Bale Zone, south east Ethiopia. One could speculate that individuals who are at risk of getting T2DM might be motivated to adopt behaviour change. They might take action to prevent T2DM if they perceive that it negatively impacts their lives. Therefore, this model (HBM) was used to bring about behavioural change in individuals at risk of T2DM. Accordingly, the developed strategies that would help prevent T2DM in adults were guided by the concept of this theory, particularly adults' knowledge and perception of the risky behaviour of T2DM and its prevention.

2.9.1 Perceived susceptibility

Perceived susceptibility refers to a person's perception of their risk of developing a condition (Joseph 2018:2). According to this model, if people perceive they have a particular health problem, they will engage to reduce their risk of developing it. Conversely, individuals with low perceived susceptibility might not believe they are at risk of contracting certain diseases (Onoruoiza et al. 2015:14). The HBM was used in this study to help determine if adults understood they had T2DM and would adopt behaviours that would change their behaviour. This suggests that a person's decision to engage in activities that would prevent T2DM may be somewhat influenced by their perception of their susceptibility to the disease. The adults would need to adopt their own T2DM risk

behaviours and decide that these behaviours have put them at risk for T2DM; therefore, they need to engage in activities that will prevent T2DM.

In Debre Berhan town, north-east Ethiopia, Shifeaw (2020:6–9) found that individuals who were not aware of their susceptibility to DM had a higher likelihood of not being screened. In their study, they also found that 21% of the participants would get DM in the future due to their perceived susceptibility to the disease. The study concluded that perceived susceptibility to developing DM in the future was a significant predictor of T2DM prevention activities. This indicates that adults perceived themselves as non-susceptible to T2DM they would developing T2DM in future.

2.9.2 Perceived severity

Perceived severity is a person's perception of how severe a condition's outcomes would be if the condition actually occurred (Joseph 2018:2). According to the HBM, individuals are more likely to adopt behaviours that either prevent health problems from occurring or lessen their severity if they perceive a particular health problem to be serious (Tarkang & Zotor 2015:5). Thus, perceptions of a disease's seriousness include beliefs about the disease itself, such as whether it constitutes a threat to life or may cause pain or disability (Onoruoiza et al. 2015:14). In this study, the model helped explain how one can be susceptible to the T2DM disease. If not properly explained, unless there were severe physical and social implications, the individual would not be motivated to change their behaviour. Adults must understand that T2DM is a serious disease with severe consequences for their lives before adopting behaviours to prevent it. Individuals must perceive T2DM as a serious non-communicable disease with severe consequences and implications for their physical and social lives before adopting preventative actions (such as regular physical activity, quitting smoking, etc.) against T2DM.

A study finding was reported from Debre Berhan town on knowledge and perception of DM among adults, which found 62.4% of respondents thought DM was a serious disease (Shiferaw et al 2020:6–9). Likewise, in a Rwandan study, 79.4% of participants thought DM was a severe disease (Mukeshimana & Nkosi 2014:541-449). In another study in Windhoek, Namibia, on "Knowledge, Attitudes, and Perceptions about DM among an Urban Adult Population", 71% of respondents thought that DM was a serious disease (Kambinda 2017).

2.9.3 Perceived benefits

According to Onoruoiza et al. (2015), perceived benefits are an individual's assessment of the benefit or efficacy of adopting health behaviours that promote health in order to lower their risk of disease. Adults are more likely to decide to engage in T2DM prevention measures if they believe that changing their behaviour and being aware of the benefits will prevent them from developing T2DM, or that doing so will motivate them to engage in prevention behaviour to maintain their health. This implies that depending on which of the two (benefits or barriers) has more weight, an adult will either decide to prevent T2DM by engaging in healthy behaviour or they will not. It should be emphasised that perceptions of a barrier's intensity varies from person to person and relies on the context in which they are experienced.

Individuals who perceive that they are susceptible to a disease and that it is severe will take preventive measures if they also perceive that doing so could be beneficial in reducing the threat (Tavafian 2012:5). Shifew et al (2020:6–9) found that approximately two-thirds of the participants perceived the benefits of the screening and preventive measures by undergoing regular health care visits, which can help find DM early and save lives.

2.9.4 Perceived barriers

Perceived barriers are those that an individual perceives will prevent them from changing their behaviour (Onoruoiza et al 2015:14). Numerous factors, such as barriers to taking medication such as cost, frequency, side effects, etc., may have an impact on people's decisions to engage in particular activities (Tarkang & Zotor 2015:5). The model revealed whether individuals understood the risks and barriers that could obstruct T2DM-related actions. It also helped clarify a number of actions that could lessen barriers to adherence, like disclosing negative effects. In other words, for behaviour to change, perceived benefits must outweigh perceived barriers. The model revealed whether individuals understood the risks and barriers that could obstruct T2DM-related actions. It also helped clarify a number of actions that could lessen barriers to adherence, such as disclosing

negative effects. In other words, for behaviour to change, perceived benefits must outweigh perceived barriers. The next stage is not possible until the person knows they have the capacity to get through these challenges. In a study in Debre Berhane Town, north-east Ethiopia, 27% of the participants perceived barriers to undergoing screening and applying lifestyle modification for prevention of DM (Shiferaw et al 2020:6–9).

2.9.5 Modifying variables

Modifying variables may indirectly impact health-related behaviours by intervening or moderating the core construct of the health belief model, influencing perceived severity, susceptibility, benefits, and barriers (Glanz et al. 2015:75). As a result, socio-demographic factors may indirectly shape individuals' approach to preventing T2DM by altering their perception of susceptibility to the disease, the severity of the disease, and the benefits of taking action. The modifying factors for adults in this study included age, gender, education level, knowledge, and perception of T2DM-related risky behaviours and their prevention. A scholar confirms that people are likely to change their lifestyle if they believe it will improve their health. They may have accepted a new code of conduct for health behaviours because they see significant benefits in doing so.

2.9.6 Cues to action

The readiness to act is prompted by other elements or cues, such as anticipated susceptibility and perceived benefits (Glanz et al 2008:49).

The HBM states that a cue or trigger is necessary for prompt engagement in health-promoting behaviours. Readiness (perceived susceptibility and perceived benefits) are two additional factors or cues to act that cause willingness to act (Glanz et al 2008:49). People can change their behaviour in response to events or environmental variables, such as media attention (Tavafian 2012:7). Hence, adults are more likely to engage in T2DM preventive activities if family members, friends, the media, or healthcare workers encourage or remind them to do so.

2.9.7 Self-efficacy

Self-efficacy is the term used to describe an individual's understanding of and confidence in their ability to carry out behaviour (Joseph 2018:2). It is the strength of a person's belief in one's own ability to respond to difficult situations and to handle any related obstacles or setbacks (Tarkang & Zotor 2015:5). According to this model, an individual may feel confident in his ability to overcome obstacles and perform the desired behaviour (Jones et al 2015:3). In this study, the HBM assisted in determining individuals' confidence in their ability to adopt behaviours that might prevent T2DM. Adults might believe that they can engage in behaviour without defaulting, regardless of obstacles that hindered T2DM prevention activities. According to a study, "Perception of and risk factors for T2DM among students attending an upstate New York college: a pilot study in 2021" 30% of study participants did not feel confident that they could prevent T2DM (Antwi et al 2020:1–8).

Results of a recent study at the Reza Clinic in Shiraz, Iran, showed that among the constructs, perceived barriers and perceived self-efficacy and knowledge were the most important predictors of T2DM preventative behaviours. In their study, perceived barriers included the negative aspects of a health action and the obstacles involved in engaging in a behaviour (Afrasiabi, Aeen & Jahromi 2022:1267). In their study, they also found that an increase in self-efficacy and knowledge, as well as a decrease in perceived barriers, led to an increase in T2DM prevention behaviours.

2.9.8 LIMITATIONS AND SUGGESTION OF HBM

HBM has several drawbacks that could limit the potential public health benefits it could provide. Primarily, it does not include actions, principles, and other factors that are involved in determining an individual's health behaviour. More specifically, it is not easy to alter an individual's typical behavioural habits, which could influence the decision-making process when deciding whether or not to accept the recommended course of action. Furthermore, environmental or economic considerations may also make HBM inappropriate when employed for non-health-related purposes, such as social acceptability, and may prevent the suggested course of action. HBM makes the

suppositions that "healthy" actions are typical, that everyone has equal access to information about diseases, and that particular behaviours are frequently utilised to influence individuals to take action (Anuar, Shah, Gafor, Mahmood, and Ghazi 2020: 9345).

Although the Health Belief Model can predict changes in behaviour, it has been criticised for its Western ethnocentric viewpoint and for failing to consider other social and cultural aspects of developing countries that could influence individual choices for non-health-related reasons, such as social acceptability, and hinder the recommended course of action.

2.10 CONCLUSION

In this literature review, the epidemiological characteristics of DM and T2DM are presented.

According to evidence from observational research, being overweight, having a higher central adiposity, being physically inactive, being older, having a family history of DM, and residing in an urban area are probably triggers for the epidemic. The studies also indicated that a highly unhealthy diet and hypertension may be contributing factors to the increased prevalence of T2DM. The review examined food insecurity, mental stress, perceptions of body size and shape, as well as knowledge, perceptions, and risky behaviours related to T2DM and its risk factors.

Therefore, the researcher conducted a cross-sectional study and a case-control study to investigate the role of these risk factors for T2DM in adults in the Bale Zone of the Oromia regional state, south-east Ethiopia, and to develop workable preventative strategies for T2DM.

CHAPTER 3 - RESEARCH DESIGN AND METHOD

3.1 INTRODUCTION

The previous chapter reviewed the literature on the worldwide problem of DM, the problem with T2DM in Ethiopia, risk factors for T2DM, knowledge and risky behaviours for T2DM prevention, and the HBM constructs. This chapter describes and explains the research designs and methods used to answer the research objectives and research questions. This study was conducted in three phases: Phase I involved a population-based descriptive cross-sectional study; Phase II involved a hospital-based unmatched case-control study; and Phase III involved developing strategies. As a result, this chapter provides detailed information on the research design and research method for Phases I and II separately.

As mentioned this study was conducted in three phases at different times as follows:

- Phase I was a population-based descriptive cross-sectional household survey that was conducted to address objectives 1, 2, and 3.
- Phase II was a hospital-based, unmatched case-control study conducted to explore the determinants of T2DM, which were addressed in Objective 4.
- Phase III was conducted to develop strategies based on findings from Phases I and II, evidence from an extensive relevant review of the literature, researcher insight, and expert opinion.

3.2 PHASE I: POPULATION-BASED DESCRIPTIVE CROSS-SECTIONAL STUDY

In this phase, detailed information on the research approach, research design, and method of research is provided. This chapter also describes the study setting, sample procedures, data collection techniques, data analysis procedures, and measures taken to ensure validity and reliability in Phase I of this study.

3.2.1 Research approach and design

A research approach refers to a plan and procedures for research that will be pursued in the process of answering the research questions (Creswell 2014:3). This approach will make it clear what the researcher should follow in order to answer the research questions. Hence, Polit and Beck (2014:391) define a research design as "the overall plan or outline of the study for addressing a research question, including specifications for enhancing the study's integrity". Creswell (2014:1) also clearly specifies that the approach will cover the broad assumptions, detailed data collection methods, analysis, and interpretation procedures of the research.

3.2.1.1 Research approach

A quantitative research approach was used for this phase of the study. A quantitative research is defined by Polit and Beck (2014:389), as an investigation of phenomena that lend themselves to precise measurement and quantification, frequently involving a rigors and controlled design. Quantitative research uses statistics to quantify the magnitude of an association or relationship between variables. It helps in isolating the effects of different variables as well (Babbie 2013:188). This approach was appropriate for this study as it sought to quantify the magnitude of the burden of T2DM.

Quantitative research is an approach that is formal, objective, and uses numerical data to gather information for the study (Grove, Gray & Burns 2015:19). The approach is used to examine relationships among variables, describe new situations, events, or concepts, and determine the effectiveness of treatment or intervention on selected health outcomes in the world, quantitative research is undertaken (Grove et al 2015:32). It describes a methodology that aims to maximise objectivity, replication, generalizability, statistical verification of results, examination of the relationships between variables, and interest in phenomenon prediction (Creswell 2014:32).

3.2.1.2 Research design

According to Grove, Burns & Grey (2012:43), and Creswell (2014:42), a research design is a plan for how research should be conducted to maximise control over factors that could interfere with a study‘s desired findings. Polit and Beck (2017:98) explain research design as the overall approach for addressing the research problems that are being investigated and dealing with some of the challenges that may develop during the study process. A researcher must select the most appropriate way to address a particular research question in light of several characteristics of the research process.

It describes what a researcher performs during the research process, including how to clearly state the study problem, the population being examined, and the methodologies and procedures to be used for data collection, measurement, and analysis (Polit & Beck 2017:273).

In this phase, quantitative approach with a cross-sectional descriptive design were used to address the following objectives of the study:

- To determine the prevalence of T2DM among adults in the Bale Zone, south-east Ethiopia.
- To identify factors associated with T2DM among adults in the Bale Zone, south-east Ethiopia
- To describe adults’ knowledge and perceptions of T2DM risky behaviour and prevention among in the Bale Zone, south-east Ethiopia

3.2.1.2.1 Cross-section design

According to Polit and Beck (2012:725), a cross-sectional design is a study design in which data is gathered at a single point in time; it is occasionally used to infer change over time when data is gathered from various age or developmental groups. Cross-sectional studies or surveys are conducted "to estimate a population parameter, such as the prevalence of some diseases in a community or the average value of a particular quantitative variable in a population" (Charan & Biswas 2013:121).

The cross-sectional design has the advantages of being very time- and cost-efficient because data is only collected once, and the researcher can easily manage their data using this design (Polit & Beck 2012:184–186). In a cross-sectional study, the researcher normally selects the sample without taking exposure or disease into account; frequently, the sample is randomly selected from a predetermined population.

Therefore, for this phase, a quantitative methods with a cross-sectional descriptive design was most appropriate for the study's aims, which were to determine the prevalence of T2DM, associated factors for T2DM, and describe adults' knowledge and perception regarding T2DM risky behaviours and its prevention among adults in the Bale Zone, south-east Ethiopia.

3.3 PHASE I - RESEARCH METHODS

According to Polit and Beck (2012:24), research methods are the procedures researchers employ to set up a study and collect and analyse data relevant to the research question(s). Thorough methodological procedures aim to reduce or eliminate bias, or to detect it and account for it when interpreting the data and raising the standard of the study's findings (Polit & Beck 2012:12).

The research methods used in this phase comprised the setting, population, sampling procedure and sample size, data collection and data collection procedures, data analysis, ensuring the validity and reliability of the study.

3.3.1 Study setting

The study setting refers to the context in which a researcher gathers data about the topic under study (Polit & Beck 2012:743). This study was conducted in administrative towns in the Bale Zone of the Oromia region, south-east Ethiopia. Oromia is the largest and most populous region in Ethiopia, accounting for one-third of the nation. Bale Robe, the zonal capital city, is located 430 kilometres from the national capital, Addis Ababa.

The Bale Zone is bordered on its southern side by the Ganale Dorya River, which separates it from the Guji Zone; on its western side by the West Arsi Zone; on its northern side by the Arsi Zone; on its northeastern side by the Shebelle River, which divides it from the West Hararge Zone and the East Hararge Zone; and on its eastern side by the Somali Region. The Zone is bordered by major Zones such as East Bale, West Arsi, and East Guji Zones as well as the regional state of Somalia (2020; Bale Zone Administration Office 2010).

The Urgoma Mountain range's Mount Batu (4,307m) is the highest point in both the Bale and Oromia Zones. Mount Tullu Dimtu, Mount Darkeena, and Mount Gaysa are a few more significant peaks of the Urgoma, according to inspection reports from the Ethiopian Coffee and Tea Authority, Bale Zone, for the year ending in 2005. This represents 4.46% of the region's output and 2.2% of overall production in Ethiopia. The Bale Zone has a total area of 63,555 km2, making it the second-largest Zone in the Oromia National Regional State after the Borana Zone. It comprises around 17.5% of Oromia's total land area. There are 351 rural kebele, 18 districts, 2 urban administrative centres, and 20 urban kebele.

Goba is a town and a separate district in the Bale Zone of Oromia, Ethiopia, approximately 446 kilometres south-east of Addis Ababa. Its Oromo and Amharic names are Gobbaa and ጎባ, respectively. This city is 2,743 metres above sea level and is located at 7°0′ N and 39°59′ E latitude and longitude. Goba, which is located at an extremely high altitude, experiences cool to cold mornings and mild to warm afternoons all year long due to its subtropical highland climate (Köppen Cwb). Between November and January, there is a short dry season with colder mornings, and between February and October, there is a long rainy season.

Bale National Park is situated 10 km to the south-west of the town, which is well-known for its Wednesday market, honey production, basketry, and cotton shawl making. The 2007 national census reported a total population for Goba of 32,025, of whom 15,182 were men and 16,843 were women; 4,797, or 6.13% of its population, were urban dwellers. The majority of the inhabitants said they practised Ethiopian Orthodox Christianity, with 69.84% of the population reporting they observed this belief, while 23.12% of the population are Muslim and 5.84% are Protestant.

The town of Robe, also known as Bale Robe, is located in the south-central Oromia region of Ethiopia. It is 430 kilometres away from the capital, Addis Ababa, and is reachable by road. It is located at latitude 7°0′ N, longitude 39°59′ E, and longitude 2,743′ above sea level. The Bale Zone contains this city. The main market day is Thursday, and there is also a smaller market open on Tuesdays and Sundays in a different part of town. East of here are the Sof Omar Caves, a popular tourist spot.

In Robe, there were 44,382 people in total, 22,543 men and 21,839 women, according to the 2007 national census. The majority of residents identify as Muslim, with 48.08% of the population saying that they adhered to this religion, followed by 45.02% of Ethiopian Orthodox Christians and 6.13% of Protestant Christians (Bale One Department of Finance and Economic Development) (BZDFED, 2004). There are a total of five government-owned hospitals, 87 health centres, and more than 300 health posts.

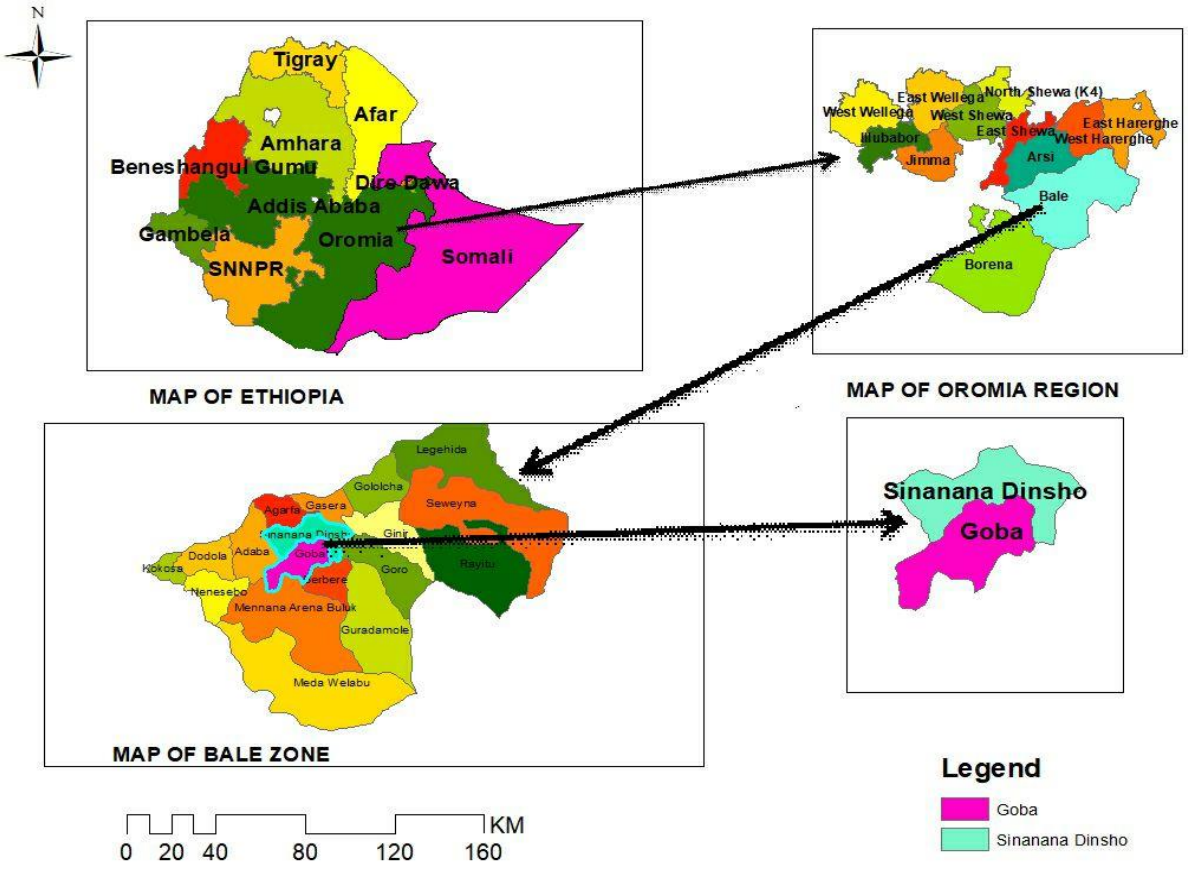

Figure 3.3: Administrative map of Bale Robe town administration (Sinana Dinsho District) and Goba town Administration

3.3.2 Research population

A study population is defined as is a group of individuals, objects, or events that share common characteristics in which the researcher is most interested (Babbie 2016:119). In this phase of the study , all adults aged ≥ 18 years who lived in two administrative towns of Bale Zone, south east Ethiopia were considered as a study population.

3.3.2.1 Target population

A target population is the entire population in which a researcher is interested (Polit & Beck 2012:744) and is also described as the total group of people that meet the sampling criteria and from whom the sample can be take (Grove et al 2015:25). The researcher would generalise the study's findings to this population, and include them in the study. In this phase, the target population was all adults aged 18 years and above who lived in two administrative towns in the Bale Zone during the study period (June 1 to August 30, 2021) and who met the eligibility criteria.

3.3.3 Sample and sampling procedure

Sampling is the process of selecting a group of individuals, events, actions, or other elements with which to conduct a study (Gray et al 2016:135).

Sampling techniques

In this phase, a multi-stage sampling technique was applied to select the study participants. Firstly, the administrative towns of Bale Zone (Robe town and Goba town) were purposefully selected from the Bale Zone. Based on the size of the two towns' populations, a different sample size was allocated for each (328 for Robe town and 229 for Goba town). Secondly, within these towns, the lowest administrative level (referred to

as clusters or gots) was identified. Robe town has 36 clusters/gots, while Goba town has 24 clusters/gots. Simple random sampling was used to select one-third (12) of the clusters from Robe town and one-third (8) of the clusters from Goba town.

Next, the required sample size for each cluster was determined through proportional allocation, based on the number of households in the selected clusters. To identify the actual households to be included in the study, a systematic random sampling technique was employed. A sampling frame, which is a list of all the households in the selected clusters along with their composition, was used for this purpose. Once the households were selected, a lottery method was used to identify one eligible adult participant from each household if there were more than one adult within the household. If the interviewee selected for the survey was not present at home during the data collection period, arrangements were made through another household to schedule a revisit appointment. The schematic presentation of the sampling procedure is presented in the Figure 3. 2 below.

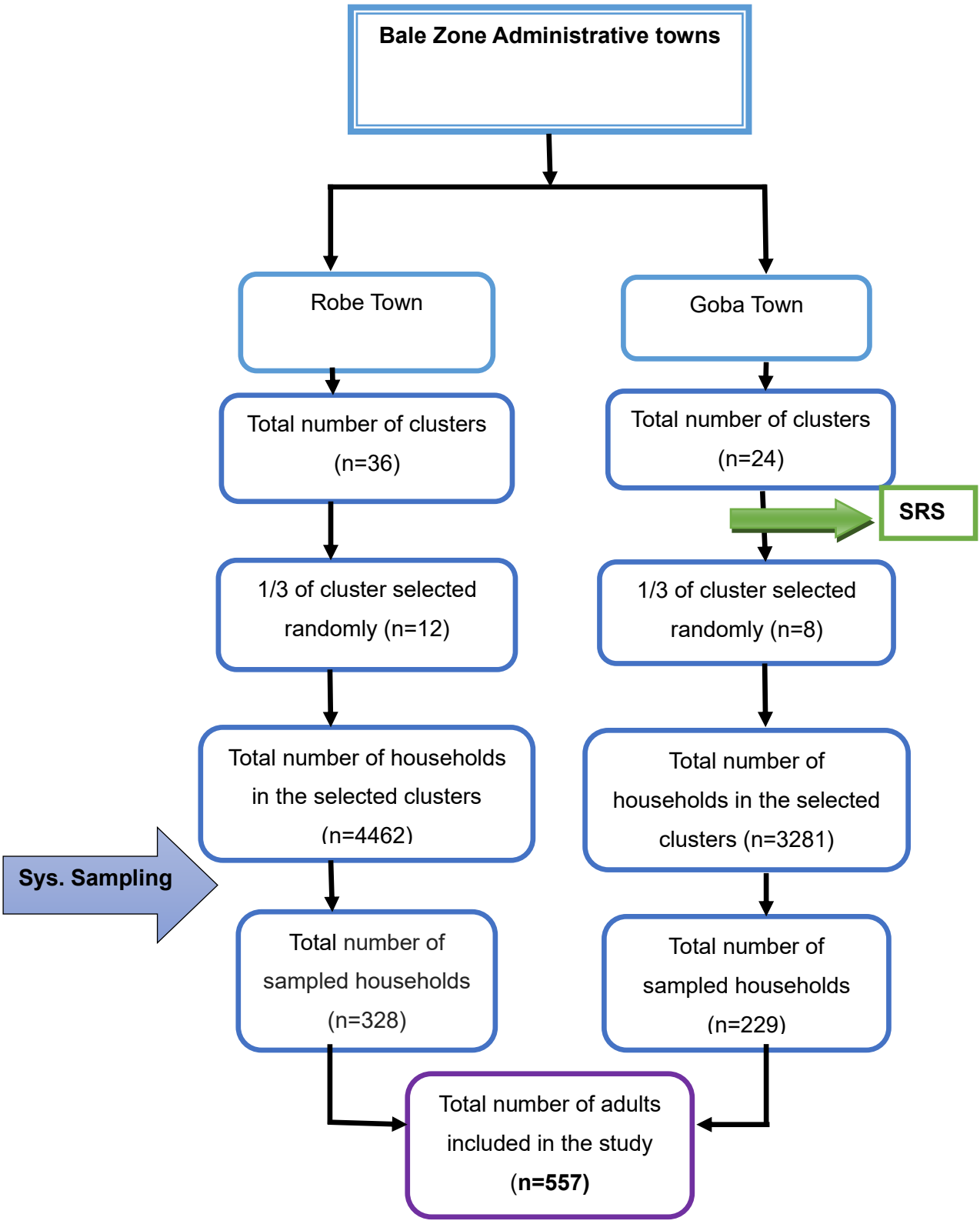

Figure 3.4: The schematic presentation of the sampling procedure is presented in phase I

N.B.: **SRS** means simple random sampling; **Sys. Sampling** means systematic random sampling.

Sample

"A sample is a subset of a population selected to participate in a study", thus sampling refers to the process of selecting a portion of the population to represent the entire population (Polit & Beck 2010:307). Probability sampling was used in this phase. The sample, comprised of adults aged 18 years and older who lived in two administrative towns (Robe and Goba towns) in the Bale Zone from June 1, 2021 to August 30, 2021, all had an equal chance of being selected to take part.

Sample size determination

The sample size of a study is the number of participants (Polit & Beck 2014:181). In a quantitative study, it is to the researcher's advantage to select a sample from a larger population. Stephen (2001:281) developed a single population proportion formula for cross-sectional research, which was used to determine the sample size in this phase. The sample size was calculated using Open Epi, version 3, an open-source calculator, considering parameters of 95% level of confidence, 3 % margin of error, 6.34 % reported prevalence of high hidden burden of DM by the previous study in urban Gondar town, northwest Ethiopia (Wolde et al 2020:3), using design effect of 2 and non-response rate of 10%, the final sample size become a total of 557.

$$n = \frac{\left(\frac{Za}{2}\right) 2P(1P)}{d^2}$$

$$n = \frac{(1.96)2\ 0.0634(1 - \ 0.0634)}{(0.03)^2}$$

$$n = 253 * 2$$

$$n = 506$$

Where,

n= the minimum sample size=506

P = prevalence of DM = 6.34%

d= Margin of error = 3%

Zα/2 = Critical value at 95% confidence interval = (1.96)

Finally, by adding the possible 10% non-responses, the overall sample size is 557.

3.3.4 INCLUSION AND EXCLUSION CRITERIA

An eligibility criterion is a list of characteristics required to be eligible in the target population (Burns & Grove 2005:342).

To select respondents for this phase, the following inclusion and exclusion criteria were applied:

3.3.4.1 Inclusion criteria of the study :

Adults who met the following criteria were included in the study:

- Adults aged 18 years and above who lived in Bale Robe town and Goba town for at least for six months preceding the survey in the clusters or "gots" selected for the study.

3.3.4. 2 Exclusion criteria of the study :

Exclusion criteria describe the characteristics that excluded specific subjects from the study because they lacked or did not meet the inclusion criteria (Polit & Beck 2012:274).

The following criteria were used to exclude respondents from the study:

- Adults who had lived in the two administrative towns of Bale Zone for less than six months.
- Adults are critically ill, as are those who were unable to communicate and had a hearing loss during the survey.
- Individuals who were taking any medications that could have an effect on their glucose metabolism (such as steroids, B-blockers, and thiazide diuretics), and other sick individuals.

3.3.5 Data collection

Data collection is the process of gathering information to address a research question (Polit & Beck 2014:288). According to Polit and Beck (2012:52), researchers identify variables, develop conceptual and operational definitions, and then collect relevant data for quantitative studies. Burns and Grove (2011:52) characterise data collection as the precise, systematic collection of information pertinent to research objectives, research questions, and/ or hypotheses. In this phase of the study, the data that was necessary for the study was collected in order to answer the research questions and provide conclusions and recommendations after analysis. The data for this study were numerical (quantitative) in character and was collected using scientific procedures (Neuman 2014:9).

The data collection section that follows includes data collection techniques, the development of data collection instruments, pretesting the instrument, data collection, and the data collection process. The researcher guided the collection of data using an interviewer-administered questionnaire, physical measurements, and fasting blood glucose testing.

Data collection approach and method

Grove et al (2015:303) state that a variety of techniques are used during data collection to measure study variables, including observation, interviews, questionnaires, scales, and biological measurements. The researcher guided the collection of data using an interviewer-administered closed-ended survey questionnaire, physical measurements, and fasting blood glucose testing. All the questionnaires were initially prepared in English, and then translated into local languages (Afan, Oromo, and Amharic) for data collection. The translation of the questionnaire from English to Afan Oromo and Amharic was performed by professional language experts who speak both languages fluently (see Annexure N). The researcher and colleagues who have previous experience translating questionnaires were re-checked.

3.3.5.1 Development and testing of the data collection instrument

Data collection tools

A data collection instrument is a device used to collect data (Babbie & Mouton 2011:102; Henning et al 2011:102; Polit & Beck 2013:179), for example a questionnaire with precise, easy, or specific items that could be self- or interview-administered (Creswell 2014:382). A structured questionnaire was developed using the WHO stepwise approach for NCD surveillance, adapted in line with the local context, to collect data for this study (WHO 2005). This was developed after an extensive review of related literature (Riley et al 2016:74–78), using three steps. The English version of the questionnaire was translated into the local languages of Afan, Oromo, and Amharic. To check the validity of the questionnaire, it was translated back into English to avoid any inconsistencies in meaning and purpose. The instrument was comprised of the following sections:

Section I: Demographic and Socio-Economic variables

There are 12 questions used to record the demographic and socioeconomic data of respondents. Were indicated residence (Robe and Goba towns); age (categorised into 18-27, 28-37, 38-47, 48-57, and ≥ 58 years); sex (male or female), marital status (categorised as single, married, divorced or widowed); educational status (categorised as cannot read and write, can read and write, primary education, secondary education, or diploma and above); occupational status (housewife, government/ non-government/ daily labour, student and retired); religious affiliation, ethnicity, occupation, household size, family size (categorised as <2, 2-4, or >4; income, ownership of the house and house hold asset). A further 14 questions were used to collect data in order to compute a wealth index based on household assets (computed by principal component analysis using household assets and ranked as low, medium, or high wealth index terciles).

Section II: Knowledge of T2DM and methods of prevention

Twenty-six questions were designed to collect data on respondents' knowledge of T2DM and methods of prevention.

Section III: Health beliefs Models constructs

To measure the HBM, 43 questions were employed. Nine items measured perceived susceptibility to T2DM. Eleven measured perceived severity, six for perceived benefit of

engaging in T2DM preventive activities, seven for assessing perceived barriers to doing so, five for cues to taking action to prevent T2DM, and five questions for self-efficacy.

Section IV: Behavioural Measurements

There are 33 questions in this section that were used to assess the respondents' behavioural information, including their usage of cigarettes, alcohol intake, chat chewing, coffee drinking, diet (fruit and vegetable), sat consumption, physical activity, travel from place to place, and reactionary activities.

Section V: History of raised blood glucose and co-morbidity.

Five questions were designed to collect information on raised high blood glucose and co-morbidity.

Section VI: Physical measurement

The physical measurements of the respondents were taken using six items. These comprised the following: height, weight, hip, and three separate measurements of blood pressure.

Section VII: Bio-chemical measurement (Fasting blood sugar)

Respondents in the study who were not eating anything during the first contact had their fasting blood sugar (FBS) directly measured. But those who ate food at the first contact were requested to fast the next night, and their FBS was measured the next day.

Dependent variables

Type 2 diabetes Mellitus/ Not diabetes mellitus

Independent's variables

Socio-demographic and economic factors

- Address/ residence
- Age
- Sex
- Educational level
- Marital status
- Religion

- Ethnicity
- Occupation
- Household population size
- Living structure of family
- Source of income for healthcare
- Household income

Lifestyle habits (behavioural factors)

- Smoking
- Alcohol consumption
- Chat chewing
- Low physical activity

Diet

- Salt use
- Vegetable and fruit intake
- drinking coffee

Anthropometric measurement and other factors

- BMI
- FBG
- Blood pressure measurement
- Family history of DM
- Family history of hypertension

3.3.5.1.1 Pre-testing the instrument

According to Polit and Beck (2010:345), a pre-test is a small-scale examination of the data collection instrument determine whether it is successful in generating the required information. Pre-testing was carried out to ascertain the questionnaires' clarity and applicability in order to improve the study's reliability (Delport & Roestenburg 2011:195). It can then be evaluated and modified to ensure that all respondents understand the questions and provide data that is pertinent to the research questions and the research.

The pre-test objectives were to determine the degree of comprehension and relevancy of the questions as well as the acceptability of the data collection technology in terms of suitable language and question clarity. The questionnaires were pretested by the researcher outside the chosen study areas. Based on the feedback, the researcher modified the questionnaire. To ensure the quality of the data, the questionnaire was first prepared in English, translated into the local languages of Afan Oromo and Amharic, and then translated back into English by an expert. The consent form was included with the final questionnaires.

Data quality control was carried out at each phase of the study. Prior to running the actual data for three weeks, a questionnaire pretest was conducted on 40 volunteer participants (10% of the total sample size of the study) in another town in south-east Ethiopia who shared the same socio-demographic characteristics. Then, corrections and adjustments were made as needed. There were only minor corrections made to the pre-test, such as rewording some of the lengthy questions and fixing some of the skipping patterns in some of the questions.

3.3.5.1.2 Data collection process

Data was collected from June 1, 2021 to August 31, 2021, using an interviewer-administered questionnaire, physical measurements, and fasting blood glucose testing.

Once the instruments for data collection were prepared and pre-tested, the next step was the data collection process. In order to collect valid and reliable data, the researcher used qualified and trained data collectors and supervisors for the study. For the data collection, six experienced health professionals with prior experience collecting data and at least a first degree in nursing, health officer, or laboratory technologists who spoke both the local languages, Afan Oromo and Amharic, were selected, trained, and deployed in the field. Three days of training was provided to the data collectors on the purpose of the study, the data collection procedure, each questionnaire item, how to perform physical measurements, and fasting blood glucose tests. They were also trained on ethical issues such as how to maintain confidentiality, privacy, anonymity, and how to obtain consent from respondents. The tools for data collection were introduced to the data collectors.

The data collectors had a practical session on physical and fasting blood glucose measurements until their skills were shown to be sufficient.

Before proceeding to data collection, permission was sought and granted by the appropriate authorities; these included obtaining ethical clearance from the Research and Ethics Committee, Department of Health Studies at Unisa, to conduct the study (see Annexure A). The Regional Learning Centre for Ethiopia at Unisa Addis Ababa wrote a letter of support indicating the study objective and addressing it to the Oromia Health Bureau (see Annexure B). Later on, a letter of approval was written in order to obtain permission from the Oromia health bureau (see Annexure C) and also permission from the Bale Zone town administration health department, Goba Referral Hospital, and the Bale Robe hospital manager.

As far as the study is community-based, the data collectors visited the sampled households, interviews were conducted, and physical measurements and fasting blood glucose measurements were performed in a manner that maintained the privacy of respondents. The interview took a maximum of 25 minutes per study participant and an additional 10–15 minutes for measuring physical measurements and fasting blood glucose levels.

Each study participant enrolled in the study was contacted for at least two consecutive days. On the initial day, activities included obtaining consent, conducting interviews, and taking physical measurements such as anthropometric and blood pressure measurements. During this initial contact, appointments were scheduled for the following morning, with participants instructed to abstain from food and fluids (fasting for at least 8 hours) until their blood samples were collected during the next morning contact session.

Further details on the data collection process include an interviewer-administered questionnaire, physical measurements, and fasting blood glucose testing, which had three steps described below:

In the first step, data on socio-demographic and behavioural factors were collected using a pretested, structured interviewer-administered questionnaire that was prepared in the local language, Afan Oromo and Amharic, as per the recommendation of the WHO stepwise approach. Questions related to alcohol use and smoking were modified to reflect the local context of Ethiopia.

The second step was for physical measurements of weight, height, waist, and hip circumferences, and the third step was for biochemical measurements (fasting blood glucose). Study participants who did not eat any food during the first contact were immediately measured for fasting blood sugar. However, participants who ate food during the first contact were asked to fast overnight, and FBS was measured the next day.

Weight was measured using an electronic digital weight scale by putting the scale on a firm flat surface after participants took off footwear and heavy clothes and emptied their pockets for heavy items. The instrument was checked and adjusted to a zero calibration before each measurement. Height was measured in the standing position by a portable height measuring board after positioning the board on a firm surface against a wall. After the participant removed their footwear, they stood facing the data collector. Readings of the height in centimetres were taken at the exact point, to the nearest millimetre.

Waist circumference was measured by constant tension tape at the end of a normal expiration, with the arms relaxed at the sides, at the midpoint between the lower margin of the last palpable rib and the top of the iliac crest (hip bone). Readings of the measurement taken at the level of the tape to the nearest 0.1 cm, making sure to keep the measuring tape snug but not tight enough to cause compression of the skin. Hip circumference was measured by constant tension tape with the arms relaxed at the sides at the maximum circumference over the buttocks. Hip circumference was measured and read at the level of the tape to the nearest 0.1 cm.

Further details on the physical measurement protocols used by this study can be found in the WHO STEPS-wise instrument guideline (Riley et al 2016:74–78). Blood glucose was measured using a Care SenseN glucometer, and DM was diagnosed based on the WHO guideline, which was fasting blood sugar (FBS) ≥ 126 mg/dl (Riley et al 2016:74–78) or self-report of a previous diagnosis of DM by a health professional or currently taking treatment for DM.

The WHO recommends that fasting blood glucose values for both venous and capillary blood should be identical (based on World Health Organization guidelines from 2006, 2017, and Animaw & Seyoum 2017:4). Therefore, this study utilised fasting capillary blood glucose tests to determine the diabetes status of the participants. Each participant had an appointment on the second day of contact to measure their fasting blood glucose levels following the visits scheduled on the first day. Before collecting the sample, the

data collectors confirmed the correct participant and verified their fasting status. Fasting blood glucose levels were determined using a finger-pricking method with a "one-touch" glucose meter Care SenseN after an overnight fast. If the initial test indicated levels above the normal range, a repeat test was conducted under similar conditions the following day. Participants in the study who had not eaten anything during the first contact had their fasting blood sugar (FBS) directly measured. However, those who had eaten during the first contact were instructed to fast the following night, and their FBS was measured the next day.

Participants who had fasting glucose levels of 126 mg/dL or above were classified as diabetics, while those who had between 100 and 125 mg/dL were considered impaired fasting glucose (IFG) cases. In this context, the data collection instruments were interviewer- administered questionnaire and physical and fasting blood glucose measurements.

Following this, the researcher and supervisors conducted daily supervision and reviews of the collected data. The role of the researcher was to supervise and oversee the overall data collection process and to resolve any problems encountered by data collectors. The completeness of the collected questionnaires was checked, and the completed questionnaires were sealed and stored safely in the researcher's office under lock and key.

3.4 RIGOURS OF THE STUDY: VALIDITY AND RELIABILITY FOR PHASE I

3.4.1 Validity of the study

Validity is a quality criterion that refers to the degree to which inferences drawn from a study are accurate and well-supported. In measurement, "validity is referred to as the correctness or truth of an inference and refers to the degree to which an instrument measures what it is intended to measure (Polit & Beck 2017:329). To ensure the validity of the research findings, the study design and instrument validity should be addressed. According to Polit and Beck (2008: 753) "there are four main approaches for evaluating

the validity of research instruments: face, construct, content, and criterion-related validity". Content, construct, and criterion were used to ensure validity in this study.

Content validity refers to the extent to which the measuring tool covers the range of meanings included within the concept (Babbie & Mouton 2011:124). Content validity was addressed in the current study through rigorous sampling and organised item construction in the tool, and experts on the subject were also consulted. A construct is an abstraction or concept that is deliberately created by researchers for a scientific purpose (Polit & Beck 2012:722). Construct validity refers to the extent to which questions capture the presence of the variables they are intended to measure. Construct validity was ensured in this study by performing an extensive literature review and conceptually and operationally defining the study's key concepts.

Criterion validity refers to the extent to which the measurements predict a directly observable occurrence. Criterion validity refers to the relationship between a measure and another accepted measure (the "gold standard") or to the use of a recognised proxy measure (Mokkink et al 2010:735-745; & Sutton et al 2016:4). Two types of criteria on validity are concurrent validity, which refers to measuring what it intends to measure, and predictive validity, which is the ability of the data collection instruments to predict future changes in the variables. Qualities of the criteria include the measure's relevance, being free from bias (i.e., collecting data from the issue in a similar way), and ensuring the reliability and availability of the information needed. This study addressed concurrent validity through the application of standard methods and procedures to address concurrent validity in testing fasting blood glucose, taking physical measurements, and using other established proxy measures to collect and test blood glucose safety practices.

3.4.2 Reliability of the study

Reliability and precision are synonyms, and reliability is the representation of the consistency of measures of an attribute, an item, or a situation that have been obtained in a study or in clinical practise by different researchers (Grove, Burns & Gray 2013:389).

Grove et al (2013:389) state that a measure is considered reliable if it consistently yields the same result when applied, assuming that the variable being measured has not

changed. In other words, reliable measures do not fluctuate but produce consistent results from the study.

The reliability was ensured by pretesting the data collection tools on 10% of the study respondents in the area, which has similar socio-demographic characteristics to the current study areas. The translation's language consistency between the backwards and forwards versions was evaluated, and it was found to be very well done.

With the assistance of a statistician, the reliability of the tool was evaluated using the Cronbach's alpha coefficient, and the consistency of the entered data was checked after cleaning to maximise its quality. As a rule of thumb, coefficients between 0.70 and 0.80 indicate adequate reliability, whereas values of 0.90 or higher indicate high reliability. In this study, Cronbach's alpha coefficient values of 0.801 were obtained among the items used to measure the HBM constructs, which was reliability. Blood pressures, blood glucose (glucometer), and anthropometric measurement equipment were also checked on a regular basis. Furthermore, reliability was ensured in this study; after completing data entry, checking, and cleaning, the data was transferred to SPSS version 25 and STATA version 14. The findings from the data analysis guided the development of a prevention strategy (model) for T2DM through modification of risk factors, which was the basis for Phase III of this study.

3.5 DATA ANALYSIS

Data analysis is defined as the systematic organisation and synthesis of research data for the purposes of organising, providing structure and meaning to the data, and employing the collected data (Polit & Beck 2014:345). According to Brink, van der Walt and van Rensburg (2014:177), data analysis refers to the process of categorising, ordering, manipulating, and summarising data and describing it in meaningful words. In this phase of the study, the outcome variables are binary, with yes/ no or T2DM/ not DM alternative responses.

A temporary data entry clerk completed the data input using the publicly accessible, basic dataset-suited EpiData 4.6 programme. It created skipping patterns to manage the data entry. The data was then imported into the Statistical Package for Social Science (SPSS Windows version 25) and STATA version 14. The analysis was carried out by the researcher with the assistance of a biostatistician and an experienced researcher with

expertise in data management and analysis. This software was very useful in conducting descriptive and inferential analyses to address the study objectives and the association of dependent and independent variables.

The data was cleaned to remove irrelevant observations before analyses were performed. In this phase, both descriptive and inferential statistics were employed for the study's analysis. In the descriptive statistics, results were reported using frequency, percentages, measures of central tendency (mean, median, and mode), standard deviations, and graphs. The wealth index was calculated using a principal component factor analysis based on household ownership of productive assets and household characteristics to determine wealth status.

The knowledge of respondents regarding T2DM risky behaviour and prevention was evaluated using 26 items, six of which were presented under each question. Each item was used to assess the respondents' level of knowledge, with the correct response getting a one and the wrong response being awarded a zero. From 26 knowledge questions, a single variable of knowledge on T2DM risky behaviour and prevention with three ordinal response options was computed to represent the respondents' overall knowledge level and for further analysis. Respondents with an overall knowledge score of 13 or less were classified as having a "low level of knowledge," those with 14 to 18 correct answers were classified as having a "medium level of knowledge," and respondents with a score of 19 or more were classified as having a "high level of knowledge."

Respondents' perceptions regarding T2DM and its prevention were assessed using the six HBM constructs. There were 43 questions in total, 38 of them included response options ranging from strongly disagree to strongly agree, ranked from one to five. The questions were constructed so that the best score was for favourable answers. Desirable responses and an optimum score were the directions the questions were going in. The following five questions were categorised using the cues-to-action construct of the model. Each question had five alternative responses, ranging from never to always, and was scored on a scale of one to four.

The findings from the HBM constructs are shown as frequencies of responses to each individual question and as a single computed variable that reflects the respective construct. After categorising the five responses on a scale of "strongly disagree" to

"strongly agree" into three categories, the frequencies were calculated (agree, uncertain, and disagree).

A composite score was generated in order to create a single variable that represented the constructs after computing Cronbach's alpha coefficients to ensure the measurement's reliability. According to Burns and Grove (2005:374), a Cronbach's alpha of 0.7 or above indicates that the constructs are reliable and adequate. In this study, among the items used to measure the constructs, Cronbach's alpha values of 0.745 and higher were found; see more detail in Table 3.1.

Table 3.1: Cronbach's alpha value for T2DM Mellitus from HBM Constructions

Items	Mean	SD	Cronbach's Alpha
Perceived susceptibility (9 items)			**0.729**
I feel I will get DM sometime during my life.	3.05	.808	
Everybody is at risk of DM.	2.71	.848	
Cigarette smokers are more prone to contract T2DM	3.72	.793	
T2DM is more likely to develop in people who aren't physically active.	4.04	.550	
Obese/overweight people are more likely to develop T2DM.	4.10	.704	
Excessive alcohol consumption increases the risk of developing T2DM.	3.91	.592	
People who frequently consume animal fat are more prone to contract T2DM.	3.98	.716	
Excessive sugar consumption increases the risk of developing T2DM.	4.00	.742	
Diabetes is a health problem in Ethiopia.	3.78	.794	
Perceived severity (11 items)			**0.707**
T2DM can be a serious disease if you don’t prevent it.	3.97	.734	
T2DM may cause sudden death.	4.07	.463	
The complications of diabetes are dangerous in life.	4.12	.457	
I believe that diabetes is a chronic disease.	3.97	.404	
T2DM is a more serious disease in older adults.	3.89	.686	
T2DM is a more severe disease in obese /overweight people.	4.15	.750	

T2DM is a more severe disease among cigarette smokers.	3.84	.741	
T2DM is a more severe disease among high-alcohol consumers.	3.89	.607	
T2DM is a more serious condition among people who consume a lot of sugar.	4.05	.447	
T2DM is a more severe disease in people who consume high amounts of animal fat.	4.05	.564	
T2DM is a more severe disease in people who lead stressful life.	3.97	.513	
Perceived Benefit (6 items)			**0.830**
Regular physical exercise will help prevent T2DM.	4.19	.490	
Reducing dietary sugar intake prevents the development of T2DM.	4.00	.547	
Activities for weight reduction that maintain a normal body weight are helpful for preventing the development of T2DM.	4.27	.666	
Quitting cigarette smoking helps prevent the development of T2DM.	3.85	.674	
Limiting alcohol consumption helps prevent the development of T2DM.	3.86	.672	
Consuming a diet that is high in fruits and vegetables and low in fat helps prevent the development of T2DM.	4.01	.584	
Perceived barriers (7 items)			**0.718**
There are several diseases higher on my priority list than DM.	3.13	1.179	
I have no adequate knowledge to protect myself against T2DM.	3.39	1.110	
Blood glucose testing is not available at health facilities.	2.67	.897	
I would like not to think about any diseases because I am in good health.	2.65	1.155	
I don't think it is worth thinking about T2DM prevention activities.	2.62	1.098	
My family and/ or friends do not encourage me to engage in T2DM prevention activities.	3.32	1.140	
I need sufficient time and space to perform T2DM preventative activities.	3.09	1.135	

Cues to action (5 items)			**0.785**
After I get adequate information on media, I try to apply T2DM prevention.	1.87	1.033	
Fear of T2DM being a chronic disease motivates me to get involved in T2DM prevention.	1.74	.927	
Health care workers have counselled me on T2DM prevention.	1.51	.860	
I'm motivated to participate in type 2 prevention activities on the advice of friends and family.	1.69	.888	
My involvement in DM prevention is prompted by those who live close to me who have the disease.	1.53	.777	
Self-efficacy(5 items)			**0.703**
I am confident that I can manage and perform T2DM prevention activities.	2.81	1.052	
I am able to actively work on a healthy lifestyle to prevent T2DM.	3.47	.878	
I attend health assessments to prevent T2DM.	2.91	1.020	
I have information on how to prevent T2DM.	2.64	1.185	
There is a lot I can do to reduce my chances of getting a T2DM-related illness.	3.69	.960	

Moreover, both bivariate and multivariate binary logistic regression analyses were utilised to identify factors associated with the outcome variable. Variables with a p-value of less than or equal to 0.25 from the bivariate binary logistic regression model were included in the multivariable binary logistic regression analysis model. The model was run using the enter technique after being checked for multi-collinearity. When Hosmer and Lemeshow's goodness of model fit was assessed, the data fit the model well (p = 0.987) in this study.

3.6 PHASE II: HOSPITAL-BASED UNMATCHED CASE-CONTROL STUDY

3.6.1 Research Design and Methods

As stated previously in Phase I in Section 3.2 of this chapter, detailed information on the research design and method of research for Phase II of the study is provided. This phase also includes the study setting, sample procedures, data collection techniques, data analysis procedures, and measures taken to ensure the validity and reliability of the study.

3.6.1 Research design

A case-control design was used in this phase.

The research design used for Phase II of this study was quantitative, descriptive, and analytical in the form of a case-control study. A case-control study design, which employs a quantitative and non-experimental method, was used to explore the determinants of T2DM in adults in two selected public hospitals in the Bale Zone, south-east Ethiopia. Such determinants or risk factors were the association between T2DM and behavioural risk variables such as diet habit, physical activity, consumption of alcohol and cigarettes, mental stress, household food security, and biologically variable factors such as being overweight or obesity, high blood pressure, high waist

circumference, and waist to hip circumference. The specific research design for Phase II of this study was an unmatched case-control design.

Justification for the case-control research design

As was briefly described in Chapter 1 of Phase II of this study, case-control design is an analytical, observational method that is commonly used in epidemiology. There are four key steps involved in conducting a case-control study. They include identifying the individuals who are cases and exhibit the disease or outcome of interest, identifying the individuals who are controls and do not exhibit the disease or outcome of interest, measuring the potential risk factors, and determining whether the cases were more likely than the controls to have been exposed to the risk factors (Bruce et al., 2008:6).

In a case-control study, the researcher chooses the case group and the control group based on a predetermined outcome, then compares the groups based on how frequently they have been exposed to potential risk factors in the past. The selection process requires the use of clear criteria for defining cases and controls to avoid biases due to possible misclassifications. After successfully identifying the cases and the controls, the researcher and researcher assistants administer the questionnaire directly to the study subjects about their past exposure to risk factors.

The case-control study is a common observational analytical research design used to examine variables related to diseases or outcomes (Tenny, Kerndt & Hoffman 2017; Miquel, Greenland, & Last 2008:31–36). Analytical investigations concentrate on examining hypothesised causal linkages in order to identify or quantify the effects of risk factors (Miquel et al 2008:31–36). An analytical analysis was conducted to determine whether there might be a causal relationship between the variables and the desired outcome. The analytical technique was utilised to compare the level of exposure to selected variables in T2DM cases using a suitable reference group of individuals without T2DM. This was done to determine the odds and infer possible causal associations between test variables and T2DM.

A case-control study is also known as an epidemiologic study that identifies and selects individuals who develop a particular health condition (cases), which were adults with T2DM in this study, and comparable individuals who do not (controls), which were individuals without T2DM (Greg & Emily, 2015). Data on exposure

histories in the two groups are acquired and analysed to identify the factors that contributed to the development of the health condition or outcome. The case-control study design was employed by the researcher to compare the differences in dietary habits (such as the use of fruit and vegetables and animal fat), physical activity, alcohol consumption, and cigarette exposure between T2DM cases and a control group of individuals from the same hospitals who did not have T2DM. According to Song and Chung (2010:2234), in case-control studies, researchers can investigate the relationship between various exposures and the intended health outcome. Moreover, this type of research is commonly referred to as a retrospective study since it collects data on past exposure and measures the risk of having risk factors among the cases and controls (Katz et al 2014:408; Oleckno 2008:55). Furthermore, controls should be comparable to cases in every other respect except for the fact that they do not have the interest of outcome. In most studies, there are far more controls than cases that can be used. Because of this, it is frequently possible to select a large number of controls for each case, increasing the sample size for analysis. However, studies have shown that adding more than four controls for each case does not significantly improve the precision of the analysis (Sullivan 2012:11–12).

Additionally, it has been shown that case-control studies have stronger statistical power to detect differences between cases and controls than other observational studies with the same sample size (Song & Chung 2010:2234). Descriptive methods were also employed to assess the data collected from research participants. According to Miquel et al (2008:31–36), the main objective of a descriptive design is to display the current distribution of variables in a study population. This study used appropriate descriptive statistical techniques to describe the frequency and proportion of variables in cases and controls. Furthermore, the researcher did not administer a treatment or other intervention to either of the study groups, making this study non-experimental in nature. The researcher is referred to as a bystander and only observes in non-experimental investigations (Brink et al. 2012).

3.6.1.1 Advantage and limitation of case-control study design

Case-control studies are a solid research method choice, however, they come with different advantages and limitations.

Advantages

A case-control study has numerous advantages over other observational epidemiologic studies. For instance, if a prospective research approach were used, it would take a very long time to find cases of rare diseases, such as genetic disorders and cancer, in ordinary health facilities, which would take many years of waiting. A case-control study design is particularly suited to investigating rare outcomes or outcomes with a long latency period since study subjects are initially selected based on their outcome status. Thus, compared to prospective cohort studies, case-control studies are relatively quick and inexpensive to conduct, include comparably fewer subjects, and also allow for simultaneous assessment of multiple exposures or risk factors for a single outcome (Song & Chung 2010:4-6). For instance, in the T2DM study, the researcher can ask both the cases and the controls about their exposures to smoking, alcohol consumption, physical inactivity, or any other number of potential exposures to identify which exposures are most likely associated with T2DM.

In general, the cost and time efficiency of a case-control study are two of its most important advantages. It also requires a smaller sample size, can evaluate multiple exposures, and is useful for rare diseases or outcomes.

Limitations

On the other hand, a case-control study design shows a few methodological limitations in producing solid evidence. The limitation of case-control study designs is that they cannot determine if a risk factor causes disease because it is unclear whether the majority of risk factors existed prior to the disease (Lewallen & Courtright 1998:1-2). Therefore, this study's design is to determine whether the risk factor and the disease are associated.

Sullivan (2012:12) and Woodward (2014:212) describe methodological issues relating to various biases that are frequently seen in case-control study designs. For instance, misclassification bias, which refers to the incorrect classification of outcome or exposure status of cases and controls, can be a problem in case-control studies. Both the cases and the controls would have similar degrees of misclassification, which would underestimate the strength of the association. However, if a larger number of cases are incorrectly identified as having the exposure or risk factor, then the association may be inflated. Another closely related type of bias is the

misclassification of cases or controls, which leads to a misinterpretation of connections between exposure and outcome. In a case-control study, the above two scenarios are examples of selection bias (Sullivan 2012:11; Woodward 2014:23).

Another disadvantage of case-control research that is most frequently retrospective in nature is the potential for recall bias (Setia 2016:146–51). In a case-control study, recall bias refers to the increased likelihood of those who experienced the outcome to recall and report exposures as compared to those who did not. In other words, even if the exposures in both groups were the same, case group participants might report the exposure more often than control group participants. Recall bias may cause people to draw false conclusions about the existence of associations between exposure and disease. Participants in case-control studies frequently have to self-report the factors they were exposed to. It results from subjects' faulty memories of past exposures. For instance, when people with T2DM are asked about their history and exposures (such as smoking, drinking, and physical inactivity), they are more likely to reflect on these exposures and recall experiencing some of the exposures that the healthy controls did (Song & Chung 2010: 4-6).

When designing a case-control study, the researcher must select an appropriate control group. Ideally, the case group (those with the outcome) and the control group (those without the outcome) wold have almost the same characteristics, such as age, gender, overall health status, and other criteria. The two groups should have similar histories and live in similar environments. For instance, in a study, T2DM cases were recruited from two selected public hospitals in the Bale zone, and controls were also recruited from people who had visited the two hospitals and were at least 18 years old. In order to strengthen the case-control study and improve their ability to discover real and valid potential correlations between exposures and disease , the researcher needs to spend a lot of effort developing a suitable control group.

Similarly, the researcher must recognise the potential for failing to identify confounding variables or exposures, introducing the risk of confounding bias, which emerges when a variable that is not being accounted for has a relationship with both the exposure and outcome. This can cause us to wrongly examine something we are not accounting for but that may be systematically different between the groups (Setia 2016: 146-51)

Overall, the case-control study design was most suitable for this current research because of time, cost, ethical, logistical, and logistical considerations, as well as

studying multiple underlying factors simultaneously that might have a causal association with a disease or health outcome.

3.7 RESEARCH METHODS

This section presents the research method of an unmatched case-control study in Phase II of this study. Research methods are referred to as tools that researchers use to look into a problem or gather information to help them find the answers to their research questions (Polit & Beck 2014: 39).

Based on the detailed description of the research method used in Phase I of this study that was provided above, the following sections provide information on the study population, sample and sampling procedure, data collection, and data analysis that were used in Phase II of this study.

3.7.1 Study setting

The study settings for Phase II of the current study were conducted at two selected public hospitals in Bale Zone, south-eastern Ethiopia. Bale Zone is located 430 kilometres south-east of Addis Ababa. Bale Zone has four hospitals, namely Goba Referral Hospital, Bale Robe General Hospital, Dellomena General Hospital, and Madda Walabu Primary Hospital. From these four hospitals in the Zone, two of them were purposefully selected, namely, Goba Referral Hospital and Bale Robe General Hospital, because the two hospitals have catchment areas covering both rural and urban areas of Bale Zone, Oromia regional state, and south-east Ethiopia, as well as because the two selected hospitals have a high patient flow and provide care for chronic illnesses like DM. Thus, a hospital-based, unmatched case-control study was conducted at Goba Referral Hospital and Bale Robe General Hospital.

Goba Referral Hospital at Madda Walabu University is a referral and teaching hospital that is located in Bale Zone. It was first established as a small clinic in a resident's house in 1955. Currently, the hospital that has 250 beds, 39 departments, and 853

staff members that provide promotion, preventive, curative, and rehabilitative services for an estimated population of 845,591. According to an annual report, the Goba Referral Hospital, which is situated in Goba town, Oromia regional state, south-east Ethiopia, handled more than 600,000 patients in 2021, of whom half were inpatients. An average of 15 to 20 new cases of T2DM patients are estimated to be diagnosed each month, which satisfied the sample size requirement of this study design within the time frame for data collection.

Bale Robe Hospital (BRGH) is located in Robe town in the Bale Zone, Oromia National Regional State. The town is located 430 kilometres south-east of the capital city, Addis Ababa, Ethiopia. Robe Hospital was started as a health centre in 1978 and operated until April 2011. Then it develops into a hospital with four wards that have 56 beds and more than 219 clinical staff members (Unpublished Robe Hospital Report, Bale Robe District Hospital, Bale Zone, South-east Ethiopia, 2014). Currently, the hospital delivers clinical services to more than half a million urban and rural residents. In addition, the hospital functions as a training centre for Madda Walabu University and offers clinical services to students, town residents who are enrolled in private colleges, and prisoners.

Further, both hospitals have a chronic follow-up clinic that provides basic treatment and diagnostic services for all forms of DM through clinical diagnosis, fasting blood glucose, and random blood glucose using fasting plasma blood and fasting capillary blood using a glucometer. The monthly flow of diabetic patients who had follow-up in the selected two hospitals was 993. Of these patients, 869 attended their follow-up at Goba Referral Hospital, and 124 attended Bale Robe General Hospital. (More detail on the study setting of Bale Zone and Goba and Robe towns can be found under Phase I).

3.7.2 Study Population

The following diagram clarifies how this study in Phase II defined and identified both cases and controls from two selected public hospitals in Bale Zone, south east Ethiopia.

As per the below schematic presentation, in Phase II, this study collected primary data from newly-diagnosed T2DM patients (aged ≥ 18 years and duration of diagnosis less than 6 months) and adults without DM aged 18 years and over who attended two selected hospitals in Bale Zone, south east Ethiopia, from September 1, 2021 to November 30, 2021. Figure 3.3 below further depicts the schematic representation of the sampling procedure used in Phase II of the study.

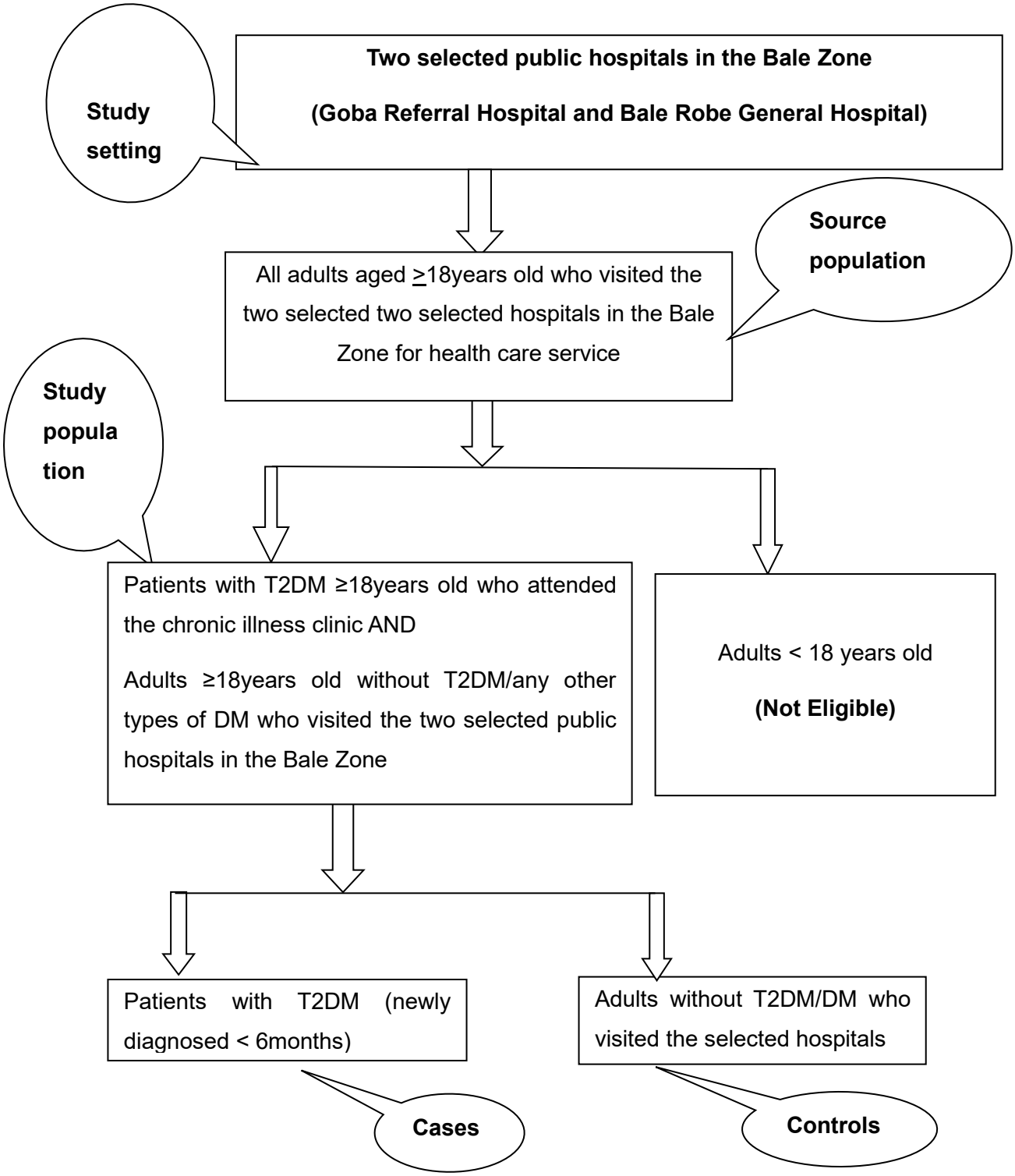

Figure 3.5: Schematic presentation of sampling procedures for case - control study

Ascertainment of cases and controls

The source population comprised all adults (aged 18 years and older) who attended outpatient departments in two selected hospitals in the Bale Zone. Cases were patients recently diagnosed with T2DM (less than six months) by a physician or those taking anti-diabetic drugs during the study period. Controls were adults attending Goba Referral Hospital and Bale Robe General Hospital with no history of T2DM or any type of DM and whose fasting blood sugar was less than 126 mg/dl or whose random blood sugar was less than 200 mg/dl during the study period.

3.7.2.1 Target population

The target population of the study in Phase II was all newly diagnosed T2DM patients (duration of diagnosis less than 6 months) aged ≥ 18 years old and adults without T2DM or any other types of DM aged 18 years and over who attended two selected hospitals in Bale Zone, south-east Ethiopia, during the study period (September 1, 2021 to November 30, 2021) and met the eligibility criteria for this study.

3.7.3 Sampling and sampling procedure

As described in the above section, according to Greg and Emily (2015), sampling is the process of selecting a subset of a population to include in a study. The study participants were selected and enrolled in the study using consecutive sampling and systematic random sampling techniques. These techniques would be explained in the sections on sampling cases and controls, respectively.

Sample

Five hundred forty-four adults aged 18 years and above (182 T2DM cases and 362 non-DM controls) who attended two selected public hospitals (Goba Referal Hospital and Bale Robe General Hospital) in Bale Zone, south-east Ethiopia, for study during

the study period (September 1, 2021, to November 30, 2021) and who fulfilled the eligibility criteria

Sample size

The sample size for the case-control study was determined using Open EPI INFO Software Version 7 to satisfy the requirements of the study. With a prevalence exposure of controls of 6.3%, an OR of 2.44 was detected with a 95% confidence level and 80% power. As an exposure variable, the use of tobacco was used (Giday, Aseffa & Kidanemariam 2014:7). Adults with follow-ups in the study area who were sampled as cases and controls comprised the population for this study. The final estimated sample size for cases was 165 and for controls was 329, for a total of 494. The cases-to-controls ratio was 1:2. A total sample size of 182 cases and 362 controls was calculated after 10% of the non-response rate was added. As a result, the final sample size is 544.

Sampling for cases

Sampling in a case-control study design begins with choosing the cases. In a case-control study, the researcher must have clearly defined inclusion and exclusion criteria before selecting cases (Song & Chung 2010: 4-6). For instance, if the outcome is having a disease, particular diagnostic criteria, disease subtypes, disease stages, or levels of severity should be given. Such criteria indicate that all of the cases are homogenous and consistent. Additionally, cases may be selected from different sources, such as patients from clinics, hospitals, or community groups. According to Song & Chung (2010: 4-6), It is essential to select cases that are representative of the target population in order to strengthen the external validity of the study. Possible explanations for why cases from the initial target population eventually emerge and become accessible as cases (study participants) for a case-control study were described above.

A case is defined as a "particular ailment, health disorder, or condition under investigation found in an individual or within a population or study group" (Miquel, Greenland, & Last 2008:31–36. For this study in phase II, a case was defined as an adult aged 18 years and older who has been recently diagnosed with T2DM (less than six months) by a physician and has been on anti-diabetic medication for at least two weeks preceding the study. T2DM cases were selected from the two selected

hospitals in the Bale zone that render care for DM cases, namely Goba referral hospital and Bale Robe general hospital. Due to the limited number of T2DM patients who reported to the hospital each day, all consenting patients who reported to the hospital and met the eligibility criteria on the day of their visit to the hospital were enrolled into the study as cases. Consecutive sampling was employed to enrol the respondents from each hospital in phase II of the current study. The total sample size for cases was 182. Based on the number of T2DM patients followed at each hospital, a sample size was assigned for each hospital. Therefore, 102 T2DM patients were selected from Goba referral hospital and 80 T2DM patients were selected from Bale Robe hospital to participate in the current study.

Sampling for controls

Selecting the appropriate group of controls might be one of the most challenging aspects of a case-control study. An important one is that both groups should come from the same source population, or that cases and controls should have the same exposure distribution (Song & Chung 2010:4-6). The researcher may also see the control group as a population that is at risk for the development of the outcome. The comparability of these two groups is crucial to the validity of the research; thus, cases and controls should otherwise meet the same inclusion criteria for the study (Song & Chung 2010:4-6).

In a case-control study, control is defined as "person(s) in a group that are used for reference in comparison to a case group" (Miquel et al 2008:31–36). In this Phase II of the study, a control was any adult aged 18 years and older who attended Goba Referral Hospital and Bale Robe General Hospital and had not been diagnosed with T2DM or any type of DM and whose fasting blood sugar was less than 126 mg/dl or whose random blood sugar was less than 200 mg/dl during the study period. Systematic random sampling techniques were used to select the control respondents from each hospital in Phase II of the current study.

The following set of criteria was used for phase II of this study to ensure that both cases and controls were enrolled in the study accordingly.

Inclusion and exclusion criteria

Clear criteria must be established for how and why study participants in the case and control groups would be enrolled in a study. This links to the definition of cases and controls in a case-control study. Cases and controls have similar inclusion and exclusion criteria, with the exception of differences in outcomes. The following set of criteria were used to ensure that only eligible adults from both the cases and the controls would be enrolled for Phase II of this study.

Cases - Inclusion

- Known type 2 DM patients on medication
- Newly diagnosed T2DM Patients (less than 6 months) attending Goba Referral Hospital and Bale Robe General Hospital within six months of data collection based on their fasting blood glucose levels were measured using a glucometer after observing an overnight fast of 8 hours according to WHO diabetes guidelines.
- Age 18 years and above
- Either sex
- Being able to undertake a face-to-face interview that includes physical measurement

Cases - Exclusion

- Individuals with type 1 DM
- Gestational DM
- Pregnant women
- Those not willing to participate

Control - Inclusion

- Adults who visit two selected hospitals from the outpatient department to seek other services or for minor health issues
- Adults who did not have DM attended the two selected hospitals.
- Adults who proved to be free from DM (diagnosed as normal fasting blood sugar less than 126 mg/dl, random blood sugar less than 200mg/dl, and confirmed by a glucose metre) according to the WHO diagnostic criteria from 2006

- Age 18 years and above
- Either sex
- Being able to undertake a face-to-face interview that includes physical measurement

Control - Exclusion

- Malignant cancer patients who are not diabetic
- Deemed too ill to participate
- Pregnant women
- Those not willing to participate

3.7.3.1 Variable of the study

3.7.3.1.1 Dependent variables

- T2DM/ Not Diabetes mellitus (The outcome variable is dichotomous, i.e., the presence or absence of T2DM)

3.7.3.1.2 Independent's variables

Socio-demographic and economic factors

- Address/ residence
- Age
- Sex
- Educational level
- Marital status
- Religion
- Ethnicity
- Occupation
- Household population size
- Living structure of family

- Source of income for healthcare
- Household income

Lifestyle habits (behavioural factors)

- Cigarette Smoking
- Alcohol consumption
- Chat chewing
- Physical activity

Diet

- Salt use
- Vegetable intake
- Fruit intake
- Coffee drinking

Anthropometric measurement and other factors

- BMI
- FBG
- Blood pressure measurement
- Family history of DM
- Family history of hypertension
- Household food insecurity status
    - Worried about not having enough food
    - Unable to eat preferred food
    - Ate just a few kinds of food
    - Ate unwanted foods Rarely
    - Ate a smaller than desired amount at a meal
    - Ate fewer meals in a day than desired Rarely
    - Had no food of any kind
    - Went to sleep at night hungry
    - Went without food over a day and night
- Mental stress (SRQ-20)

3.7.4 Data collection

Data collection is the process of gathering information to answer a research problem (Polit & Beck 2014:288). The researcher took into consideration the type of data required to answer the research questions. The researcher guided the data collection with an interviewer-administered questionnaire, followed by measurements such as physical measurements and biochemical measurements (blood glucose).

3.7.4.1 Data collection tools

A data-collection tool is used to collect information from respondents (Polit & Beck 2012:725).

3.7.4.2 Development and testing of the data collection instrument

The questionnaire was developed based on the objectives of the study from previous literature reviews and adapted from the World Health Organisation (WHO) Stepwise approach for NCDs in developing countries (Bonita et al 2003:9–22; Riley et al 2016:74–78). The first questionnaire was prepared in English by the principal investigator with the consultation of the research supervisor and experts on questionnaire development, and then the questionnaire was translated from English into the local languages of Afan Oromo and Amharic by an independent translator in order to maintain its consistency in meaning and to maintain and check the validity of the questionnaire. This was done in order to make the questionnaire understandable to the respondents and to obtain the most accurate and complete information possible. Based on the study purpose and local context, the questionnaire was customised. Modifications were made to the original questionnaire to reflect the local context (Ethiopia).

As stated in the above paragraph, data on T2DM risk variables in both cases and controls were gathered using a questionnaire based on the WHO stepwise approach to chronic disease risk factor surveillance (STEPS) instrument. The questionnaire, which was composed of several questions over six sections, was first written in English, then translated into the local languages, Afan Oromo and Amharic, and finally translated back to English by language experts to ensure consistency. Section one of the questionnaire included demographic questions; Section two consisted of

behavioural risk factors (such as cigarette smoking, alcohol consumption, dietary habits, and physical exercise); Section three comprised anthropometric measurements and fasting blood sugar; Section four consisted of perceptions of body shape and size; Section five included household food security; and Section six consisted of mental stress-related questions. More detail on this would be described in the next section.

3.7.4.3 Characteristic of the data collection instruments

In this Phase II of the current study, the adapted research instruments were categorised as indicated below

The questionnaire developed is composed of the following six sections:

- Section Ib: Socio-demographic and economic characteristics
- Section IIb: Behavioural factor for T2DM
- Section IIIb: WHO step-wise approach for blood pressure, physical measurement, and blood glucose
- Section IVb: Questionnaire on Perception of Body Size and Shape
- Section Vb: Household Food Insecurity Assessment Scale (HFIAS) Occurrence
- Section VIb: Mental Stress (Risk Factors) for T2DM

The detailed descriptive of the above components as follows:

Section IB: Socio-demographic and economic characteristics

Socio-demographic and economic characteristics were collected through face-to-face interviews with an interviewer-administered questionnaire. Socio-demographics such as age, sex, education level, marital status, religion, ethnicity, occupation, name of hospital attended (Goba Referral Hospital or Bale Robe General Hospital), household size, and household assets. Socio-demographic and economic characteristics were used to determine their association with the study objective.

Section IIb: Behavioural Measurements

The behavioural characteristics of respondents were compared between cases and controls for different groupings, including smoking, khat chewing, alcohol intake, physical activity level, and dietary habits (such as daily consumption of vegetables,

daily consumption of fruit, and daily consumption of fatty meat). Smoking was deemed to be consuming at least one cigarette daily for a continuous or cumulative period of six months. At least one alcoholic beverage per week was considered to be drinking. Physical activity intensity was divided into sedentary, moderate, and vigorous.

Section IIIb: Physical measurements

In the second step, physical measurements of the respondents' height and weight were measured using standard instruments in order to calculate the body mass index (BMI). The weight was measured on a digital weighing scale by putting the scale on a firm, flat surface. During weight measurement, each participant wears a light cloth and is recorded in kilogrammes to the nearest 0.1 kg. The weighing scale was calibrated to zero before each measurement, and its functioning was checked using a well-known weight object.

Height was measured using a sliding metre, read in centimetres, and recorded to the nearest 0.1 cm. During height measurement, respondents stood in the normal anatomical position with their heels, buttocks, shoulders, and backs of their heads touching the measuring board. Body mass index (BMI) was calculated as the ratio of weight in kilogrammes to the square of height in metres (Grundy et al 2004:433–438).

Waist circumference was measured using constant tension tape at the end of normal expiration, with the arms relaxed at the sides, at the midpoint between the lower margin of the palpable rib and the top of the iliac crest (hip bone). Readings should be taken at the level of the measuring tape to the nearest 0.1 cm, making sure to keep it snug but not so tight as to compress the skin. After that, the WC was divided by the hip circumference to determine the waist to hip ratio.

Blood pressure (BP) was measured using a mercury sphygmomanometer, with respondents sitting after resting for at least five minutes. Instructions were given to avoid talking and to breathe normally during the time of measurement. For each participant, the BP was measured twice, at least five minutes apart. Fasting blood glucose level was measured by a glucometer. After the study subjects had fasted over the night for at least 12 hours, their fasting blood glucose levels were measured.

Furthermore, measurement of outcome variable described as follow:

As briefly highlighted in Section 3.7.2 of Phase II of the current study, the diagnostic criteria for T2DM as an outcome variable were as follows: Patients were categorised

as cases if they were aged ≥ 18 years old, had a newly diagnosed diagnosis of T2DM (less than 6 months) from a physician and/ or had an FBG reading above or equal to 126 milligrams per decilitre (mg/dl), or had been receiving anti-diabetic medications during the period of the study. Whereas a control is defined as any adult aged ≥ 18 years old who attended Goba Referral Hospital and Bale Robe General Hospital and had not been diagnosed with T2DM or any type of DM and whose fasting blood sugar was less than 126 mg/dl or whose random blood sugar was less than 200 mg/dl during the study period.

Section IVb: Questionnaire on Perception of Body Size and Shape

Perception of body size and shape of respondents were used to determine their association with the study objective.

Section Vb: Household Food Insecurity Assessment Scale (HFIAS) Occurrence

This section is about household food insecurity measurement. Food security is defined as a state in which "all people at all times have both physical and economic access to sufficient food to meet their dietary needs for a productive and healthy life" (USAID, 1992). A validated nine-item screening questionnaire can be used to determine the risk of food insecurity. The household food insecurity access scale (HFIAS) was used to measure household food insecurity and was validated in Ethiopia (Gebreyesus et al 2015:1–10). The questionnaire had nine occurrence questions, each of which was followed by a question on frequency of occurrence (Coates, Swindale & Bilinsky 2007:14-16). The researcher used the work of Coates et al (2007:18) to develop a tool to assess food security. The questionnaire consists of nine questions that ask respondents if they have ever experienced one of nine conditions that are associated with food insecurity over the course of the previous four weeks (30 days). There are two possible answers to the question (0 = no, 1 = yes). A second question offers three possible answers, with 1 denoting rarely, 2 denoting sometimes, and 3 denoting often. A hunger scale as well as food and nutritional technical support were used to assess food insecurity (Ballard et al 2011:115).

Moreover, two categories (food insecure and food secure) were used to classify the level of food insecurity among households/ respondents. Further, household food insecurity status was classified as mild, moderate, or severe based on the frequency of the occurrence of each item or question as follows:

A food -secure household was declared if [(Q1a=0 or Q1a=1) and Q2=0 and Q3=0 and Q4=0 and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0].

Mildly food- insecure household if [(Q1a=2 or Q1a=3 or Q2a=1 or Q2a=2 or Q2a=3 or Q3a=1 or Q4a=1) and Q5=0 and Q6=0 and Q7=0 and Q8=0 and Q9=0].

Moderately Food Insecure household if [(Q3a=2 or Q3a=3 or Q4a=2 or Q4a=3 or Q5a=1 or Q5a=2 or Q6a=1 or Q6a=2) and Q7=0 and Q8=0 and Q9=0].

Severely Food Insecure household if [Q5a=3 or Q6a=3 or Q7a=1 or Q7a=2 or Q7a=3 or Q8a=1 or Q8a=2 or Q8a=3 or Q9a=1 or Q9a=2 or Q9a=3] (Coates, Swindale & Bilinsk 2007: 20).

Remark Q denotes a Question or item.

Household food secure status of respondents was used to determine its association with the study objective.

Section VIb: Mental Stress (Risk Factors) for T2DM

Mental stress was examined using a self-reporting questionnaire (SQR-20) comprising 20 variables. Mental stress was categorised into three levels: mild, moderate, and severe (Beusenberg, Orley & World Health Organization 1994). Mental stress status of respondents was used to examine its association with the study objective.

3.7.4.4 Pre-testing

A pretest was conducted 3 weeks prior to the commencement of the main study using 10% of respondents with and without T2DM at Dododal General Hospital. Results from the pretest were used to refine questions in the questionnaire and improve the content validity of the research instrument. The pretest included a total of fifty-four respondents, of whom 18 were cases and 36 were controls. In order to minimise bias, respondents included in the pretests were not included in the main study.

3.7.4.5 Data collection process

In Phase II, data collection was conducted in two selected hospitals in Bale Zone, from September 1, 2021 to November 30, 2021.

First of all, before data collection began, the Research and Ethics Committee of UNISA in the Department of Health Studies and the Oromia Region Health Bureau granted permission to collect data for this study. Additionally, permission was obtained from the management of the two selected hospitals (Goba Referral Hospital and Bale Robe General Hospital) where the data was collected. The data collection took place at the outpatient departments of two hospitals in the Bale Zone.

Six data collectors and three supervisors were recruited from health professionals working in public health facilities based on their experience in data collection and supervision. The principal investigator conducted training for two days for data collectors and supervisors, focusing on data collection techniques, ethics, and measurements. Practical sessions to familiarise the data collectors with the tools and ensure that they fully understand the training before proceeding to the data collection sites. As a result, quantitative data was collected using the WHO's stepwise approach for noncommunicable disease surveillance (Bonita et al 2003:9–22; Riley et al. 2016:74–78), which consists of three steps.

The first step involved gathering data on sociodemographic and behavioural factors using a pretested, structured, interviewer-administered questionnaire prepared in the local language (Afan Oromo and Amharic) as recommended by the WHO to both cases (T2DM) and controls in areas where the privacy of the clients was maintained. The questionnaire included sociodemographic and economic conditions, behavioural factors, physical measurements and fasting blood glucose measurements, perceptions of body size and shape, food insecurity, and mental stress-related questions. Questions related to alcohol use and smoking were modified to be in line with the local context of Ethiopia.

The second step focused on physical measurements, while the third step involved biochemical measurements, specifically blood glucose. In the case of control participants who had not consumed any food during the first contact, they were directly measured for fasting blood sugar; however, participants who had eaten food during data collection were measured for their random blood glucose.

3.8 RELIABILITY VALIDITY AND RELIABILITY

3.8.1 Validity of research instrument

Instrument validity is an evaluation of a measurement tool's precision in capturing the variables it is intended to capture (Brink et al 2012). The validity of the data collection tool was verified using approaches for content validity and face validity. Content validity is the ability of the instrument to accurately capture every aspect of the variable that has to be evaluated. The instrument used in this study was adapted from the WHO STEPS questionnaire and was developed by experts to capture the prevalence of risk factors for non-communicable diseases. In addition, the questionnaire was customised to the local context. To ensure the content and face validity of research instruments, a draft of the adapted questionnaire was sent to the research supervisor to assess content and face validity. The questionnaire was then edited and refined based on the comments before conducting data collection from study participants.

3.8.2 Reliability of research instrument

Reliability has to do with the ability of the research instrument to consistently produce the same results when the measurement is repeated over time on the same participant or when used by two researchers (Brink et al 2012). The questionnaire used in Phase II of the current study was based on the WHO STEPS instrument, which has been used over time by several researchers in various settings and countries to measure risk factors for non-communicable diseases. The reliability of the questionnaire that was used to gather the data was assessed by looking at its stability. The same person received the same instrument twice in the course of one day. The researcher investigated the responses for patterns.

To ensure the quality of the data, the questionnaire was first prepared in English, translated to the local languages of Afan Oromo and Amharic, and then back translated into English by an expert. Pre-tested materials were used. Data collectors and supervisors received extensive training for two days. Supervisors and researcher/ investigator closely followed the data collection process. The completeness of questionnaires was checked by supervisors and the principal investigator on each day

of data collection. After checking for consistency and completeness, supervisors submit the filled-out questionnaires to the principal investigator. The collected data was double entered by the researcher to verify whether the data was properly entered or not by the data clerk.

3.9 DATA ANALYSIS

The data was cleaned, processed checked for completeness, coded and entered into Epi-Data Version 4.6.0, and analysed using SPSS Version 25 and STATA Version 14 software for analysis. A frequency of each variable was calculated to check for accuracy, outliers, consistency, and missed values. Variables entered into the first unadjusted model were age, marital status, educational and occupational status, drinking of alcohol and coffee, physical activity and BMI, food insecurity, and mental stress. Crude and adjusted odds ratios were done for each explanatory variable at a 95% confidence level. Variables with a p-value ≤0.25 were taken into the final adjusted model. The model was adjusted for age and sex. Variables with a p-value less than 0.05 were considered statistically significant in the final model.

3.10 ETHICAL CLEARANCE FOR BOTH PHASES OF STUDY

Approval to conduct the study was sought in the following manner:

- The ethical clearance certificate was obtained from the Higher Degrees Committee of the Department of Health Studies at the University of South Africa (Annexure A).
- A support letter that indicates the objective of the study was written to the Oromia health bureau from Unisa Addis Ababa, Ethiopia, Regional Learning Centre (Annexure B).
- An approval letter to conduct was obtained from the Oromia Health Bureau Health Research Review Board (Annexure C).
- A permission letter to conduct the study was requested from the Bale Zone Town Administration and Health Department (Annexure D) and from the Goba Referral Hospital and Bale Robe Hospital Manager (Annexure E).

Furthermore, all respondents were informed of the study's purpose, that participation was voluntary, and that their privacy, anonymity, and confidentiality would be protected. Informed consent was obtained from all the respondents (Annexure N). Data collection started after permission was granted.

3.10.1 Ethical Considerations

According to Polit and Beck (2014:381) and Neuman (2011:143), ethics is associated with the researcher's moral commitment to uphold the respondent's legal values and professional obligation to behave ethically towards the respondent. Maximising benefits while minimising harm to study respondents is the aim of ethical research. To achieve this, the research should adhere to research procedures, legal, ethical, social, and professional obligations, and ensure that the client's human rights are protected (Polit & Beck 2021:727). In this study, the researcher observed the ethical principles of informed consent, confidentiality and privacy, self-determination, and beneficence (De Vos et al 2011:119).

Obtaining informed consent, ensuring confidentiality and anonymity, protecting human rights, and maintaining scientific integrity were among the ethical issues that arose at research institutions. In this study, the rights of the research institution, study respondents, and ensuring scientific integrity were all considered. These ethical principles are presented under the following subheadings.

Protecting the rights of the participants

The researcher must be protected respondents from any kind of harm including physical, emotional, economic, and social aspects (De Vos et al 2011:115; Polit & Beck 2012:152-6).The researchers and data collectors informed the study participants that neither their choice to decline participation in the study nor their decision to withdraw from the interview was shared with the head of their healthcare facility or any other member of their team or colleagues. Therefore, this research considered all possible consequences that could hurt or destroy any of the participants. The data collectors introduced themselves and the purpose of the study to the members of the households, as well as to those from the hospital from which

data were to be collected. The interviews with the selected individuals started after a brief explanation of the study and the obtaining of both verbal and written consent. Information about the study participants was kept confidential. The study participants were interviewed in private rooms and had their physical measurements taken there to protect their anonymity. In addition to these means of protection, unit identifiers were used to maintain the anonymity of respondents' information.

For the fasting blood glucose measurements, blood was taken using a finger-pricking method with a "one-touch" glucose metre, CareSenseN, to minimise the risk of infection or related complications from finger pricking. Trained data collectors measured the participants' blood sugar levels. Before the finger pricking, individuals who were unsure received psychological support, which included assurances that there was no risk involved and explanations of the blood-taking procedure. Blood was taken using the tip of the ring finger of the left hand. Before the pricking figure was taken, the site was thoroughly cleaned with cotton swabs and alcohol to lessen the chance of infection. After taking the blood, cotton swabs were gently placed on the blood to avoid bleeding. The data collectors closely observed the study participants for ten minutes to make sure the bleeding stopped. Blood was obtained and analysed with the CareSenseN glucose metre, which minimises the risk of infection or related devices, and those who were screened to have high blood sugar were advised to visit a health facility for further diagnosis and treatment. After the interview, physical measurements, and fasting blood glucose test, every study participant was given acknowledgement for their time and participation in the study.

The three basic principles relevant to medical ethics involving human subjects include respect for persons, beneficence, and justice (Joubert & Ehlrich 2007:31).

Informed consent

Informed consent means respondents must have adequate information about the research, be able to comprehend it, and be able to voluntarily consent or decline to participate (Polit & Beck 2012:177). In this study, every adult who was eligible for both study phases provided information in a language they could understand based on the information sheet (the information sheet and consent form are located in Annexures N and O. The information includes the objectives of the study, its benefits and risks, and participants' rights. The study included only adults who were 18 years of age or

older. Adults who agreed and signed consent forms for the interview, physical measurements, and blood glucose testing were considered to have given consent and were enrolled in both phases of the study.

Confidentiality and Anonymity

Confidentiality refers to respondents taking a pledge to maintain any information they provide, promising that it won't be disclosed to the public in a manner that is able to identify them and that it won't be made accessible to anyone else (Polit & Beck 2012:163). Study participants have a right to expect that any data they provide will be kept in the strictest confidence. Participants' right to privacy was protected through various confidentiality procedures (Polit & Beck 2008:180). The researcher was ensuring anonymity by not linking the participants to their data, which was the most secure means of protecting confidentiality. This was done by ensuring that no respondent wrote their name on the questionnaire. The list of names of the respondents was only to be available to the researcher and the supervisor and was only to be used to distribute the questionnaires

Beneficence

The definition of beneficence comprises three guiding principles: one ought to prevent evil, one ought to remove evil, and one ought to do, or promote, good. Even the expert shouldn't be exposed to a compromised situation or a situation for which they are not equipped to handle (Brink et al 2012:25). Respondents can learn more about themselves through the study interviews. The respondents saw no direct financial benefit from this study or any chance of incentives. The study's findings will advance scientific knowledge of T2DM, its risk behaviour, and how to prevent the disease through modifying modifiable risk factors for T2DM in adults in Bale Zone, south-east Ethiopia.

This research study was conducted in such a way that minimises the probability of harm. The researcher obtained background information by doing a literature search so that no harm would be imparted to the research participants.

Respect and autonomy for the person, according to Polit & Beck (2012:154), entails the participants' right to self-determination and full disclosure.

Self-determination is the ability of a potential participant to actively decide whether to participate in a study without fear of discrimination. It also includes the freedom to

enquire, withhold information, and leave the study at any moment without damaging one's health.

Respect and autonomy for person

Respect and autonomy for the person entail the participants' right to self-determination and full disclosure (Polit and Beck 2012: 154). Self-determination is the ability of a prospective respondent to voluntarily decide whether to participate in a study without fear of discrimination. It also includes the freedom to enquire, refuse to give information, and withdraw the study at any moment without damaging one's health.

In this study, the research participant has the right to choose to participate in a research study after they have been given all the information about the study. This principle is adhered to by obtaining the prospective participant's informed consent. The participant was then making an informed choice about whether to participate or not (see Annexure N and O).

Justice

The principles of justice mean that respondents have the right to fair consideration and treatment, and this is the unifying principle in health and nursing. Fairness and the right to privacy are some of its guiding ideas (Brink et al 2012:36). The right to privacy was maintained in that the researcher ensured that the research was not more intrusive than it needed to be and that the participant's privacy was maintained throughout the study. The benefit to the study respondents was that advice was given to each respondent on how to prevent T2DM, regardless of their risk status. Participants with the risk factors, including heavy alcohol drinking, tobacco use, high blood sugar levels, and high blood pressure, were advised to visit a health institution for further diagnosis and treatment.

Protecting the rights of the institution

To protect the rights of the institution, the researcher was requesting approval from the University of South Africa (UNISA) ethics committee to conduct the study, as well as from all heads of institutions where the study was contacted. Additionally, approval was sought from the Oromia Region Health Bureau's Health Research and Ethics Committee in Ethiopia.

Scientific integrity

The principle of fidelity and scientific integrity refers to the goal of discovering valid knowledge (Christensen 2007:145). Without using any fabrication, falsification, forgery, manipulation, or plagiarism, the researcher reported his findings honestly. All sources were acknowledged.

The proposal for this study was submitted to the Department of Health Studies at the University of South Africa. The proposal was reviewed by the University's Ethical Review Board, which then granted ethical clearance.

Permission to conduct the study was also requested from the management of both the town administrative health bureau and hospitals in order to protect the rights of the study institution. A formal letter was written to the different administrative bodies and organisations to obtain permission to conduct the research in the study settings.

Local institutions, including the Oromia Region Health Bureau, Madda Walabu University, and hospital administrative bodies, were consequently contacted to obtain permission to conduct this research in the setting. The purpose of the study was explained to the respondents, and they were invited to consent to their participation in the study. The researcher was ensuring scientific integrity by acknowledging all the sources used appropriately. Results from this study will be disseminated by manuscripts to be submitted for publication in accredited journals.

The purpose of the study was explained to the respondents. An ethical clearance certificate from the university was presented to them to confirm approval to conduct the study. A written consent was then requested. Consent form and information leaflet attached.

There was no physical or psychological risk because of participation in this study. The respondents were informed of the results of their measurements.

The fieldworkers should be involved in data collection; indicate how you met the ethical considerations involved.

Data was collected by the researcher using an interviewer-administered schedule, and six trained research assistants, who are BSc nurses, health officers, and laboratory technicians, were assigned to collect the data. The data was collected by health workers. The researcher was supervising the data collection process to ensure

and guide proper data collection and minimise errors that could impact internal validity and confidentiality.

3.11 CONCLUSION

This chapter has provided the research design, methods of data collection and analysis, validity and reliability of the study, and ethical considerations of the study. The research findings and data analysis are presented in the next chapter.

CHAPTER 4 - DATA ANALYSIS AND PRESENTATION OF RESULTS

4.1 INTRODUCTION

This chapter presents the findings of the study which addressed the objectives of the research under each study Phase. The major findings of the study are presented in this chapter.

For both the cross-sectional (Phase I) and case-control research designs (Phase II), adults who were aged above or equal to 18 years were enrolled in the study. In Phase I, descriptive cross-sectional study data was gathered from population-based adults residing in two administrative towns in the Bale Zone, south-east Ethiopia. Phase II involved collecting data from type 2 diabetes mellitus (T2DM) patients with less than six months of diagnosis as cases and non-diabetic individuals as controls who visited the two hospitals in the Bale Zone, namely, Goba Referral Hospital and Bale Robe General Hospital.

Data was collected using administered interviews, physical measurements, and fasting blood glucose measurements, as was already indicated in the methodology section of Chapter 3 of the study.

The current study was undertaken to address the following objectives:

- To determine the prevalence of T2DM among adults in the Bale Zone, south-east Ethiopia (Phase I).
- To identify factors associated with T2DM among adults in the Bale Zone, south-east Ethiopia (Phase I).
- To describe adults' knowledge and perceptions of T2DM risky behaviour and prevention among in the Bale Zone, south-east Ethiopia (Phase I).
- To examine the determinants of T2DM among the adult population visiting selected public hospitals in the Bale Zone, south-east Ethiopia (Phase II).
- To develop strategies that contribute to the prevention of T2DM among the adult population of Bale Zone, south-east Ethiopia (Phase III).

The results section is divided into two sections: the first section is the Phase I results, and the second section is the Phase II results.

The descriptive cross-sectional survey results from Phase I are included in Section one of the results as follows:

- Socio-demographic characteristics of respondents.
- Distribution of behaviours, biological risk factors of T2DM, and physical measurements.
- Distribution of the knowledge, perception, and preventive risky behaviours of T2DM.
- Prevalence of T2DM.
- Factors associated with the prevalence of T2DM.

The case-control study results from Phase II are presented in Section two of the results to explore the determinants of T2DM as follows:

- Socio-demographic characteristics of respondents.
- Socio-demographic determinants of T2DM.
- Distribution of behavioural-related characteristics of respondents.
- Behavioural determinants of T2DM.
- Distribution of physical measurements of respondents.
- Physical measurement determinants of T2DM.
- Distribution of perceptions of body shape and size and in relation to T2DM risk factors.
- The occurrence of the Household Food Insecurity Access Scale and proportion of food insecurity in relation to T2DM.
- Distribution of mental stress-related factors in relation to T2DM.
- Perception and mental stress-related determinants of T2DM.
- Overall independent predictors of T2DM.

4.2 FINDING OF CROSS-SECTIONAL STUDY PHASE I

4.2.1 Socio-demographic characteristics of respondents

From the total of 557 adults who were residents in Goba town and Bale Robe town during the time of data collection, a total of respondents were carefully selected from the sample, from which 549 adults successfully completed the questionnaire voluntarily, yielding a response rate 98.6%. Five other adults did not agree to offer a blood sample, and three adult's data was incomplete, and removed from the analysis.

4.2.1.1 Age of respondents

As can be seen in Table 4.2.1 and Figure 4.1, the ages of the respondents' ranged from 18 to 80 years, with the mean (±SD) age was 36.58 ± 13.47 years. A higher proportion of the study respondents belonged to the 28–37 age group (37%, n = 203) while 23.7 % (n = 130) were in the age group 18–27, followed by 19.9 %(n = 109) in the age group 38 to 47 years.

4.2.1.2 Gender of respondents

As shown in Table 4.1, it indicated that out of 549 research participants, female respondents accounted for 57.6 % (n = 316), which is higher than male respondents (42.2 %, n = 233).

Table 4.1: Age and gender distribution of respondents (N=549)

Age group	Frequency	Percent
18-27	130	23.7
28-37	203	37.0
38-47	109	19.9
48-57	55	10.0
>=58	52	9.5
Gender		
Male	233	42.4
Female	316	57.6

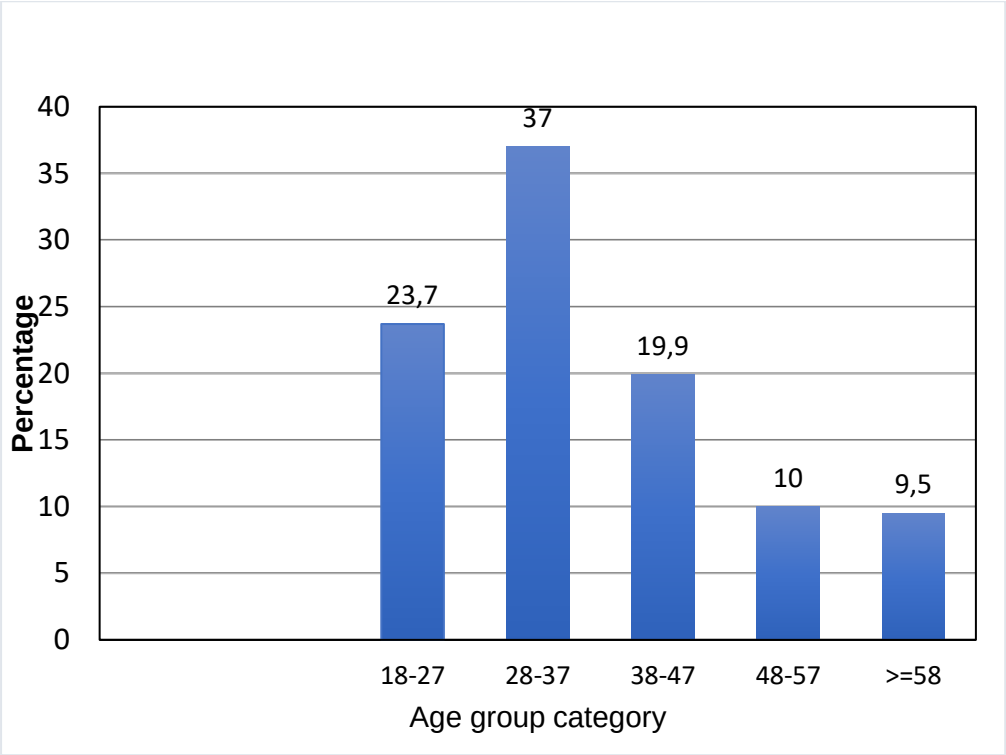

Figure 4.1: Age category of respondents (N=549)

4.2.1.3 Marital status of respondents

The marital status of adults was examined and is depicted in Figure 4.2). Nearly three-quarters (73.2%, n = 402) of them reported being married, while 23.3% (n = 128) of respondents were single, and Figure 4.2 below further reveals that only 1.8% (n = 10) and 1.6 % of respondents were divorced and windowed, respectively.

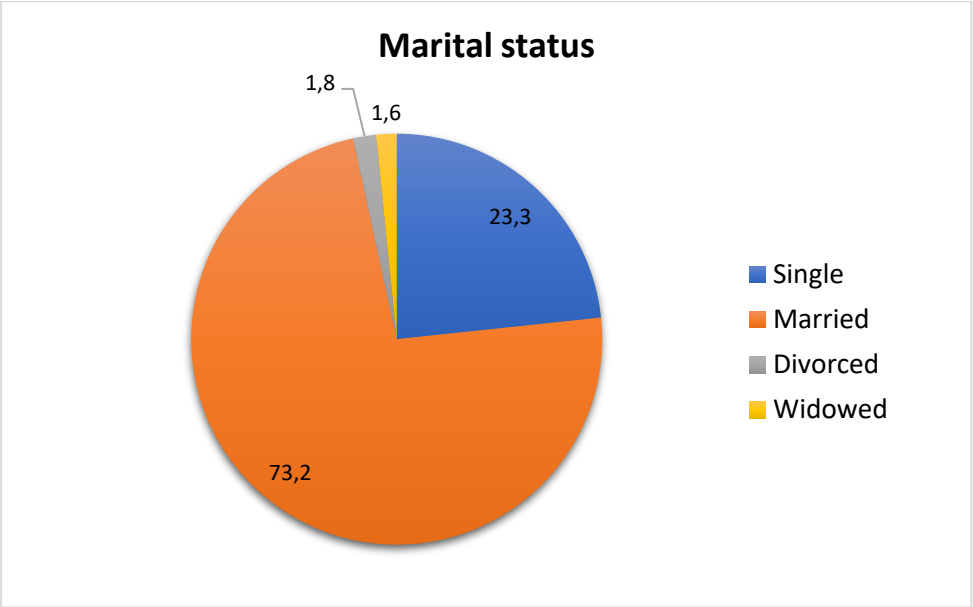

Figure 4.2: Marital status distribution of respondents (N=549)

4.2.1.4 Educational status of respondents

As can be seen from Figure 4.3 below, two hundred twelve (39%) of the study respondents educational level was secondary school, followed by 34.1% (n = 187), who were classified as having a diploma or higher in terms of their educational background.

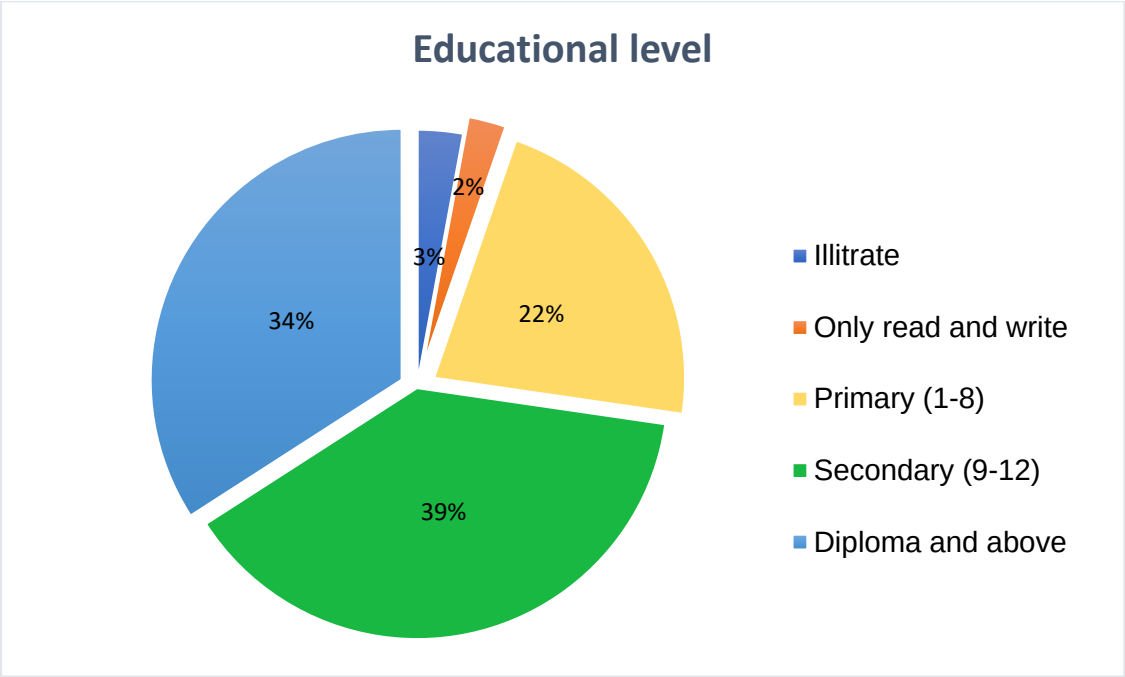

Figure 4.3: Educational status distribution of respondents (N=549)

4.2.1.5 Religious affiliation of respondents

In terms of religious affiliation, nearly two-thirds of respondents (65.25%) (n=358)) were Orthodox Christian, followed by Muslim 24.8% (n=136) and Protestant 9.8% (n=54). Only 0.2% (n=1) of respondents reported they practised another type of religion (See Figure 4.4). Figure 4.4 below shows the religious affiliation of study participants.

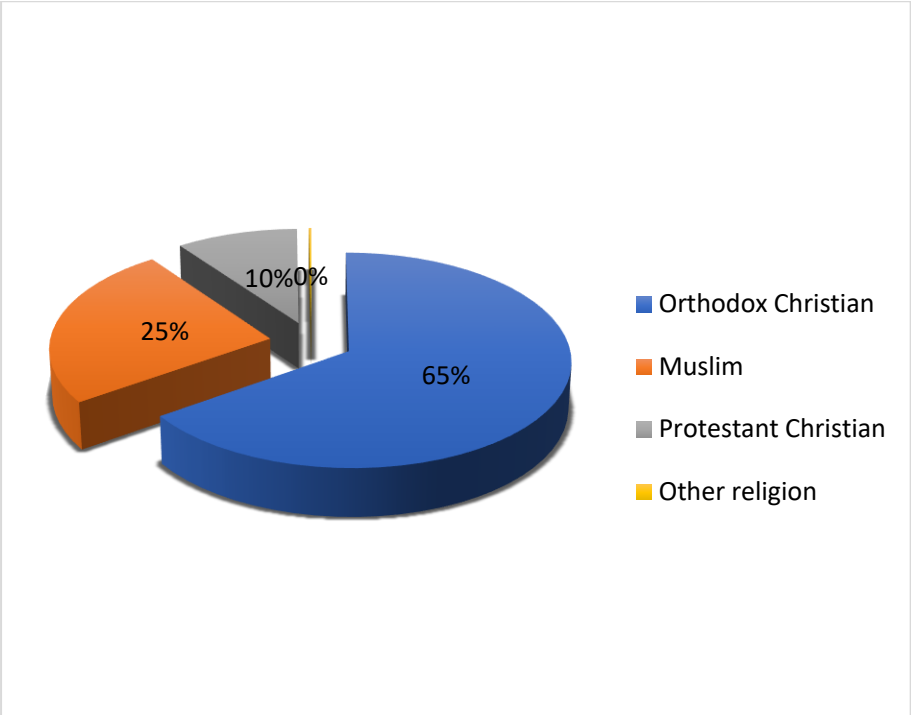

Figure 4.4: Religious distribution of respondents (N=549)

4.2.1.6 Ethnicity of respondents

Figure 4.5 below shows the ethnicity of respondents. Out of the total number of respondents, two-thirds (65.8%) identified as Oromo in terms of ethnicity, followed by Amhara (31.8%, n = 172). Only 0.5% (n=3) of respondents identified as belonging to the Tigre ethic group. Other ethnic groups represented are Wolayita, Gamo, and Gurage.

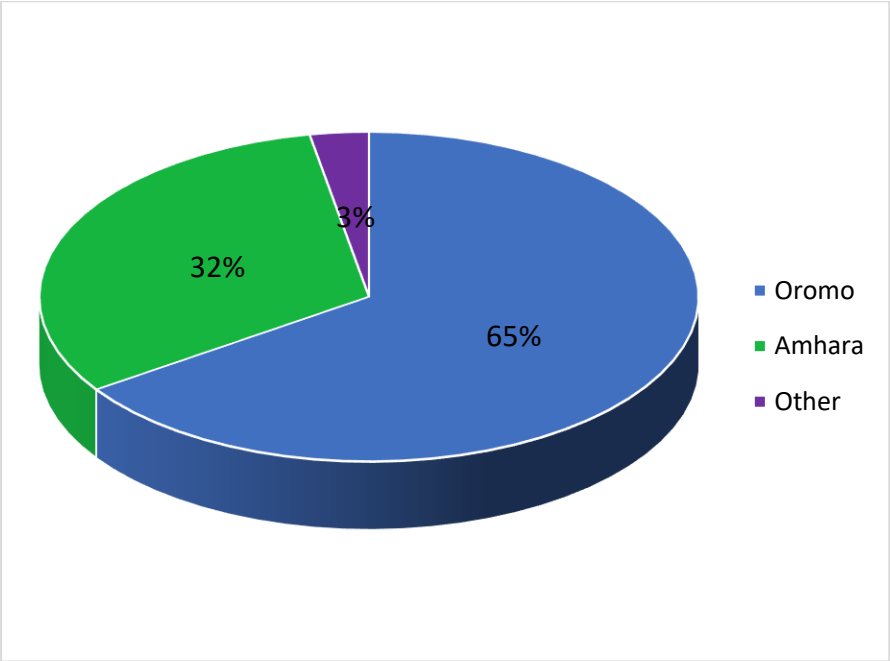

Figure 4.5: Ethnicity of respondents (N=549)

4.2.1.7 Family size and ownership of house

The median number of persons per household was four, with a mean family size of 4.10 and a standard deviation of 1.77. The number of persons in a house ranges from a minimum of one person to a maximum of nine. In terms of house ownership, 60.5% of respondents (n=332) own their own house, while 39.5% (n=217) reside in a rented house.

4.2.1.8 Average monthly household income and occupations

The study's total average monthly income ranges from 300 Ethiopian Birr (6.08 USD) at the lowest end to 16,000 Ethiopian Birr (32.41 USD) at the maximum, with 4,000 Ethiopian Birr as the median (81.03 USD). Twenty-eight percent (n=154) of respondents were housewives, followed by 24.4% (n=134) being employees. As indicated in Figure 4.6 of the box plot chart, because occupation had more than two categories, the one-way analysis of variance (ANOVA) was used to compare differences in the monthly incomes of the respondents. A one-way ANOVA revealed that the monthly income difference was statistically significant at a 0.05 p-value using ANOVA ($P<0.01$).

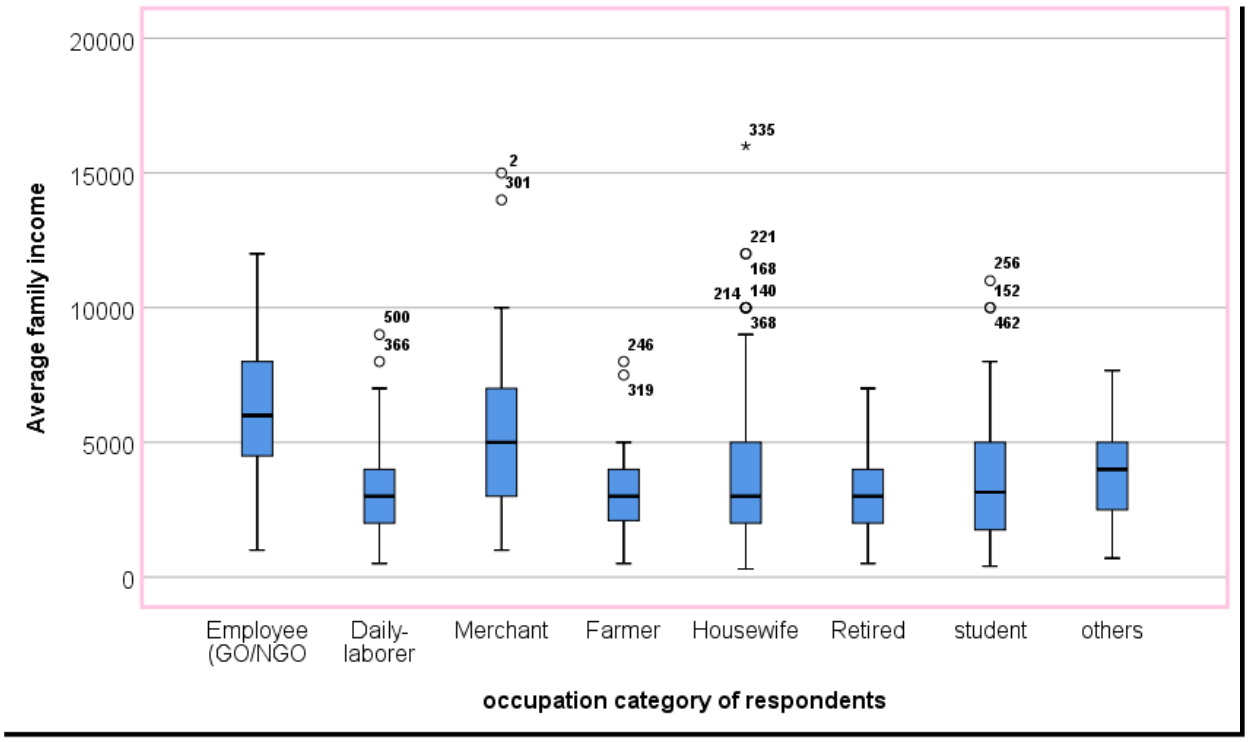

Figure 4.6: Box plots showing occupation relationship to average monthly income in Ethiopian Birr (N=549)

Table 4.2: ANOVA table showing the correlation between respondents' occupations and their average monthly incomes (N = 549)"

	Sum of Squares	Df	Mean Square	F	Sig.
Between Groups	834307840.8	7	119186834	20.05	<.000
Within Groups	3216842256	541	5946103.99		
Total	4051150097	548			

4.2.1.9 Occupation of the respondents

Regarding their occupational categories, 28%, 25%, 15%, and 10% were housewives, government employees, students and merchant, respectively. Figure 4.7 below shows occupational categories of respondents.

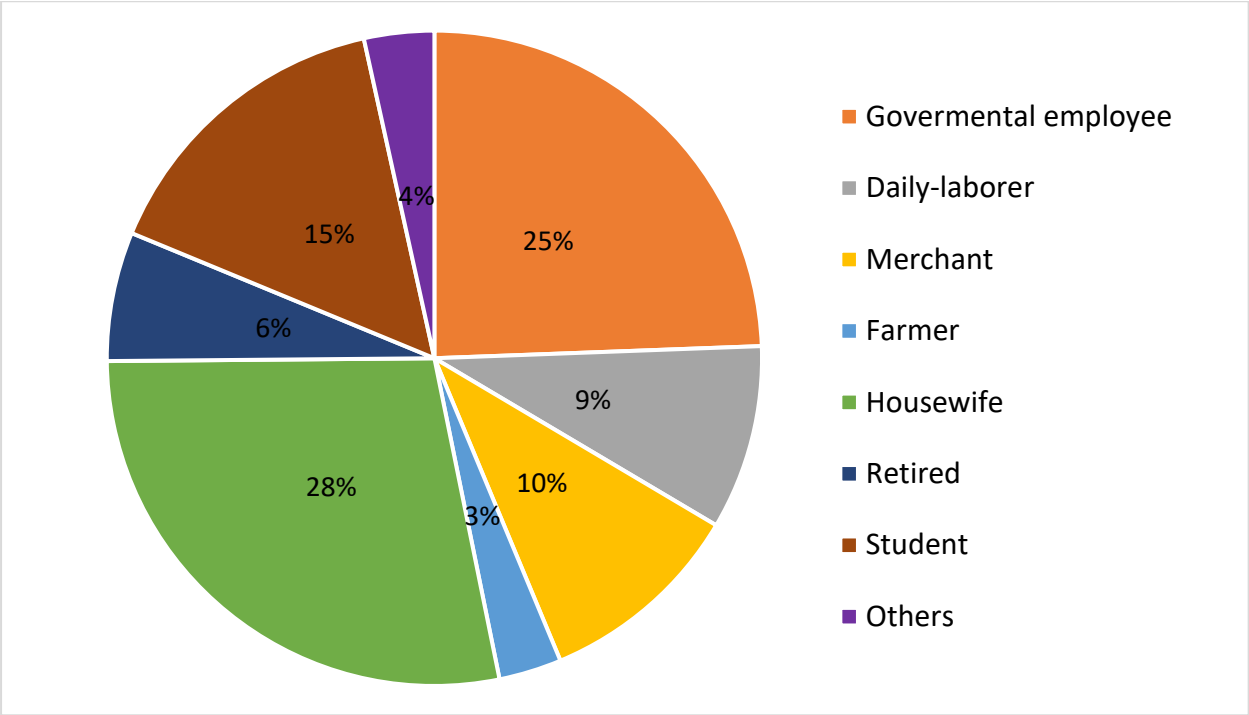

Figure 4.7: Occupation of respondents (N=549)

4.2.2 Respondents knowledge of Type 2 Diabetes mellitus risky behaviours and prevention

Table 4.3 describes the respondents' knowledge of T2DM risky behaviour and prevention. Twenty-one items, with one variable having multiple response options, were used to evaluate the knowledge of respondents on the definition, signs, and symptoms of T2DM, as well as risky behaviour and the prevention of T2DM. Each question was used to indicate the respondents' level of knowledge, and a single, comprehensive knowledge score on T2DM prevention was computed to give a description of the respondents' tool knowledge level and to be used for further analysis. (See Chapter 3 for details). The mean (± SD) knowledge score of the respondents was 14.78 ± SD.

Figure 4.8 describes that 42.6% of respondents had low knowledge regarding T2DM and risk factors for T2DM. About 38.3% of respondents had medium knowledge, and only 19.1% had high knowledge of T2DM and its risky behaviours.

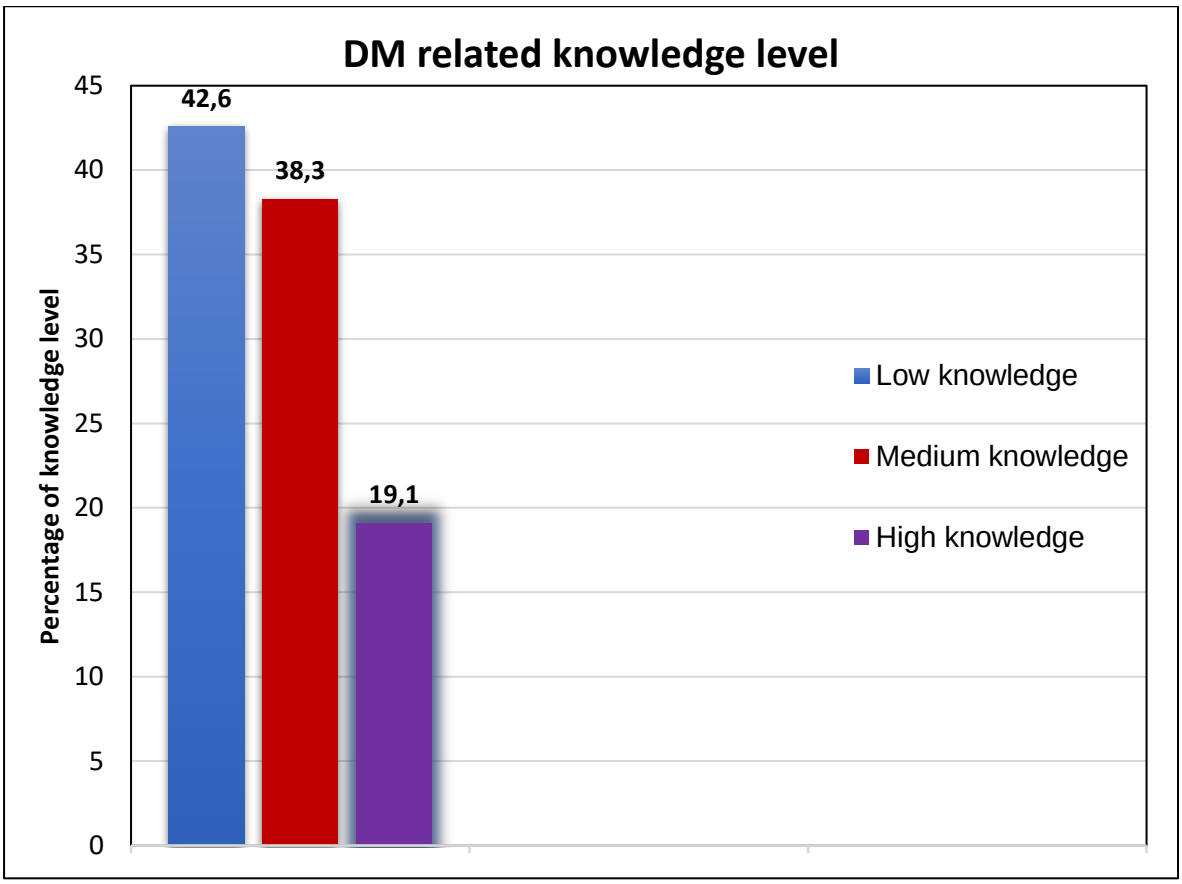

Figure 4.8: Diabetes related level of knowledge of respondents (N=549)

As presented in Table 4.3 below, approximately 88.9% (n = 488) of respondents heard about DM. Most of the respondents received information on DM from the media, family and friends, social functions, health facilities, and new papers. Figure 4.9 below depicts the source of information provided by respondents regarding T2DM and its risky behaviours. The most important sources were television or media (55.7%) and family and friends (54.3%), respectively, followed by social functions like Facebook and Telegram (38.3%), and health facilities (27.1%).

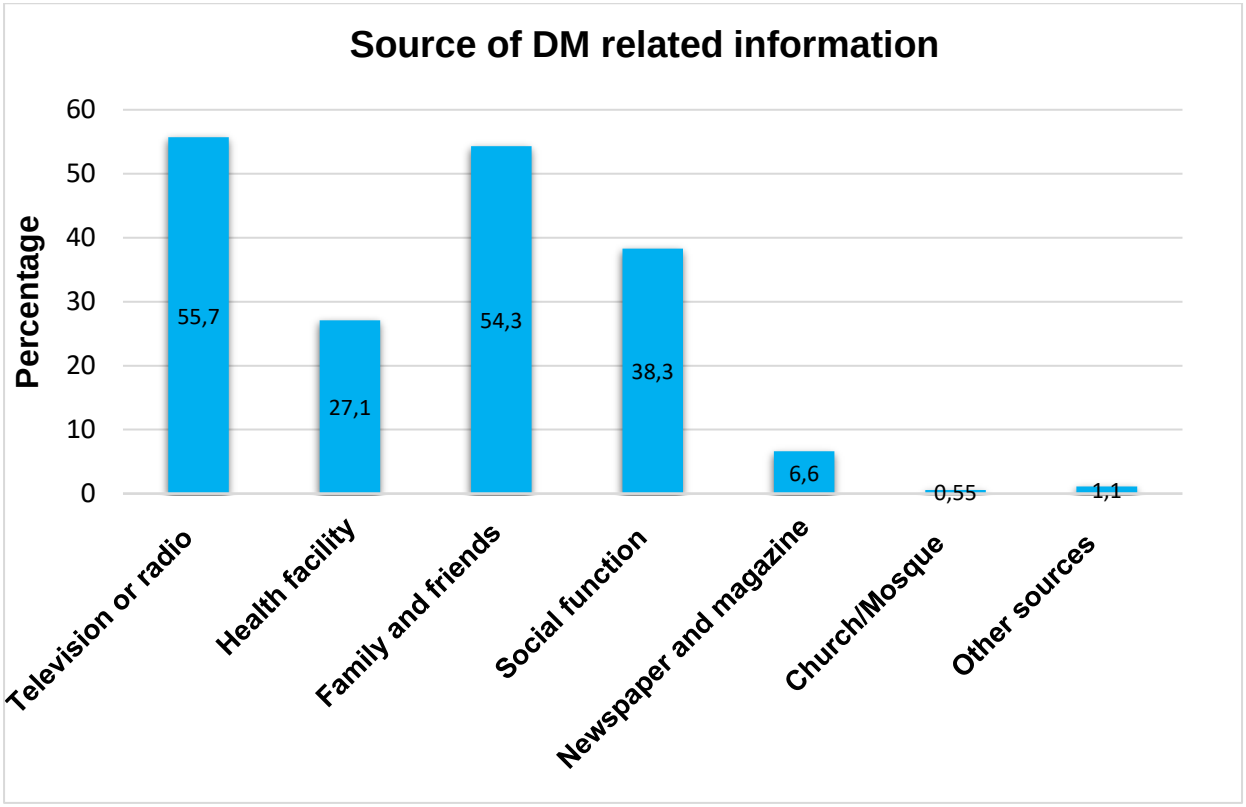

Figure 4.9: Source of DM related formation among respondents (N=549)

When asked to name a location for measuring blood glucose, the majority of respondents (79.6% (n = 437)) mentioned at least one location for measuring blood glucose. In contrast, only 3.7% (n = 17) of respondents knew the expected value of 70–110 mg/dl when asked about normal values of fasting blood glucose.

Approximately 59% (n = 324) of respondents correctly defined DM as the presence of a high blood sugar level in the body. But only one-third (33.3%) of respondents (n = 183) correctly defined DM as a condition of insufficient insulin production, and approximately 68.1% (n = 374) said that DM is incurable. More than two-thirds (67.8%, n = 372) of the respondents knew about the signs and symptoms of DM, whereas 36.7% (n = 200) of the respondents didn't know. Among respondents who knew the signs and symptoms, 67.8% (n = 372) of them said that excessive thirst and hunger are signs and symptoms of DM; similarly, 67.6% (n = 371) of the respondents said that excessive urination is one of the signs and symptoms of the disease, where 63.6% (n = 349) of them reported that unexplained weight loss is one of the signs and symptoms of DM.

With respect to the complication of DM, less than a fifth (19.7%; n = 108) of respondents knew about the complication. Only a small portion of the study respondents (34.2%, n = 188) correctly identified DM as the cause of kidney problems. Most respondents (64.5%; n = 354) wrongly answered DM as don't damage heart disease and 80.3% (n = 441) as cannot cause loss of sensation in feet. Furthermore, only 35.5% (n = 195) of respondents were aware that diabetes can harm the heart.

Less than half (46.3%) of the (n = 254) respondents agreed that even if I have DM, I can live a normal life. About 80.9% (n = 444) of the respondents didn't agree that DM can be transmitted from one person to another. Three hundred fifty-six (64.8%) of respondents agreed that T2DM is a preventable and controlled disease. While 54.8% of respondents (n = 301) agreed that T2DM is a hereditary disease, furthermore, nearly three-quarters of respondents (792.2%, n = 435) correctly identified diabetes as a chronic disease. The majority (84.7%, n = 465) of the respondents agreed that T2DM may cause sudden death.

In terms of risk factors for developing T2DM, slightly more than half of the respondents (52.3%) correctly identified cigarette smoking as a risk factor for T2DM; 56.8% (n = 312) identified physical inactivity as a risk factor for T2DM; 53.4% (n = 293) identified excessive alcohol consumption; 69.4% (n = 381) identified excessive sugar consumption; and 43.9% (n = 241) identified stressful life as a risk factor for T2DM. Table 4.3 below presented percentage distribution of respondents' knowledge of T2DM risky behaviour and prevention.

Table 4.3: Knowledge of T2DM risky behaviour and prevention among respondents (N=549)

Variables	Category	Frequency	Percent
Has ever heard DM	Correct	488	88.9
	Incorrect	61	11.1
Diabetes is a condition of insufficient insulin production	Correct	183	33.3
	Incorrect	363	66.7
Diabetes is when there is too much sugar in the blood	Correct	324	59.0
	Incorrect	225	41.0
The symptoms of diabetes are excessive thirst and hunger	Correct	372	67.8
	Incorrect	177	32.2
The symptoms of diabetes are excessive urination	Correct	371	67.6
	Incorrect	178	32.4
	Correct	349	63.6

The symptoms of diabetes are unexplained weight loss	Incorrect	200	36.4
T2DM is a preventable and controlled disease.	Correct	356	64.8
	Incorrect	193	35.2
Mentioned at least one place for measuring blood glucose	Correct	437	79.6
	Incorrect	112	20.4
Even if I have diabetes, I can live a normal life	Correct	254	46.3
	Incorrect	295	53.7
T2DM be transmitted from one person to another	Correct	444	80.9
	Incorrect	105	19.1
DM is a hereditary disease.	Correct	301	54.8
	Incorrect	248	45.2
T2DM is a chronic disease	Correct	435	79.2
	Incorrect	114	20.8
T2DM may cause sudden death	Correct	386	70.3
	Incorrect	163	29.7
DM is not curable	Correct	374	68.1
	Incorrect	175	31.9
Diabetes does not damage your heart	Correct	195	35.5
	Incorrect	354	64.5
Diabetes can cause kidney problem	Correct	188	34.2
	Incorrect	361	65.8
Diabetes can cause blindness	Correct	360	65.6
	Incorrect	189	34.4
Diabetes cannot cause loss of sensation in your feet	Correct	108	19.7
	Incorrect	441	80.3
T2DM affects only older people	Correct	404	73.6
	Incorrect	145	26.4
Know the normal blood glucose value	Correct	17	3.1
	Incorrect	532	96.9
Cigarette smoking is a risk behaviour for developing T2DM	Correct	287	52.3
	Incorrect	262	47.7
Physical inactivity is a risk behaviour for developing T2DM	Correct	312	56.8
	Incorrect	237	43.2
Excessive alcohol use is a risk behaviour for developing T2DM	Correct	293	53.4
	Incorrect	256	46.6
Frequent consumption of animal fat is a risk behaviour for developing T2DM	Correct	289	52.6
	Incorrect	260	47.4
Excess sugar consumption is a risk behaviour for developing T2DM	Correct	381	69.4
	Incorrect	168	30.6
Stressful life is a risk behaviour for developing T2DM	Correct	241	43.9
	Incorrect	308	56.1

4.2.3 Perceptions towards type 2 diabetes mellitus risky behaviour and prevention among adults in the Bale zone administrative town in terms of the health belief model

The respondents' perceptions of T2DM prevention were evaluated using the six constructs of the Health Belief Model (HBM). A total of 43 questions were administered, with 38 of them utilizing a rating scale of 1-5. The response options ranged from strongly disagree to strongly agree. The remaining five questions were specifically designed to measure the "use cues to action construct of the model" and had response choices ranging from "not at all" to "always." The findings of the HBM constructs are presented in two ways: as a single calculated variable representing each construct and as the frequency distribution of answers to individual questions. To compute the frequencies, the responses from the five-point scale (ranging from strongly disagree to strongly agree) were divided into three categories: agree, uncertain, and disagree. Additionally, a composite score was generated to create a single variable reflecting each construct. Cronbach's alpha coefficients were calculated to assess the reliability of the measurements, and constructs were considered reliable when their Cronbach's alpha was 0.7 or higher (Burns & Grove 2005: 374).

As shown in Table 4.4, the items used in this study to measure the HBM components have Cronbach's alpha values of 0.7 or above. Therefore, perceived susceptibility (nine items with a Cronbach's alpha of 0.729), perceived severity (eleven items with a Cronbach's alpha of 0.707), perceived benefit (six items with a Cronbach's alpha of 0.830), perceived barrier (seven items with a Cronbach's alpha of 0.718), perceived cues to action (five items with a Cronbach's alpha of 0.785), and perceived self-efficacy (five items with a Cronbach's alpha of 0.703) are reliable in this study. Among the items used to measure the components, Cronbach's alpha values of 0.745 and higher were found for all components. Please see the detailed description of each match with HBM constructs in Table 3.1 of Chapter 3.

Table 4.4: Internal consistency of the scales for HBM constructs and risk perceptions of T2DM

HBM Construct	Number of items,n	Cronbach's Alpha
Perceived susceptibility	9	0.729
Perceived severity	11	0.707
Perceived benefit	6	0.830
Perceived barrier	7	0.718
Cues to action	5	0.785
Self-efficacy	5	0.703

4.2.3.1 Perceived susceptibility

This study evaluated respondents' perceptions about behavioural risk factors for T2DM, their likelihood of getting T2DM, and the level of the problem in Ethiopia. Only 22% (n=121) of the total respondents (n=549) said they believed that everybody is at risk for T2DM, and nearly one-third (31%) said they are susceptible to the disease. In addition, 82% (n=450) of the respondents regarded diabetes as Ethiopia's main health problem.

Regarding the susceptibility of people to contract T2DM, 76.3% (n=419) of the total respondents agreed that smokers are more likely to develop T2DM. In addition, 77.4% (n=425) of respondents agreed that physically inactive people are more likely to develop the disease. Likewise, 81.8% (n=449) of respondents agreed that people who are obese or overweight are more likely to do so. Seventy-eight percent (n=429) of respondents agreed that heavy drinkers are more likely to develop T2DM. Furthermore, 76% (n=417) of respondents agreed that people who consume animal fat frequently and 81.4% (n=447) of respondents agreed that people who consume excess sugar are more likely to develop T2DM.

4.2.3.2 Perceived severity of Type 2 Diabetes mellitus

Regarding the perceived severity of T2DM, this study found that 86.5% of respondents (n=475), 90.7% of respondents (n=498), 92.2% of respondents (n=506), and 82% of respondents (n=450) all agreed that T2DM is a chronic disease that can

cause sudden death, have dangerous side effects, and be a serious disease if it is not prevented.

With respect to modifiable and non-modifiable risky behaviours, 80.9% (n=444) of respondents agreed that T2DM is a more severe disease in older persons among non-modifiable risk factors. On the other hand, according to the category of modifiable risk factors, 81.1% (n=445) of respondents believed that T2DM is a more severe disease among obese and overweight adults. Seventy percent (n=373) of respondents acknowledged that T2DM is a more serious condition among cigarette users. Furthermore, 73% of respondents (n=401) believed that T2DM was a more severe disease among heavy drinkers. Furthermore, a sizable proportion of respondents, 93.1%, agreed that T2DM is a more severe condition that affects people who have a more severe disease, among them individuals who consume high amounts of sugar. Additionally, 78.7% (n=432) of respondents agreed that T2DM is a more severe disease in people who consume a high animal fat diet, and 79.2% (n=435) of respondents thought that T2DM is a more severe disease in people with stressful life.

4.2.3.3 Perceived benefit of applying Type 2 Diabetes mellitus prevention activities

The majority of respondents (84.5%, n=464) agreed that regular physical activity can help prevent T2DM. Reducing dietary sugar consumption and engaging in weight-reduction exercises to maintain a healthy body weight were deemed crucial by 87.1% (n=478) and 86.9% (n=477) of respondents, respectively, to preventing the development of T2DM. In addition, 80% (n=439) and 72.9% (n=400) agreed that reducing alcohol use and quitting smoking can help prevent the development of T2DM. Additionally, the majority of respondents (84.7%, n=465) agreed that eating a diet rich in fruits, vegetables, and low-fat dairy products can help prevent T2DM.

4.2.3.4 Perceived barriers to Type 2 Diabetes mellitus prevention activities

The prevention of T2DM may be hindered by several obstacles. In the current study, 61.4% of respondents (n=337) agreed that they lacked knowledge about T2DM preventive activities, and 46.8% (n=257) said that other diseases should take priority over T2DM prevention activities. 17.5% (n=96) agreed that one of the challenges to taking part in T2DM preventive activities is the difficulty in finding a health institution where one can get tested for blood glucose. A majority of respondents, nearly two-thirds (65.0%) (n=357), agreed that they are not encouraged by family or friends to engage in T2DM preventive activities, and 55.4% (n=304) said they feel these activities need time, money, and space.

In this study, the study participants mentioned perceived barriers to T2DM preventive behaviours. Table 4 shows that 314 (57.2%) do not experience any barriers to implementing T2DM prevention activities.

4.2.3.5 Cues to action

With regard to the question of what prompts them to apply T2DM prevention activities, only 11.1% (n=61) to 23.7% (n=130) of respondents responded that they always apply T2DM prevention action after they have received adequate information about T2DM from mass media, heard from a health extension worker, and advice from friends and family. According to this study , less than half 238 (43.4%) of respondents had cues to act on T2DM prevention.

According to this study, above half (n = 311, 56.6%) of respondents had low cues to act on T2DM prevention behaviours.

4.2.3.6 Self- efficacy

The respondents' self-efficacy (confidence) was assessed by the level of their agreement on how confident they are to manage and perform T2DM prevention activities easily.

Slightly more than one-third, 35.7% (n=196), of the respondents agreed that they were confident enough in performing T2DM prevention activities. Nearly two-thirds [63.6% (n= 349)] of the respondents agreed that they actively participated in a healthy lifestyle

to prevent T2DM. Around 39.7% (n=218) and one-third (33.9%) of them agreed that they attended health assessments and had information on how to prevent T2DM, respectively.

In addition, more than two-thirds (69.9%) of respondents agreed that they could practise so many activities to reduce their chances of getting a T2DM related illness. Table 4.5 below presents the percentage distribution attitudes of respondents on T2DM risky behaviour and prevention in terms of HBM.

Table 4.5: Perceptions towards type 2 diabetes mellitus risky behaviour and prevention among adults in the Bale Zone administrative town in terms of the health belief model (N=549*)*

Variables	Category	Agree N (%)	Uncertain N (%)	Disagree N (%)
Perceived Susceptibility	I feel I will get diabetes sometime during my life	170(31.0%)	262(47.7%)	117(21.3%)
	Everybody is at risk of diabetes	121 (22.0%)	170 (31.0%)	258 (47.0%)
	Cigarette smokers are more prone to contract T2DM	419 (76.3%)	63 (11.5%)	67 (12.2%)
	Physically inactive peoples are more prone to contract T2DM	425 (77.4%)	72 (13.1%)	52 (9.5%)
	People being obese/overweight are more prone to contract T2DM	449 (81.8%)	66 (12.0%)	34 (6.2%)
	Excessive alcohol consumers are more prone to contract T2DM	429 (78.1%)	93 (16.9%)	27 (4.9%)
	People consuming animal fat frequently are more prone to contract T2DM	417 (76%)	105 (19.1%)	27 (4.9%)
	People using excess sugar are more prone to contract type 2 DM	447 (81.4%)	55 (10%)	47 (8.6%)
	Diabetes is health problem of Ethiopia	450 (82%)	52 (9.5%)	47 (8.6%)
Perceived Susceptibility (mean=14.41)			High susceptible	Low susceptible

			312 (56.8%)	237 (43.2%)
Perceived severity	T2DM can be a serious disease if you don't prevent it	474 (86.3%)	23 (4.2%)	52 (9.5%)
	T2DM can cause sudden death	498 (90.7%)	12 (2.2)	39 (7.1%)
	Complications of DM are dangerous in life	506 (92.2%)	34 (6.2%)	9 (1.6%)
	I believe that DM is chronic disease	475 (86.5%)	74 (13.5%)	
	T2DM is a more severe disease in old adults	444 (80.9%)	76 (13.8%)	29 (5.3%)
	T2DM is a more severe disease in obese /overweight peoples	445 (81.1%)	88 (16.0%)	16 (2.9%)
	T2DM is a more severe disease among cigarette smokers	373 (67.9%)	132 (24%)	44 (8%)
	T2DM is a more severe disease among high alcohol consumers	401 (73%)	99 (18%)	49 (8.9%)
	T2DM is a more severe disease among peoples consuming high sugar	491 (93.1%)	40 (7.3%)	18 (3.3%)
	T2DM is a more severe disease among peoples consuming high animal fat food	432 (78.7%)	99 (18%)	18 (3.3%)
	T2DM is a more severe disease among peoples with stressful life	435 (79.2%)	114 (20.8%)	
Perceived severity (mean=20.29)			High perceived severity	Low perceived severity
			335 (61.0%)	214 (39.0%)
Perceived benefits	Regularly physical exercise will help to prevent T2DM	464 (84.5%)	70 (12.8%)	15 (2.7%)
	Reducing dietary sugar intake prevents development of T2DM	478 (87.1%)	52 (9.5%)	19 (3.5%)
	Weight reduction activities to maintain normal body weight helps to prevent developing T2DM	477 (86.9%)	48 (8.7%)	24 (4.4%)

	Quitting cigarette smoking helps to prevent developing T2DM	400 (72.9%)	118 (21.5%)	31 (5.6%)
	Limiting alcohol consumption helps to prevent developing T2DM	439 (80%)	66 (12%)	44 (8%)
	Consuming a diet that is rich in fruits and vegetables and in low fat helps to prevent developing T2DM	465 (84.7%)	60 (10.9%)	24 (4.4%)
Perceived benefit (mean=11.11)			High benefit	Low benefit
			355 (64.7%)	194 (35.3%)
Perceived barriers	There are several priority diseases other than DM	257 (46.8%)	52 (9.5%)	240 (43.7%)
	I have no adequate knowledge to protect myself against T2DM	337 (61.4%)	36 (6.6%)	176 (32.1%)
	Health facilities are not accessible to get tested for blood Glucose	96 (17.5%)	193 (35.2%)	260 (47.4%)
	I don't like to think about any disease while I am healthy	193 (35.2%)	46 (8.4%)	310 (56.5%)
	I don't think it is worth thinking about T2DM prevention activities	147 (26.8%)	17 (3.1%)	385 (70.1%)
	I am not encouraged by family and/or friends to perform T2DM prevention activities	357 (65.0%)	15 (2.7%)	177 (32.2%)
	Performing T2DM prevention activities needs me to have enough time & space	304 (55.4%)	19 (3.5%)	225 (41.0%)
Perceived barriers (mean=6.84)			High barriers	Low barriers
			235 (42.8%)	314 (57.2%)
Cues to action			Always/sometimes (1)	Not at all/Rarely (0)
	After I get adequate information on media, I try to apply T2DM prevention.		130 (23.7%)	419 (76.3%

	Fear of T2DM being a chronic disease motivates me to involve in T2DM prevention		104 (18.9%)	445 (81.1%)
	Health care workers counsel me on T2DM prevention		110 (20.0%)	439 (80.0%)
	Friends' and family's advice provokes me to be involved in activities for T2DM prevention		108 (19.7%)	441 (80.3%)
	Individuals near to me who have diabetes encourage me to become involved in diabetes prevention		61 (11.1%)	488 (88.9%)
Cues to action (mean=0.93)			High cues to action	Low cues to action
			238 (43.4%)	311 (56.6%)
Self-efficacy		Agree	Uncertain	Disagree
	I am confident that I can manage performing T2DM prevention activities	196 (35.7%)	111 (20.2%)	242 (44.1%)
	I am able to actively work on a healthy lifestyle to prevent T2DM	349 (63.6%)	89 (16.2%)	111 (20.2%)
	I attend health assessments to prevent T2DM	218 (39.7%)	70 (12.8%)	261 (47.5%)
	I have information on how to prevent T2DM	186 (33.9%)	95 (17.3%)	268 (48.8%)
	There is a lot I can do to reduce my chances of getting an T2DM related illness	384 (69.9%)	105(19.1%)	60(10.9%)
Self-efficacy(mean=5.71)			high Self-efficacy	Low self – efficacy
			283(51.5%)	266 (48.5%

Constructs of the HBM about T2DM prevention behaviours

Moreover, based on these questions, mean scores of perceived susceptibility, perceived severity, perceived benefit, perceived barriers, and cues to action were calculated to classify the respondents into two groups: above the mean and below the mean, as shown in Table 4.6

Three hundred and twelve (56.8%) of the respondents had high perceived susceptibility to T2DM, while the rest, 237 (43.2%), had low perceived susceptibility to T2DM, with a mean score ± SD of 14.41± 2.97. Regarding the second component of HBM, the perceived severity of the disease, of the respondents, 335 (61.0%) had high perceived severity of T2DM, while the rest, 214 (39.0%), had low perceived severity, and the mean score for perceived severity was 20.29 with a standard deviation of ±1.78. In the perceived benefit component of the health belief model, nearly two-thirds of the respondents had high perceptions about the benefit of T2DM prevention behaviours, while 194 (35.3%) of the respondents had a low perceived benefit with a mean ± SD score of 11.11±1.88. Three hundred-fourteen (57.2%) of the respondents had a low perceived barrier, while 235 (42.8%) of the respondents had a high perceived barrier to prevent T2DM with a mean ± SD score of 6.86±3.58. Three hunderes and eleven (56.6%) were exposed to low-triggering factors for T2DM prevention activities. Of those who participated in T2DM prevention behaviours, about 283 (51.5%) had high self-efficacy, whereas the remaining respondents had low self-efficacy. More detail is displayed in Tables 4.5 and 4.6.

Table 4.6: Mean score of HBM constructs for prevention of risky behaviour against T2DM among adults in two administrative towns of the Bale Zone (N = 549)

HBM constructs	Number of items	Mean ±¬SD	Range of scores
Perceived susceptibility	9	14.41± 2.97	4-18
Perceived severity	11	20.29±1.78	14-22
Perceived benefits	6	11.11±1.88	1-12
Perceived barriers	7	6.86±3.58	0-14
Cues to action	5	5.57±2.81	0-10
Self-efficacy	5	0.93±1.22	0-4

4.2.3.7 Likelihood of participating in Type 2 Diabetes mellitus preventive behaviour

The likelihood of taking part in T2DM preventive behaviour was determined by subtracting the weighted mean scores of the benefits from the weighted mean scores of the barriers among adults in the Bale zone. Figure 4.10 below shows a summary

of the respondents' perceptions of the mean scores regarding the likelihood to take part in T2DM prevention. As a result, 56.8% of respondents in this study participated in T2DM prevention practices.

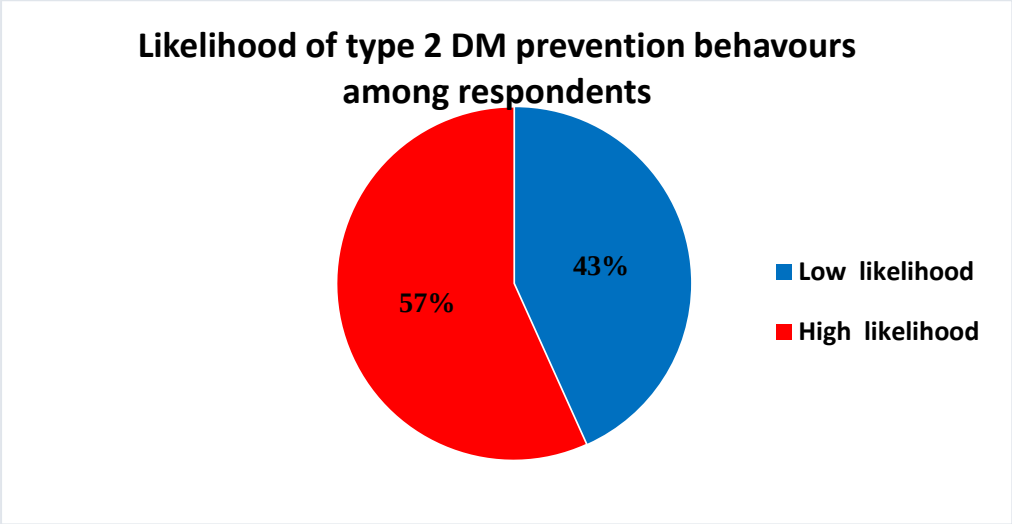

Figure 4.10: Likelihood of T2DM prevention behaviour among adults in Bale Zone (N=549)

4.2.4 Behavioural measurements

4.2.4.1 Cigarette smoking, alcohol consumption and Khat chewing

Table 4.7 below describes the behavioural measurements of respondents, such as cigarette smoking, alcohol consumption, and chat chewing. Accordingly, only 36 (6.6%) of the respondents reported having ever smoked cigarettes in their lifetime. Current cigarette smokers comprised 2.7% (n = 15). Likewise, 80% (n = 12) of the current smokers were reported as daily smokers. With regard to alcoholic drink consumption, more than one-third (36.4%) of study respondents said that they had consumed alcohol in their lifetime.

About 28.2% (n=155) of the respondents stated they were current alcohol drinkers. Out of the total respondents who currently drink, 58.7% (n=91) reported that they drink 1-2 days per week, followed by 31% (n=48) of them who said they do so 3–4 days per week. In response to a question on chewing Khat, 9.1% (n=50) of respondents responded they had chewed Khat at some point in their lifetime, and 6.0% (n=33) of

respondents said they currently chew Khat. Of these total current Khat chewers, 24.2% (n=8) of respondents chewed daily, and 57.3% (n=19) reported they chewed Khat 3–4 days a week and 1-2 days per week.

4.2.4.2 Dietary habit of respondents

Five hundred and five (92%) respondents consumed fruits at least once per week, and the mean number of days they ate fruits per week was 3.50 (± 0.69) days, and nearly two-thirds (n=292) of them ate fruit 1-2 days per week. Similarly, most (92.2%) (n=528) of the respondents reported that they ate vegetables at least once per week, with a mean of 1.04 (± 0.19) per week, and most of them (44.1%) (n=233) ate fruit 3–4 days per week.

Furthermore, nearly half of them (51.9%) (n=285) reported that they eat animal fat, and of these totals of consuming animal fat, 85.3% (n=243) reported doing so 3–4 days per week. Regarding salt consumption, only a small portion of respondents (10.9%; n=60) acknowledged that they ever added salt to their plates after food preparation. Moreover, a significant number of them (93.6%) (n=514) reported that they drink coffee. Of these, most respondents (84.8%; n=436) drink coffee on a daily basis, and 41.2% (n=216) of the total coffee drinkers drink 3–4 cups a day, followed by 41.0% (n=108) who drink 1-2 cups a day. Table 4.7 depicts the behavioral measurements of respondents.

Table 4.7: Behavioural related characteristics of respondents (N=549)

Variables	Category	Frequency	Percent (%)
Have ever smoked cigarettes	Yes	36	6.6
	No	513	93.4
Current smoking status	Yes	15	2.7
	No	534	97.3
Cigarette smoking frequency in a week (n=15)	Daily	12	80
	5-6 days per week	-	-
	3-4 days per week	2	13.3
	1-2 days per week	1	6.7
Ever consumed an alcoholic drink	Yes	200	36.4
	No	349	63.6
Drink alcohol drink currently	Yes	155	28.2

	No	394	71.8
Alcohol consumption frequency in a week (n= 155)	Daily	9	5.8
	5-6 days per week	7	5.8
	3-4 days per week	48	31
	1-2 days per week	91	58.7
Have ever chewed Khat	Yes	50	9.1
	No	499	90.9
Currently chewing Khat	Yes	33	6
	No	516	94
Khat chewing frequency in a week (n=33)	Daily	8	24.2
	5-6 days per week	6	18.2
	3-4 days per week	9	27.3
	1-2 days per week	10	30.3
Eat fruit	Yes	505	92
	No	44	8
Fruit eating habit in a week (n=505)	Daily	15	3
	5-6 days per week	11	2.2
	3-4 days per week	187	37
	1-2 days per week	292	57.8
Eat vegetables	Yes	528	96.2
	No	21	3.8
Vegetables eating habit in a week (n=528)	Daily	31	5.9
	5-6 days per week	80	15.2
	3-4 days per week	233	44.1
	1-2 days per week	184	34.8
Eat animal fat	Yes	285	51.9
	No	264	48.1
Animal fat eating habit in a week (n=285)	Daily	5	1.8
	5-6 days per week	37	13
	3-4 days per week	243	85.3
	1-2 days per week	5	1.8
Use of added salt	Yes	60	10.9
	No	489	89.1
Drink coffee	Yes	514	93.6
	No	35	6.4
Coffee drinking in a week (n=514)	Daily	436	84.8
	5-6 days per week	21	4.1
	3-4 days per week	44	8.6
	1-2 days per week	13	2.5
Number of cups of coffee	1-2 cup a day	208	41
	3-4 cups a day	216	41.2
	Five and more cups a day	90	17.8

4.2.4.3 Physical activity

Two hundred and thirty-seven (43.2%) of the respondents reported that they participated in vigorous-intensity physical activity; of the total involved in vigorous-intensity physical activity, 42.2% (n=100) of them reported doing so on a daily basis. Nearly all 527 respondents (96.0%) reported they walk continuously for at least ten minutes to travel from place to place. As presented in Table 4.8 below, one fifth of respondents (n=112) reported that they performed vigorous-intensity sports activity in a week.

4.2.5 History of raised Blood glucose and co-morbidities

Table 4 .8 below further reveals that nearly one-sixth (n = 89) of respondents reported that they have ever had their blood sugar levels measured, and only a very few (0.5%) (n = 3) reported that they have been told they have DM, and all of them are being treated for DM with medication and/or advice. Moreover, about 6.2% (n = 34) of the study respondents had a family history of high blood glucose, or DM. The proportion of respondents who had ever been told they had hypertension was about 11.1% (n = 61).

Table 4.8: Physical activity, history of raised blood glucose and co morbidity (N=549)

Variables	Category	Frequency	Percent
Work involves vigorous-intensity activity	Yes	237	43.2
	No	312	56.8
Days in a week with work involving vigorous-intensity activity (n=237)	Daily	100	42.2
	5-6 days per week	16	6.8
	3-4 days per week	78	32.9
	1-2 days per week	43	18.1
Walking at least 10 continual minutes	Yes	527	96
	No	22	4
Number of days for walking at least 10 continual minutes in a week (n= 527)	Daily	431	81.8
	5-6 days per week	46	8.7
	3-4 days per week	38	7.2

	1-2 days per week	12	2.3
Mode of transport	On foot	526	95.8
	Bicycle	12	2.2
	Engine using vehicle	11	2
Vigorous-intensity sports activity	Yes	111	20.2
	No	438	79.8
Days in a week with work vigorous-intensity sports activity (n=111)	Daily	12	10.8
	5-6 days per week	11	9.9
	3-4 days per week	51	45.9
	1-2 days per week	37	33.3
Ever measured blood glucose	Yes	89	16.2
	No	460	83.8
Ever been told by a doctor they have DM	Yes	3	0.5
	No	546	99.5
Currently on DM medication or receiving advice	Yes	3	0.5
	No	546	99.5
Family history of high blood glucose	Yes	34	6.2
	No	515	93.8
Ever told have hypertension	Yes	61	11.1
	No	488	88.9

4.2.6 Physical measurements

As presented in Tables 4.9 and 4.10 below, respectively, the mean BMI for respondents was 22.75 (SD±3.35 kg/m2), with a minimum of 14.69 and a maximum of 36.16. About 71.4% (n = 392) of respondents had a normal BMI, followed by 16.0% (n = 88) adults who were overweight, and 4.4% (n = 24) were obese. The average hip-waist ratio was 0.90 (SD±0.064 $m^{2)}$ with a minimum of 0.72 and a maximum of 1.25, with 0.91 (SD±0.068 $m^{2)}$ for males and 0.89 (SD±0.061 m2) for females, respectively. The majority of females (80.70%) and 54.94% of males had abdominal obesity. With regard to blood pressure, three consecutive blood pressure measurements were taken from 549 respondents, and an average of the second and third measurements was used for blood pressure analysis. The mean systolic pressure of respondents was 127.65 (SD± 13.53 mmHg), minimum 93, and maximum 181.67 mmHg, and the mean diastolic blood pressure was 83.24 (SD± 8.77),

minimum 59, and maximum 113.67 mmHg. In the biochemical measurements of the respondents, the average FBS was 93.68 (SD± 19.45 mg/dl), the minimum was 62, and the maximum was 318.

Table 4.9: Characteristics of respondents' blood pressure and anthropometric measurement related variables of DM by gender (N=549)

Characteristics	Total number	Mean &SD	P value
BMI (kg/m2)	549	22.75(±3.35)	0.000
WC for male (cm)	233	82.34(±9.57)	0.000
WC for female (cm)	316	84.13(±9.83)	0.023
WC for both genders (cm)	549	83.37(±9.75)	0.000
Waist–hip ratio [Male]	233	0.91 (±0.068)	0.003
Waist–hip ratio(cm) [Female]	316	0.89(±0.061)	0.430
Waist–hip ratio for both genders	549	0.90(±0.064)	0.008
WHtR (cm)	549	0.51 (± .064)	0.001
SBP (mm Hg)	549	127.65(±13.53)	0.000
DBP (mm Hg)	549	83.24 (± 8.77)	0.000
FBG (mg/dl)	549	93.68 (± 19.45)	

BMI: Body Mass Index; WC: waist circumference; Waist-Height ratio: WHtR; SBP: systolic blood pressure; DBP: diastolic blood pressure; FG: fasting glucose.

Table 4.10: Distribution of Blood pressure and anthropometric measurement related variables of DM (N=549)

Variables	Category	Frequency	Percent
Isolated diastolic blood pressure (DBP)	<90 mm Hg	440	80.1
	>=90 mm Hg	109	19.9
Isolated Systolic blood pressure (SBP)	<140 mm Hg	456	83.1
	>=140 mm Hg	93	16.9
High blood pressure	Yes	144	26.2
	No	405	73.8
BMI (kg/m2)	Under weight (<18.5)	45	8.2
	Normal weight (18.5 to 24.9)	392	71.4
	Overweight (25 to 29.9)	88	16.0
	Obese (30 or more)	24	4.4
Waist circumference [Male], (n=233)	< 94 cm (Normal)	203	87.12

	≥ 94 cm(High)	30	12.88
Waist circumference [Female], (n=316)	< 80 cm ((Normal)	93	29.43
	≥ 80 cm((high)	223	70.57
Waist circumference for both genders	Normal	296	53.9
	High	253	46.1
Waist–hip ratio [Male], (n=233)	< 0.90 cm	105	45.06
	≥ 0.90 cm	128	54.94
Waist–hip ratio [Female], (n=316)	< 0.8 5cm	61	19.30
	≥ 0.85 cm	255	80.70
Waist–hip ratio for both genders	Low	166	30.2
	High	383	69.8
Waist-Height ratio (WHtR)	≤ 0.5 cm	233	42.4
	> 0.5 cm	316	57.6

DBP, diastolic blood pressure; DM, diabetes mellitus; FBG, fasting blood glucose; SBP, systolic blood pressure.

The distribution of diastolic, systolic, and both systolic and diastolic blood pressures is indicated in Figure 4. 11 below. The proportion of diastolic blood pressure >=90 mmHg was 19.9%, the proportion of systolic blood pressure >=140 mmHg was 16.9%, and the proportion of overall hypertension (both diastolic and systolic blood pressure) was 26.2%.

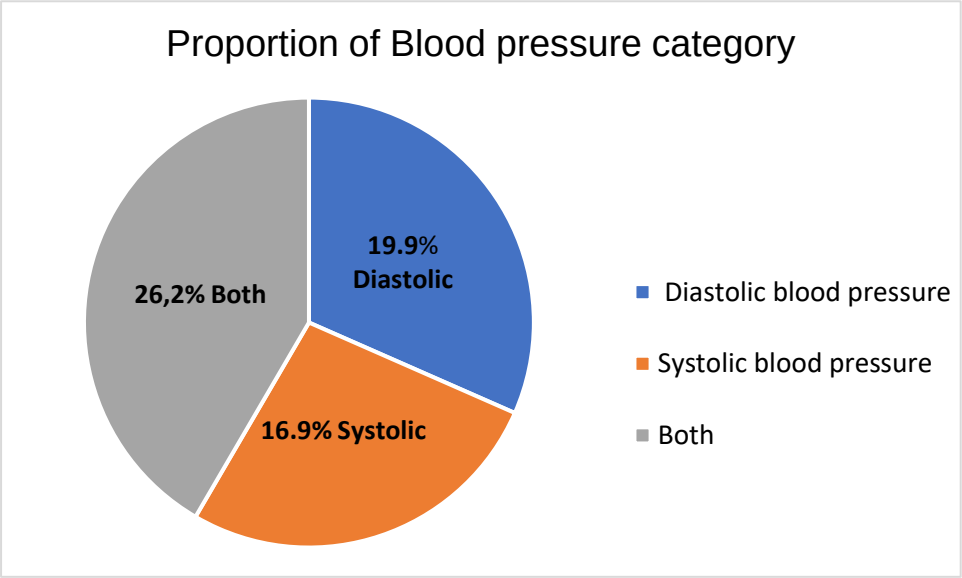

Figure 4.11: Distribution of high blood pressure (N=549)

4.2.7 Prevalence of Type 2 Diabetes mellitus

Figure 4.12 depicts the fasting blood glucose level of 549 study participants. Hyperglycemia (DM) is when the fasting blood sugar (FBS) level is ≥ 126 mg/dl. The prevalence of hyperglycemia (DM) by biochemical measurement (fasting capillary blood sugar) was 6.7%. Figure 4.12 below further shows that 16.21% (n = 89) of study participants had pre-diabetes (impaired blood sugar). The remaining 77% had a normal FBS level.

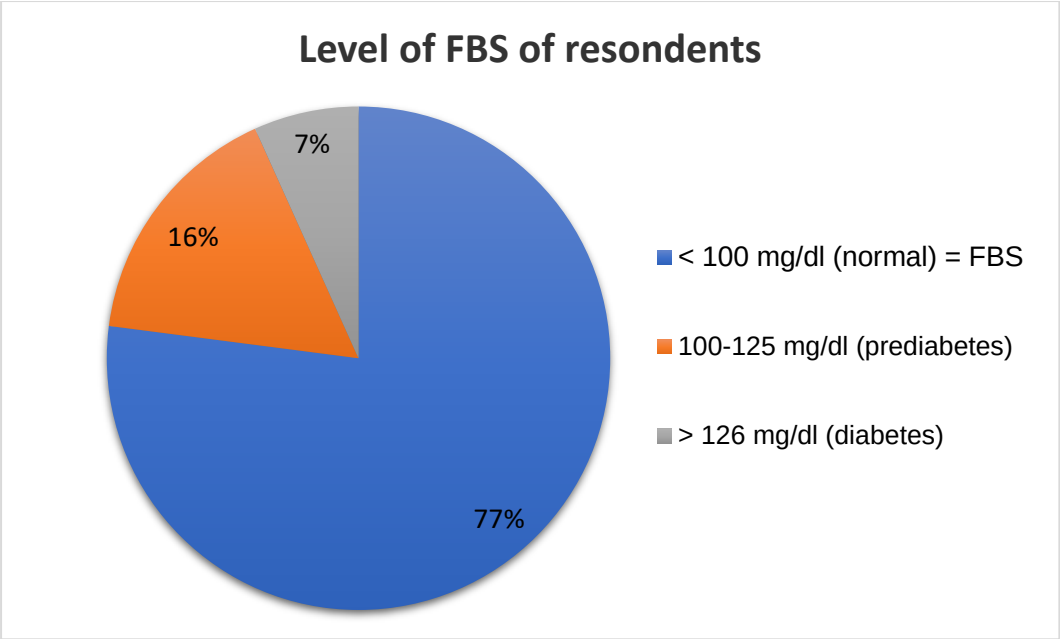

Figure 4.12: Level of fasting blood sugar among study respondents

As depicted in Figure 4.12 and Table 4.11, the overall prevalence of T2DM was found to be 6.7% (95% CI: 4.64, 8.84). The proportion was 3.83% (95% CI: 5.48, 13.11) in Goba town residences and 2.91% (95% CI: 2.57, 7.33) in Bale Robe town residences. Table 4.10 below further shows the sex-specific prevalence of DM was 7.3% (95% CI:

4.39–10.16) for females and 6.0% (95% CI: 2.93–9.08) for males. The prevalence of pre-diabetes (impaired blood sugar) was 89 (16.21%) [95% CI: 24.77, 34.61]. It was 14.59% for males and 17.41% for females. The prevalence of known DM patients taking anti-diabetic medication was 3.5%.

Table 4.11: The prevalence of DM, pre-diabetes and previous history of DM by age group and gender (N=549)

Characteristics T2DM , Prediabetes and Previous history of DM	Male N (%)	Female N (%)	Both N (%)
T2DM(n =37)			
Overall	**14 (6.01%)**	**23 (7.28%)**	**37 (6.7%)**
18-27	1 (2.94%)	2 (5.41%)	3 (8.12%)
28-37		8 (21.62%)	8 (21.62%)
38-47	2 (5.41%)	6 (16.23%)	8 (21.62%)
48-57	5 (13.51%)	3 (8.12%)	8 (21.62%)
>=58	6 (16.23%)	4 (10.82%)	10 (27.03%)
Prediabetes (n=89)			
Overall	**34 (38.2%)**	**55 (61.8%)**	**89 (16.21%)**
18-27	6 (6.74%)	11 (12.36%)	17 (19.10%)
28-37	9 (11.11%)	20 (22.47%)	29 (32.58%)
38-47	8 (8.99%)	8 (8.99%)	16 (17.98%)
48-57	3 (3.37%)	9 (11.11%)	12 (13.48%)
>=58	8 (8.99%)	4 (4.49%)	10 (11.24%)
Previous history of DM (n=3)			
Overall	2 (66.66%)	1 (33.33%)	3 (0.55%)

Figure 4.13 below shows that the level of FBS by age was higher in the group of adults over 58, where it was reported to be 27%.

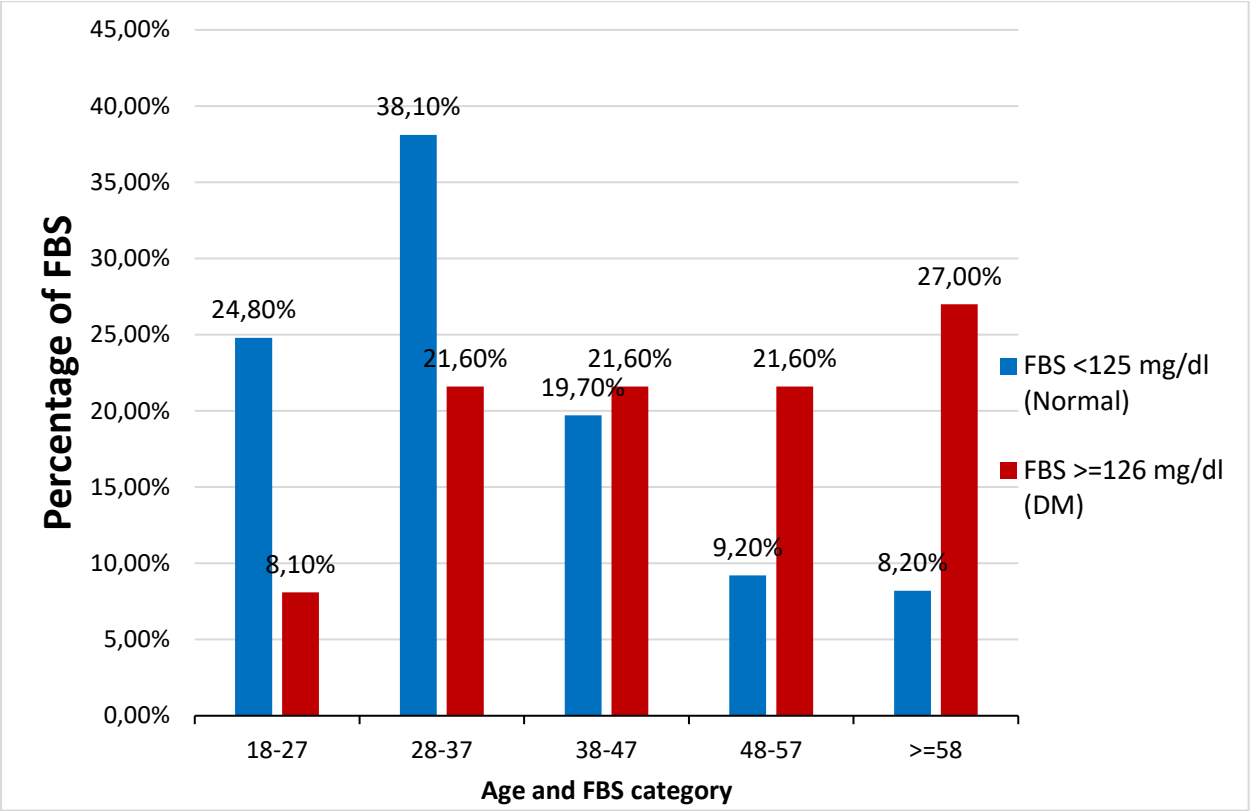

Figure 4.13: Distribution of fasting blood sugar by age and gender among study respondents (N=549)

Figure 4.14 below indicates that the prevalence of T2DM was higher in the age group of 28–37 years and among females.

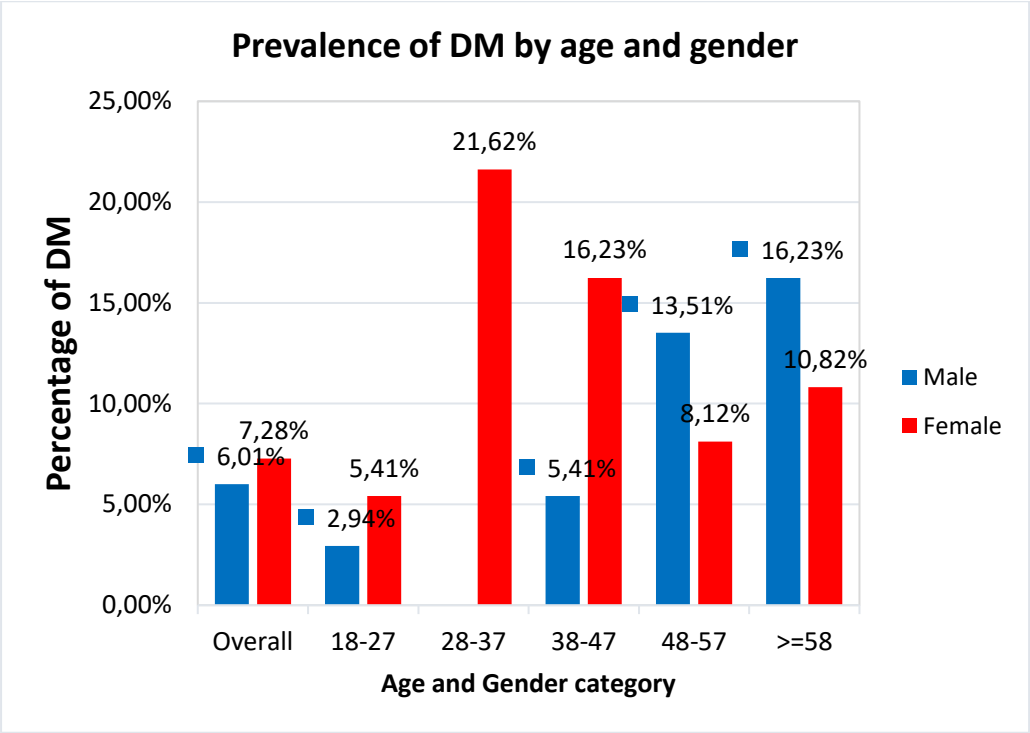

Figure 4.14: Distribution of prevalence of diabetes mellitus T2DM by age and gender (N=549)

Similar to the above, Figure 4.15 indicates that the prevalence of pre-diabetes was higher in the age group 28–37 years and among females, which was reported at 22.47%.

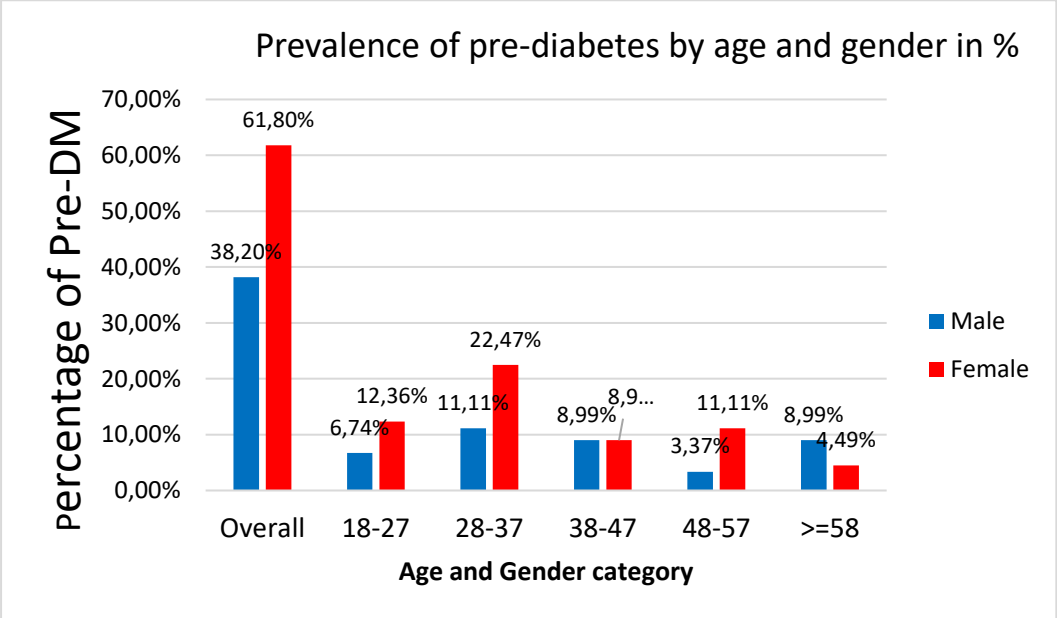

Figure 4.15: Distribution of prediabetes by age and gender (N=549)

4.2.8 Prevalence of Type 2 Diabetes mellitus in relation to selected behavioural characteristics of respondents

As presented in Table 4.12 below, out of the total number of current smokers, 6.7% were found to have T2DM. Among respondents who reported being current alcohol users, 7.1% were found to have T2DM. The proportion of diabetics among those who didn't engage in vigourous intensity physical activity at work was 8.7%. In those who had not consumed fruits and vegetables, the prevalence of T2DM was found to be 22.7% and 23.8%, respectively. Among those who consume animal fat, T2DM was found in 9.8% of respondents. It was revealed that 18.4% of the respondents who were overweight or obese had T2DM. Diabetes mellitus was present in 16.7% of those with high blood pressure. The prevalence of T2DM was also found to be 11.9% and 8.6%, respectively, in respondents with a high waist circumference (WC) and a high waist-to-hip (WHR) ratio. Table 4.12 below shows the percentage distribution of T2DM in study participants by selected risk factors.

Table 4.12: Prevalence of DM among adults by selected risk factors in Bale Zone *(*N=549)

Prevalence of DM	Percent	95% CI
Overall (n=549)	6.7	4.64-8.84
Among current smoker (n=15)	6.7	7.63-20.97
Among current alcohol user (n=155)	7.1	3.01-11.18
Among those who did not engage vigorous intensity physical at work (n=312)	8.7	1.64-6.80
Among who did not consume fruits(n=44)	22.7	3.38-7.32
Among who did not consume vegetables (n=21)	23.8	4. 2-8.10
Among who consume animal fat (n=285)	9.8	6.35-13.30
Among those with abnormal BMI (n=114)	18.4	1.90-5.45
Among hypertensive respondents (n=144)	16.7	1.49-4.93
Among high waist circumference respondents (n=253)	11.9	0.62-4.11
Among high waist to hip ratio respondents (n=385)	8.6	0.05-4.77

Among high waist to height ratio respondents (n=316)	9.8	0.53-4.62

4.2.9 Factors associated with prevalence of type 2 diabetes mellitus

On bivariable logistic regression analysis, the prevalence of DM had a statistically significant association with residence address, age, fruit eating habit, animal fat, Work involves vigourous-intensity activity, measured blood glucose, family history of DM, waist-to-hip, hypertension, and BMI (kg/m2), as presented in Table 4. 13 below. On multivariable binary logistic regression, variables with p=<0.25 results from bivariable logistic analysis and clinically important confounders were included in the multivariable logistic regression model. Before we analysed the multivariable model, we checked for outliers, and we removed any values with standardised residuals for outliers greater than 2.58. Further, any multi-collinearity effect was checked for.

Table 4.13: Bivariable binary logistic regression analysis of DM prevalence and exposure variables among respondents (N=549)

Variables	Category	T2DM		Unadjusted or (95% CI)	p-value
		Yes	No		
Address	Goba town	21 (9.3%)	205 (90.7%)	1.97 (1.00,3.85)*	0.049
	Robe town	16 (5.0%)	307 (95.0%)	1	
Age				1.06 (1.03,1.0) *	p<0.001
Gender	Male	14 (6%)	219 (94%)	1	
	Female	23 (7.3%)	293 (92.7%)	1.23 (.62, 2.44)	0.558
Wealth index	Low	2 (12.5%	14 (87.5%)	1	
	Middle	34 (7.0%)	451 (93.0%)	0.53 (0.12,2.41)	0.41
	High	1 (2.1%)	47 (97.9%)	0.15 (0.13,1.76)	0.131
Ever smoked cigarette	Yes	5 (13.9%	31 (86.1%)	2.42 (0.88, 6.66)	0.086
	No	32 (6.2%)	481 (93.8%)	1	
	smoking	1 (6.7%)	14 (93.3%)	(0.30(0.03,3.04)	0.31

Current cigarette status	Not Smoking	4 (19.0%)	17 (81.0%)	1	
Ever `consumed alcoholic drink	No	19 (5.4%)	330 (94.6%)		
	Yes	18 (9.0%)	182 (91.0%)	1.72 (0.88, 3.36)	0.113
Ever chewed Khat	No	35 (7.0%)	464 (93.0%)	1	
	Yes	2 (4.0%)	48 (96.0%)	0.55 (0.13,2.37)	0.424
Drink coffee	No	4 (11.4%)	31 (88.6%)	1	
	Yes	33 (6.4%)	481 (93.6%)	0.53 (0.18,1.59)	0.26
Fruit eating habit	Yes	27 (5.3%)	478 (94.7%)	1	
	No	10 (22.7%)	34 (77.3%)	5.21 (2.33,11.64) *	p<0.001
Eating animal fat	No	9 (3.4%)	255 (96.6%)	1	
	Yes	28 (9.8%)	257 (90.2%)	3.09 (1.43, 6.67) *	0.004
Salt use (top added)	Yes	4 (6.7%)	56 (93.3%)	0.99 (0.34,2.89)	0.981
	No	33 (6.7%	456 (93.3%)	1	
Work involves vigorous-intensity activity	Yes	10 (4.2%)	227 (95.8%)	1	
	No	27 (8.7%)	285 (91.3%)	2.15 (1.02,4.54) *	0.044
Perform physical fitness activities	Yes	4 (3.6%)	107 (96.4%)	1	
	No	33 (7.5%)	405 (92.5%)	2.18 (0.76,6.29)	0.149
Measured blood glucose	Yes	14 (15.7%)	75 (84.3%)	1	
	No	23 (5.0%)	437 (95.0%)	0.28 (0.14, 0.57) *	p<0.001
Family history of DM	Yes	14 (15.7%)	75 (84.3%)	3.35 (1.29,8.68) *	0 .013
	No	23 (5.0%)	437 (95.0%)	1	
Waist-to-Hip	Low	4 (2.4%)	162 (97.6%)	1	
	High	33 (8.6%)	350 (91.4%)	3.82 (1.33,10.96)	0.013
Overall hypertension	Normotensive	13 (3.2%	392 (96.8%	1	
	Hypertensive	24 (16.7%	24 (16.7%)	6.03 (2.98,12.21)	p<0.001

BMI(Kg/m2)	<=24.99kgm2	16 (3.7%)	419 (96.3%)	1	
	>=25kg/m2	21 (18.4%)	93 (81.6%)	5.91 (2.97,11.77)	p<0.001

In the final model, the odds of DM increased more than five times (AOR: 5.68; 95% CI: 2.03–15.89) among respondents who did not consume fruit compared to those who did. The odds of developing DM among respondents who consumed animal fat were sixfold higher (AOR: 6.59, 95% CI: 2.53–17.22) than their counterparts. The odds of developing DM were almost six times higher (AOR: 5.91, 95% CI: 2.97–11.77) among overweight/ obese respondents as compared to those with a normal BMI. The odds of developing DM were two times lower among respondents who worked in vigorous-intensity activity (AOR: 2.15; 95% CI: 1.02-4.54) than those who did not. The likelihood of developing DM among adults who had higher blood pressure (hypertension) was three times higher (AOR: 3.15; 95% CI: 1.30–761) than that of those with normal blood pressure, as shown in Table 4.13. In this particular study, risky behaviours including smoking, alcohol use, age, family history of DM or hypertension, and a high waist-hip circumference ratio were not significantly associated with DM. Table 4.14 shows a multivariable binary logistic regression analysis of the prevalence and exposure variables of T2DM among respondents..

Table 4.14: Multivariable binary logistic regression analysis of prevalence and exposure variables among respondents (N=549)

Variables	Category	T2DM		Adjusted OR (95% CI)	P-value
		Yes	No		
Address	Goba town	21 (9.3%)	205 (90.7%)	1.18 (0.54,2.59)	0.685
	Robe town	16 (5.0%)	307 (95.0%)	1	
Age				1.03 (0.99,1.06)	0.102
Fruit eating habit	Yes	27 (5.3%)	478 (94.7%)	1	
	No	10 (22.7%)	34 (77.3%)	5.68 (2.03,15.89)*	**0.001**
Eating animal fat	No	9 (3.4%)	255 (96.6%)	1	
	Yes	28 (9.8%)	257 (90.2%)	6.59 (2.53,17.22)**	**0.000**

Work involves vigorous-intensity activity	Yes	10 (4.2%)	227 (95.8%)	1	
	No	27 (8.7%)	285 (91.3%)	2.81 (1.18, 6.7)*	**0.020**
Measured blood glucose	Yes	14 (15.7%)	75 (84.3%)	1	
	No	23 (5.0%)	437 (95.0%)	1.05 (0.42,2.63)	0.917
Family history of DM	Yes	14 (15.7%)	75 (84.3%)	1.66 (0.52,5.26)	0.389
	No	23 (5.0%)	437 (95.0%)	1	
Waist-to-Hip	Low	4 (2.4%)	162 (97.6%)	1	
	High	33 (8.6%)	350 (91.4%)	1.24 (0.38,4.09)	0.722
Overall hypertension	Normotensive	13 (3.2%	392 (96.8%)	1	
	Hypertensive	24 (16.7%	24 (16.7%)	3.15 (1.30,7.61)*	**0.011**
BMI (Kg/m2)	<=24.99kgm2	16 (3.7%)	419 (96.3%)	1	
	>=25kg/m2	21 (18.4%)	93 (81.6%)	4.40 (1.91,10.17)*	**0.001**

Footnotes; 1(Ref): reference, P-value < 0.05 * and <0.000**

4.3 FINDINGS OF CASE-CONTROL STUDY PHASE II

This section presents the findings of Phase II of the current study, which are based on the results of data analysis procedures performed on data obtained from T2DM cases and their appropriate controls from two selected public hospitals in the Bale Zone, south-east Ethiopia. Descriptive analysis in the form of frequencies, proportions, and means was used to describe the distribution of demographic and behavioural factors in cases and controls. The chi-square test for difference was employed to determine statistical significance at the 95% level of significance. Bivariate analysis was performed by constructing two-by-two tables for each potential risk factor outcome in order to obtain the odds ratio, which was then used to investigate and determine the association between each factor (exposure) and T2DM (outcome). Multiple logistic regression was performed with all of the factors found to be significant in the bivariate studies as dependent variables. Multiple logistic

regression was used to identify the most important risk factors and reduce the effect of confounders.

4.3.1 Socio-demographic characteristics of respondents

A total of 507 adults aged 18 years and above were included in this case-control study. One hundred sixty-nine were cases (T2DM patients), and the remaining 338 were controls (non-DM adults), making a response rate of 93%. Above half of the cases, 90 (53.3%), and 118 (34.9%) of the controls were male. Among the cases, 117 (69.2%) were from Goba referral hospital, and 52 (30.8%) were from Bale Robe general hospital. Similarly, among the controls, 221 (65.4%) and 117 (34.6 %%) were from Goba referral hospital and Bale Robe general hospital, respectively. Nearly two-thirds of the 220 (65.1%) controls were female. The mean ± SD ages for the cases and controls were 48.96 ± 13.34 years and 38.65 ±15.81) years, respectively. The youngest subjects were 18 years old, and the oldest was 91 years old. The results also showed that 107 (63.3%) of the cases and 335 (99.1%) of the controls lived in urban areas. The marital status composition of respondents showed that 116 (68.6%) of cases and 251 (74.9%) of controls were married as illustrated in Table 4.15.

With respect to religion, 112 (66.2%) of the cases and 248 (73.4%) of the controls were followers of the Orthodox Christian religion, and 51 (30.2%) of the cases and 69 (20.4%) of the controls were Muslims. Forty-four (26.1%) of cases and 16 (4.7%) of controls couldn't read and write. Regarding occupational status, 46 (27.2%) of cases and 103 (30.5%) of controls were housewives; 27 (16.0%) of cases and 77 (22.8%) of controls were government employees; 38 (22.5%) of cases and 7 (2.1%) were farmers. Table 4.15 presents the distribution percentage of socio-demographic characteristics of study respondents in phase II of the current study.

Table 4.15: Socio- demographic characteristics of study respondents in Goba Referral Hospital and Bale Robe General Hospital (N=507)

Characteristic		Participant type		Total	P-value
		Cases N (%)	Controls N (%)		
Hospital name	Goba Referral Hospital	117 (69.2%)	221 (65.4%)	338 (66.7%)	0.386
	Bale Robe General Hospital	52 (30.8%)	117 (34.6%)	169 (33.3%)	
Permanent residence	Urban	107 (63.3%)	335 (99.1%)	442 (87.2%)	<0.001
	Rural	62 (36.7%)	3 (0.9%)	65 (12.8%)	
Gender	Male	90 (53.3%)	118 (34.9%)	208 (41.0%)	
	Female	79 (46.7%)	220 (65.1%)	299 (59.0%)	
Age category	18-29 years	13 (7.7%)	115 (34.0%)	128 (25.2%)	<0.001
	30-39 years	30 (17.8%)	90 (26.6%)	120 (23.7%)	
	40-49 years	32 (18.9%)	52 (15.4%)	84 (16.6%)	
	50-59 years	51 (30.2%)	29 (8.6%)	80 (15.8%)	
	≥60 years	43 (25.4%)	52 (15.4%)	95 (18.7%)	
Educational status	Cannot read and write	44 (26.0%)	16 (4.7%)	60 (11.8%)	<0.001
	Can only read and write	20 (11.8%)	2 (0.6%)	22 (4.3%)	
	Primary (1-8)	40 (23.7%)	72 (21.3%)	112 (22.1%)	
	Secondary (9-12) school	41 (24.3%)	142 (42.0%)	183 (36.1%)	
	Diploma or Higher above	24 (14.2%)	106 (31.4%)	130 (25.6%)	
Ethnicity	Oromo	127 (75.1%)	223 (66.0%)	350 (69.0%)	0.067
	Amhara	42 (24.9%)	112 (33.1%)	154 (30.4%)	
	Tigre		3 (0.9%)	3 (0.6%)	
Religion	Orthodox Christian	112 (9.5%)	248 (73.4%)	360 (71.0%)	0.07
	Muslim	51 (30.2%)	69 (20.4%)	120 (23.7%)	
	Protestant Christian	6 (3.6%)	20 (5.9%)	26 (5.1%)	
	Others		1 (0.3%)	1 (0.2%)	

Marital status	Never married	12 (7.1%)	76 (22.5%)	88 (17.4%)	<0.001
	Married	116 (68.6%)	253 (74.9%)	369 (72.8%)	
	Divorced	25 (14.8%)	4 (1.2%)	29 (5.7%)	
	Widowed	16 (9.5%)	5 (23.8%)1.5%	21 (4.1%)	
Occupational status	Employee Government	27 (16.0%)	77 (22.8%)	104 (20.5%)	
	Housewife	46 (27.2%)	103 (30.5%)	151 (29.8%)	
	Merchant	9 (5.3%)	39 (11.5%)	48 (9.5%)	
	Farmer	38 (22.5%)	7 (2.1%)	45 (8.9%)	
	Retired	27 (16.0%)	32 (9.5%)	59 (11.6%)	
	Daily labourer	5 (3.0%)	7 (2.1%)	12 (2.4%)	
	Student	21 (12.4%)	73 (21.6%)		
Family size	1-3	50 (29.6%)	122 (36.1%)	172 (33.9%)	
	4-5	48 (28.4%)	146 (43.2%)	194 (38.3%)	<0.001
	>5	71 (42.0%)	70 (20.7%)	141 (27.8%)	
Wealth index	Low	144 (85.2%)	151 (44.7%)	295 (58.2%)	
	Medium	3 (1.8%)	36 (10.7%)	39 (7.7%)	<0.001
	High	22 (13.0%)	151 (44.7%)	173 (34.1%)	

4.3.2 Socio-demographic determinants of Type 2 Diabetes mellitus

As shown in Table 4.16, the socio-demographic determinants of T2DM were assessed using binary logistic regression analysis. Socio-demographic variables with a p value of <=0.25 on crude analysis were fitted in the final model to identify the independent predictors after adjustment. In a multiple logistic regression analysis, permanent residence in urban areas, being of the male gender, age 50 years and above, being ever married, no formal education and primary (1–8) school, occupational status of retired and daily labourers, and medium and high values in the wealth index were significantly associated with the development of T2DM.

The odds of developing T2DM were 3.67 times higher in respondents aged 50 years and older than in respondents under 50 years of age (AOR = 3.674, 95% CI: 1.654, 6.396). The odds of developing T2DM were 3.5 times higher in respondents who were males than respondents who were females (AOR = 3.501; 95% CI: 1.771, 6.921). The study found that respondents with no formal education and primary school had approximately 8.5 and 3.4 times higher odds of developing T2DM (AOR = 8.494; 95% CI = 2.693, 26.792), respectively, than those with higher education (AOR = 3.397; 95% CI = 1.229, 9.389).

In this study, respondents who were retried and worked in daily labour were about 70.5% and almost 73% less likely to develop T2DM than counterparts (AOR = 0.295, 95% CI: 0.097, 0.894) and AOR = 0.271, 95% CI: 0.085, 0.863), respectively. The study also revealed that respondents with a medium and high wealth index were 91% and 87.6% less likely to develop T2DM than respondents with a low wealth index (AOR = 0.090, 95% CI: 0.020–0.399) and AOR = 0.124, 95% CI: 0.056, 0.272), respectively as depicted in Table 4.16.

Table 4.16: Socio-demographic determinants of T2DM among the respondents from Goba Referral Hospital and Bale Robe General Hospital (N=507)

Variables	Category	Study respondent type		Odds Ratio with 95%		
		Case	Control	COR	AOR	P-value
Permanent residence	Urban	107 (63.3%)	335 (99.1%)	0.015 (0.005-0.050)	0.020 (0.005-0.082)**	**<0.001**
	Rural	62 (36.7%)	3 (0.9%)	1(Ref)	1	
Gender	Male	90 (53.3%)	118 (34.9%)	2.124 (1.458-3.093)	3.501 (1.771-6.921)**	**<0.001**
	Female	79 (46.7%)	220 (65.1%)	1		
Age	<50	87 (51.5%)	269 (79.6%)	1	1	
	>=50	82 (48.5%)	69 (20.4%)	3.674 (2.460-5.488)	3.252 (1.654-6.396)*	**0.001**
Marital status	Never married	12 (7.1%)	76 (22.5%)		1	
	Ever Married	157 (92.9%)	262 (77.5%)	3.795 (2.001-7.199)	6.814 (2.224-20.874)*	**0.001**
Educational status	No formal education	64 (37.9%)	18 (5.3%)	15.704 (7.913-31.164)	8.494 (2.693-26.792)**	**<0.001**
	Primary (1-8)	40 (23.7%)	72 (21.3%)	2.454 (1.363-4.417)	3.397 (1.229-9.389)*	**0.018**
	Secondary (9-12) school	41 (24.3%)	142 (42.0%)	1.275 (0.726-2.239)	1.782 (0.749- 4.239)	0.192
	Diploma or Higher above	24 (14.2%)	106 (31.4%)	1(Ref)	1	
Occupational status	Employee Government	27 (16.0%)	77 (22.8%)	1.219 (0.634-2.344)	2.293 (0.720-7.306)	0.160
	Housewife	46 (27.2%)	103 (30.5%)	2.483 (0.714-8.632)	0.447 (0.079-2.533)	0.363
	Merchant	9 (5.3%)	39 (11.5%)	0.802 (0.335-1.919)	0.484 (0.147-1.591)	0.232
	Farmer	38 (22.5%)	7 (2.1%)	18.871 (7.364-48.356)	0.326 (0.074-1.432)	0.138
	Retired	27 (16.0%)	32 (9.5%)	1.417 (0.775-2.592)	0.295 (0.097-0.894)*	**0.031**

	Daily labourer	5 (3.0%)	7 (2.1%)	2.933 (1.448-5.940)	0.271 (0.085-0.863)*	**0.027**
	Student	21 (12.4%)	73 (21.6%)	1	1	
Family size	1-3	50 (29.6%)	122 (36.1%)	1	1	
	4-5	48 (28.4%)	146 (43.2%)	0.802 (0.505-1.275)	0.659 (0.352-1.235)	0.194
	>5	71 (42.0%)	70 (20.7%)	2.475 (1.553-3.945)	1.419 (0.694-2.902)	0.338
Wealth index	Low	144 (85.2%)	151 (44.7%)	1	1	
	Medium	3 (1.8%)	36 (10.7%)	0.087 (0.026-0.290)	0.090 (0.020-0.399)**	**<0.001**
	High	22 (13.0%)	151 (44.7%)	0.153 (0.092-0.252)	0.124 (0.056-0.272)**	**<0.001**

Footnotes; 1(Ref): reference, P-value < 0.05 * and <0.000**

4.3.3 Behavioural related characteristics of respondents

4.3.3.1 Smoking

Ever having smoked cigarettes was reported by 7.1% of respondents. Case respondents reported 14.2% compared to control respondents' 3.6% ($p < 0.0001$). However, there was a difference in current smoking among the case respondents and the control respondents. Thirty-two (18.9%) cases and 19 (5.6%) controls had a history of khat chewing during their lifetime ($P<0.001$) as indicated in Table 4.17.

4.3.3.2 Alcohol consumption

About 231 (45.6%) of the study respondents had ever consumed alcohol as showed in Table 4.17.

4.3.3.3 Dietary habits

A majority of 467 (92.1%) of the study respondents consumed fruit, representing 79.8% of cases and 98.5% of controls, respectively. In a typical week, fruit was consumed on average for 3.48 days by cases and 3.3 days by controls. Only 5.2% of respondents in cases and 3.9% of respondents in controls consumed one serving of fruit on a daily basis. However, 35 (20.7%) of the cases and 5 (1.5% of the controls) did not consume any fruit at all in this atypical week. The mean number of days that case respondents ate vegetables per week was 3.33 ± 0.84 and controls were 2.56±0.98. Regarding the dietary salt, 45 (26.6%) of cases and 42 (12.4%) of controls claimed that they added salt on top. More cases (34.9%) than controls (26.3%) consumed animal fat (p 0.045). (See Table 4.17).

Table 4.17: Behavioural related characteristics of respondents (N=507)

Variables	Category	Cases	Controls	Total	P-value
Ever smoked cigarettes	Yes	24 (14.20%)	12 (3.60%)	36 (7.10%)	
	No	145 (85.8%)	326 (96.4%)	471 (92.9%)	
Current smoking status (n=36)	Yes	8 (33.3%)	4 (33.3%)	12 (33.3%)	
	No	16 (66.7%)	8 (66.7%))	24 (66.7%)	
Cigarette smoking frequency in a week (n= 12)	Daily	6 (75.0%)	2 (50.0%)	8 (66.7%)	
	5-6 days per week				
	3-4 days per week				0.547
	1-2 days per week	2 (25.0%)	2 (50.0%)	4 (33.3%)	
Ever consumed an alcoholic drink	Yes	77 (45.6%)	154	231 (45.6%)	
	No	92 (54.4%)	184 (54.4%)	276 (54.4%)	
Currently drinks alcohol	Yes	17 (22.1%)	75 (48.7%)	92 (39.8%)	
	No	60 (77.9%)	79 (51.3%)	139 (60.2%)	
Alcohol consumption frequency in a week (n= 92)	Daily	1 (5.9%)	6 (8.0%)	7 (7.6%)	
	5-6 days per week	2 (11.8%)	3 (4.0%)	5 (5.4%)	
	3-4 days per week	7 (41.2%)	25 (33.3%)	32 (34.8%)	
	1-2 days per week	7 (41.2%)	41 (54.7%)	48 (52.2%)	0.503
Ever chewed Khat	Yes	32 (18.9%)	19 (5.6%)	51 (10.1%)	
	No	137 (81.1%)	319 (94.4%)	456 (89.9%)	<0.001
Chewing Khat currently	Yes	15 (46.9%)	9 (47.4%)	24 (47.1%)	
	No	17 (53.1%)	10 (52.6%)	27 (52.9%)	0.973
Khat chewing frequency in a week (n=24)	Daily	8 (53.3%)	3 (33.3%)	11 (45.8%)	
	5-6 days per week	2 (13.3%)	1 (11.1% (	3 (12.5%)	0.124
	3-4 days per week	2 (13.3%)	5 (55.6%)	7 (29.2%)	
	1-2 days per week	3 (20.0%)	-	3 (12.5%)	
Eat fruit	Yes	134 (79.3%)	333 (98.5%)	467 (92.1%)	<0.001
	No	35 (20.7%)	5 (1.5%)	40 (7.9%)	
Fruit eating habit in a week (n=467)	Daily	7 (5.2%)	13 (3.9%)	20 (4.3%)	
	5-6 days per week	7 (5.2%)	14 (4.2%)	21 (4.5%)	<0.001
	3-4 days per week	35 (26.1%)	158 (47.4%)	193 (41.3%)	

	1-2 days per week	85 (63.4%)	148 (44.4%)	233 (49.9%)	
Eat vegetables	Yes	152 (89.9%)	335 (99.1%)	487 (96.1%)	<0.001
	No	17 (10.1%)	3 (0.9%)	20 (3.9%)	
Vegetables eating habit in a week (n=487)	Daily	10 (6.6%)	69 (20.6%)	79 (16.2%)	
	5-6 days per week	7 (4.6%)	61 (18.2%)	68 (14.0%)	<0.001
	3-4 days per week	58 (38.2%)	154 (46.0%)	212 (43.5%)	
	1-2 days per week	77 (50.7%)	51 (15.2%)	128 (26.3%)	
Eats animal fat	Yes	59 (34.9%)	89 (26.3%)	148 (29.2%)	0.045
	No	110 (65.1%)	249 (73.7%)	359 (70.8%)	
Animal fat eating habit in a week (n=148)	Daily	3 (5.1%)	2) (2.2%)	5 (3.4%)	
	5-6 days per week	3 (5.1%)	9 (10.1%)	12 (8.1%)	0.086
	3-4 days per week	11 (18.6%)	30 (33.7%)	41 (27.7%)	
	1-2 days per week	42 (71.2%)	48 (53.9%)	90 (60.8%)	
Use of top added salt	Yes	45 (26.6%)	42 (12.4%)	87 (17.2%)	<0.001
	No	124 (73.4%)	296 (87.6%)	420 (82.8%)	
Drink coffee	Yes	159 (94.1%)	307 (90.8%)	466 (91.9%)	
	No	10 (5.9%)	31 (9.2%)	41 (8.1%)	0.205
Coffee drinking in a week (n=466)	Daily	146 (91.8%)	260 (84.7%)	406 (87.1%)	
	5-6 days per week	2 (1.3%)	9 (2.9%)	11 (2.4%)	
	3-4 days per week	11 (6.9%)	29 (9.4%)	40 (8.6%)	0.063
	1-2 days per week		9 (2.9%)	9 (1.9%)	
Number of cups of coffee	1-2 cup a day	74 (46.5%)	162 (53.3%)	236 (51.0%)	
	3-4 cups a day	74 (46.5%)	112 (36.8%)	186 (40.2%)	0.111
	Five and more cups a day	11 (6.9%)	30 (9.9%)	41 (8.9%)	
Number of days fruit consumed in a typical week (mean ± SD)		3.48 ± 0.82	3.32 ± 0.73	3.37 ± 0.76	<0.001
Number of days vegetables consumed in a typical week (mean ± SD)		3.33 ±0.84	2.56±0.98	2.8 ± 1.01	<0.001

4.3.3.4 Level of Physical activities

Regarding the physical activities experienced by respondents, more than half (54.4%) of the cases compared with the controls (28.4%) involved vigourous physical exercise (p <0.001). The mean number of days that case-response respondents and control respondents participated in vigourous physical activity per week was 2.163 ± 1.23 and 2.14 ± 1.12, respectively. The average number of days per week that case respondents participated in recreational activities such as sports was 1.75 ±2.32, while control respondents participated in 1.89 0.31 days per week. Table 4.18 below further shows that 45 (26.6%) of cases and 15 (4.4%) of controls had a family history of high blood glucose (p< 0.001), and among the cases, nearly one out of three (31.4%) had a family history of hypertension compared to 14.6% in the controls (p<0.001). Table 4.18 shows percentage distribution of study respondents' physical activity history of raised blood glucose and co-morbidity.

Table 4.18: Physical activity, history of raised blood glucose and co-morbidity (N=*507*)

Variables	Category	Case	Controls	Total	P-value
Work involves vigorous-intensity activity	Yes	92 (54.4%)	96 (28.4%)	188 (37.1%)	<0.001
	No	77 (45.6%)	242 (71.6%)	319 (62.9%)	
Number of days with work involving vigorous-intensity activity in a week (n=188)	Daily	45 (48.9%)	42 (43.8%)	87 (46.3%)	
	5-6 days per week	5 (5.4%)	11 (11.5%)	16 (8.5%)	0.225
	3-4 days per week	24 (26.1%)	31 (32.3%)	55 (29.3%)	
	1-2 days per week	18 (19.6%)	12 (12.5%)	30 (16.0%)	
Walking for at least 10 continual minutes	Yes	155 (91.7%)	322 (95.3%)	477 (94.1%)	0.11
	No	14 (8.3%)	16 (4.7%)	30 (5.9%)	
Days in a week with at least 10 minutes of continuous walking (n= 477)	Daily	123 (79.4%)	250 (77.6%)	373 (78.2%)	
	5-6 days per week	9 (5.8%)	29 (9.0%)	38 (8.0%)	0.226
	3-4 days per week	21 (13.5%)	32 (9.9%)	53 (11.1%)	
	1-2 days per week	2 (1.3%)	11 (3.4%)	13 (2.7%)	
Mode of transport	On foot	159 (32.6%)	328 (67.4%)	487 (96.1%)	
	Bicycle	7 (3.4%)	201 (96.6%)	208 (41.0%)	
	Engine using vehicle	31 (56.4%)	24 (43.6%)	55 (10.8%)	
Vigorous-intensity sports activity	Yes	42 (24.9%)	36 (10.7%)	78 (15.4%)	<0.001
	No	127 (75.1%)	302 (89.3%)	429 (84.6%)	
Days in a week with work vigorous-intensity sports activity (n=78)	Daily	27 (64.3%)	11 (30.6%)	38 (48.7%)	
	5-6 days per week		8 (22.2%)	8 (10.3%)	0.002
	3-4 days per week	8 (19.0%)	8 (22.2%)	16 (20.5%)	

	1-2 days per week	7 (16.7%)	9 (25.0%)	16 (20.5%)	
Family history of high blood glucose	Yes	45 (26.6%)	15 (4.4%)	60 (11.8%)	<0.001
	No	124 (73.4%)	323 (95.6%)	447 (88.2%)	
Family history of hypertension	Yes	53 (31.4%)	21 (6.2%)	74 (14.6%)	<0.001
	No	116 (68.6%)	317 (93.8%)	433 (85.4%)	

4.3.4 Behavioural determinants of Type 2 Diabetes mellitus

As shown in Table 4.19, behavioural determinants of T2DM were assessed using binary logistic regression analysis. After adjusting for potential cofounders, behavioural variables with a p value <=0.25 in a case of T2DM on crude analysis and those believed to have biological relationships were fitted into the final model. Accordingly, respondents who had ever smoked a cigarette were 5.8 times more likely to have a case of T2DM than non-smokers (AOR = 5.762, 95% CI: 1.678, 19.792). Respondents who currently drank alcohol had a 78.5% lower risk of developing T2DM than those who did not (AOR = 0.215, 95% CI: 0.094, 0.493). This study revealed that respondents who engaged in vigorous work-related physical activity had an almost 59% decreased probability of getting T2DM compared to respondents who did not engage in such activities. (AOR = 0.412; 95% CI: 0.204, 0.831). The study also revealed that respondents who had a family history of DM had about four times higher odds of developing T2DM than their counterparts (AOR = 3.920, 95% CI: 1.051, 14.617).

Table 4.19: Behavioural determinants of T2DM among the respondents from Goba Referral Hospital and Bale Robe General Hospital (N=507*)*

Variables		Study respondent type		Odds Ratio with 95%		
		Case	Control	COR	AOR	P-value
Has ever smoked cigarettes	Yes	24 (14.2%)	12 (3.6%)	4.497 (2.189-9.238)	5.762 (1.678-19.792)*	**0.005**
	No	145 (85.8%)	326 (96.4%)	1(Ref)	1(Ref)	
Currently drinks alcohol	Yes	17 (22.1%)	75 (48.7%)	0.298 (0.160-0.557)	0.215 (0.094-0.493)**	**<0.0001**
	No	60 (77.9%)	79 (51.3%)	1	1	
Ever chewed Khat	Yes	32 (18.9%)	19 (5.6%)	3.922 (2.148-7.159)	0.919 (0.261-3.235)	0.896
	No	137 (81.1%)	319 (94.4%)	1	1	
Drinks coffee	Yes	159 (94.1%)	307 (90.8%)		1	
	No	10 (5.9%)	31 (9.2%)	0.623 (0.298-1.303)	0.183 (0.025-1.334)	0.094
Eats animal fat	Yes	59 (34.9%)	89 (26.3%)	1.501 (1.008-2.235)	1.230 (0.576-2.627)	0. 593
	No	110 (65.1%)	249 (73.7%)	1	1	
Use of top added salt	Yes	45 (26.6%)	42 (12.4%)	2.558 (1.599-4.092)	2.227 (.804-6.174)	0.124
	No	124 (73.4%)	296 (87.6%)	1	1	

Work involves vigorous-intensity activity	Yes	92 (54.4%)	96 (28.4%)	1	1	
	No	77 (45.6%)	242 (71.6%)	0.332 (0.226-0.487)	0.412 (0.204-0.831)*	**0.013**
Walks at least 10 continual minutes	Yes	155 (91.7%)	322 (95.3%)	1	1	
	No	14 (8.3%)	16 (4.7%)	1.818 (0.865-3.819)	0.760 (0.138-4.184)	0.149
Family history of high blood glucose	Yes	45 (26.6%)	15 (4.4%)	7.815 (4.204-14.526)	3.920 (1.051-14.617)*	**0.042**
	No	124 (73.4%)	323 (95.6%)	1	1	

Footnotes; 1(Ref): reference, P-value < 0.05 * and <0.000**

4.3.5 Physical measurement of respondents

4.3.5.1 Anthropometric values

The mean body mass index (BMI) of the respondents was 23.82 kg/m$^{2.}$ Cases had a higher mean BMI than controls (25.55 vs. 22.95 kg/m^2, p <0.001).In addition, females had a slightly higher mean BMI than males (23.4 vs. 24.06 kg/m^2, p < 0.001).

The mean waist to hip circumference (WHR) for both sexes among cases and controls was found to be 0.96 ±0.11 and 0.89± 0.07 cm, respectively, while the mean waist to hip circumferences of the male and female sexes were 0.98 ± 0.06 and 0.91 ± 0.06 cm, respectively. See more details in Table 4.20.

4.3.5.2 Blood pressure

The mean systolic blood pressure among the cases and the controls was 129.28 (±15.76) and 126.85 (±12.91) mmHg, respectively, while the mean diastolic blood pressure was 81.58 (±7.76) and 81.44 (±7.98) mmHg, respectively as depicted in Table 4. 20.

Table 4.20: Characteristics of respondent's Blood pressure and anthropometric measurement related variables of DM by gender (N=*507)*

Characteristics	Total number	Mean &SD		
		Case	Control	For both groups
BMI (kg/m2)	507	25.545 (±4.38)	22.95 (±3.38)	23.82 (±3.934)
WC for male(cm)		96.51 (±11.45)	83.896 (±7.84)	89.355 (±11.42)
WC for female (cm)		92.189 (±15.36)	87.141 (±10.09)	88.475 (±11.90)
WC for both genders (cm)		94.491 (±13.55)	86.01 (±9.48)	88.836 (±11.699)
Waist–hip ratio [Male]		0.967 (±0.059)	0.905 (±0.0584)	0.932 (± 0.066)
Waist–hip ratio (cm) [Female]		0.967 (±0.059)	0.905 (± 0.058)	0.911 (±0.106)
Waist–hip ratio for both genders	507	0.962 (±0.111)	0.898 (± 0.073)	0.919 (± 0.092)
WHtR (cm)	507	0.583± (±0.086)	0.529 (±0.064)	0.547 (±0.076)
SBP (mm Hg)	507	129.28 (±15.76)	126.85 (±12.91)	127.66 (±13.96)
DBP (mm Hg)	507	81.58 (±7.76)	81.437 (±7.98)	81.483 (±7.898)

BMI: Body Mass Index; WC: waist circumference; Waist-Height ratio: WHtR; SBP: systolic blood pressure; DBP: diastolic blood pressure; FG: fasting glucose

4.3.5.3 Distribution of Blood pressure and anthropometric measurement

With regard to anthropometric measurements, nearly two-thirds (63.1%) of the study respondents had normal body mass indices (18.5-24.9). However, the BMIs of overweight (25 to 29.9) and obese (30 or more) among the two groups were significantly different (38.5% vs. 18.6%) and (16.0% vs. 3.3%), p <0.001, respectively.

The proportion of obesity (BMI ≥ 30.0 kg/m2) among cases was 5-fold higher than in controls (16.0% vs. 3.3%), p <0.001. Overall, 56.2% and 17.2% of the cases and controls, respectively, had abdominal obesity. Moreover, almost two-thirds (65.56%) of males and (45.57%) of females from the cases group, respectively, had abdominal obesity compared to controls (8.47% of males and 21.82% of females, respectively. Table 4.21 presents the percentage distribution of study respondents' blood pressure and anthropometric measurements.

Table 21: Distribution of Blood pressure and anthropometric measurement related variables of DM (N=*507)*

Variables	Category	Case	Control	Total	P-value
Isolated diastolic blood pressure (DBP)	<90 mmHg	143 (84.6%)	299 (88.5%)	442 (87.2%)	0.222
	>=90 mmHg	26 (15.4%)	39 (11.5%)	65 (12.8%)	
Isolated Systolic blood pressure (SBP)	<140 mmHg	127 (75.1%)	294 (87.0%)	421 (83.0%)	0.001
	>=140 mmHg	42 (24.9%)	44 (13.0%)	86 (17.0%)	
High blood pressure	Yes	50 (29.6%)	58 (17.2%)	108 (21.3%)	0.001
	No	119 (70.4%)	280 (82.8%)	399 (78.7%)	
BMI (kg/m2)	Under weight (<18.5)	4 (2.4%)	17 (5.0%)	21 (4.1%)	
	Normal weight (18.5 to 24.9)	73 (43.2%)	247 (73.1%)	320 (63.1%)	<0.001
	Overweight (25 to 29.9)	65 (38.5%)	63 (18.6%)	128 (25.2%)	

	Obese (30 or more)	27 (16.0%)	11 (3.3%)	38 (7.5%)	
BMI (kg/m2)	<=24.99kg/m2	77 (45.6%)	264 (78.1%)	341 (67.3%)	<0.001
	>=25kg/m2	92 (54.4%)	74 (21.9%)	166 (32.7%)	
Waist circumference [Male], (n=)	< 94 cm	31 (34.44%)	108 (91.53%)	139 (66.83%)	
	≥ 94 cm	59 (65.56%)	10 (8.47%)	69 (33.17%)	
Waist circumference [Female], (n=)	< 80 cm	43 (54.43%)	172 (78.18%)	215 (71.91%)	
	≥ 80 cm	36 (45.57%)	48 (21.82%)	84 (28.09%)	
Waist circumference for both genders	High	95 (56.2%)	58 (17.2%)	153 (30.2%)	<0.001
	Normal	74 (43.8%)	280 (82.8%)	354 (69.8%)	
Waist–hip ratio [Male], (n=)	≥ 0.90 cm	77 (85.56%)	63 (53.39%)	140 (67.31%)	
	< 0.90 cm	13 (14.44%)	55 (46.61%)	68 (32.69%)	
Waist–hip ratio [Female], (n=)	≥ 0.85 cm	48 (60.76%)	100 (45.45%)	148 (49.50%)	
	< 0.8 5cm	31 (39.24%)	120 (54.55%)	151 (50.50%)	
Waist–hip ratio for both sex	High	125 (74.0%)	163 (48.2%)	288 (56.8%)	<0.001
	Low	44 (26.0%)	175 (51.8%)	219 (43.2%)	
Waist-Height ratio (WHtR)	≤ 0.5 cm	26 (15.4%)	113 (33.4%)	139 (27.4%)	<0.001
	> 0.5 cm	143 (84.6%)	225 (66.6%)	368 (72.6%)	

DBP, diastolic blood pressure; DM, diabetes mellitus; FBG, fasting blood glucose; SBP, systolic blood pressure.

4.3.6 Physical measurement determinants of Type 2 Diabetes mellitus

The odds of developing T2DM were 1.92 times higher for respondents with a BMI (kg/m2) of 25 kg/m2 and above than for respondents with a BMI (kg/m2) less than 25 kg/m2 as compared to their counterparts (AOR = 1.920; 95% CI: 1.11, 3.32). Those with a higher waist circumference (WC) were 3.3 times more likely to have T2DM compared to those with a normal WC (AOR = 3.270; 95% CI: 1.87–5.717). The study also revealed that the odds of developing T2DM were almost two times higher in respondents with a raised waist-hip ratio (WHR) than in respondents with a normal waist-hip ratio (AOR = 31.873; 95% CI: 1.165, 3.013). Despite statistically significant differences in bivariate analyses,

isolated measures of diastolic blood pressure (DBP), high blood pressure, and waist-height ratio (WHtR) did not exhibit statistically significant associations with T2DM when fitted to the final model. Table 4.22 depicts the physical measurement determinants of T2DM among the respondents.

Table 4.22: Physical measurement determinants of T2DM among the respondents from Goba Referral Hospital and Bale Robe General Hospital (N=*507*)

Variables		Study type respondent		Odds Ratio with 95%		
		Case	Control	COR	AOR	P-value
Isolated diastolic blood pressure (DBP)	<90 mmHg	143 (84.6%)	299 (88.5%)	1	1	
	>=90 mmHg	26 (15.4%)	39 (11.5%)	2.210 (1.379-3.540)	0.792 (0.330-1.900)	0.597
High blood pressure	Yes	50 (29.6%)	58 (17.2%)	2.028 (1.313-3.133)	1.294 (0.615-2.719)	0.497
	No	119 (70.4%)	280 (82.8%)	1(Ref)	1	
BMI (kg/m2)	<=24.99kg/m2	77 (45.6%)	264 (78.1%)	1	1	
	>=25kg/m2	92 (54.4%)	74 (21.9%)	4.263 (2.864-6.344)	1.920 (1.111-3.319)*	**0.019**
Waist circumference for both genders	High	95 (56.2%)	58 (17.2%)	6.198 (4.092-9.386)	3.270 (1.871-5.717)	**<0.0001**
	Normal	74 (43.8%)	280 (82.8%)	1	1	
Waist–hip ratio for both genders	High	125 (74.0%)	163 (48.2%)	3.050 (2.035-4.570)	1.873 (1.165-3.013)*	**0.010**
	Low	44 (26.0%)	175 (51.8%)			
Waist-Height ratio (WHtR)	≤ 0.5 cm	26 (15.4%)	113 (33.4%)	1		
	> 0.5 cm	143 (84.6%)	225 (66.6%)	2.762 (1.718-4.442)	0.931 (0.527-1.647)	0.807

Footnotes; 1(Ref): reference, P-value < 0.05 * and <0.000**

4.3.7 Perception of body shape and shape size and related conditions

The study respondents' perceptions of body and shape are displayed in Table 4.23. With regard to whether being overweight is a sign of good health, 19 (11.2%) of the cases and 13 (3.8%) of the controls believed that being overweight is a sign of good health (p = 0.005), while 6 (3.6%) of the case respondents and 14 (4.1%) of the controls (p = 0.005), respectively, had no idea if being overweight is a sign of good health. Twenty (11.8%) of the cases and 23 (6.7%) of the controls in the study had respondents who thought that overweight or obese people are mostly wealthy; however, 2.4% of the cases and 1.2% of the controls, respectively, had no such ideas. Only 8.3% of the case respondents and 13.3% of the control respondents perceived that being overweight or obese was a sign of attractiveness.

A total of 124 cases (84.4%) and 127 controls (43.3%) respondents believe that being overweight or obese makes one seem unattractive, while 76, or 52.4%, of the cases and 136, or 46.4%, of the control respondents perceive it as a sign of health problems. Twenty-nine (17.1%) of the case respondents and 23 (6.8%) of the control respondents wanted the body size of their spouses to be obese or overweight (p <0.000). Three-fifths (101; 59.8%) of the cases respondents and the majority of controls (302; 89.3%), p <0.000 at the time of data collection, both described their body size and shape as normal. Additionally, 51, or 30.2%, of the cases and 74, or 21.9%, of the controls perceived that they were overweight or obese.

With respect to their feelings about their body shape, nearly three-quarters (73.4%) of the cases and almost three-quarters (74.9%) of the controls stated they liked their body size and shape, whereas 43 (25.4%) of the cases and 72 (21.3%) of the controls stated they did not like it. Nearly half (48.5%) of the cases and 144 (42.6%) of the controls (p = 0.001), respectively, experienced comments regarding their size and body shape. The majority, 131 (77.5%) of the case respondents, and most, 313 (92.6%) of the control respondents (p = 0.001), perceived that being overweight or obese has adverse consequences. The remaining 27 (5.3%) individuals, both the controls and the cases, either thought there were no adverse effects or were unaware of any such effects.

Regarding their eating habits of animal and plant products, 35 (20.7%) of the cases and 52 (15.4%) of the control respondents perceived that eating beef or raw meat was beneficial for their body and shape. Additionally, 69 (40.8%) of the case respondents and

42 (12.4%) of the control respondents (p = 0.0001) stated that frequent consumption of plant products, including fruits, vegetables, and green leafy vegetables, would have a negative effect on their body and shape. See Table 4.24.

Table 4.23: Perception of body shape and size among the respondents in Goba Referral Hospital and Bale Robe General Hospital (N=*507*)

Variables		Study respondent type		Total	P-value
		Cases	Controls		
Being overweight/ obesity is an indication of good health.	Yes	19 (11.2%)	13 (3.8%)		0.005
	No	144 (85.2%)	311 (92.0%)		
	I don't know	6 (3.6%)	14 (4.1%)		
Overweight or obese people are more likely to be wealthy	Yes	20 (11.8%)	23 (6.8%)	43 (8.5%)	
	No	145 (85.8%)	311 (92.0%)	456 (89.9%)	0.089
	I don't know	4 (2.4%)	4 (1.2%)	8 (1.6%)	
Overweight/ obesity is an indicator of attractiveness	Yes	14 (8.3%)	45 (13.3%)	59 (11.6%)	
	No	147 (87.0%)	285 (84.3%)	432 (85.2%)	0.103
	I don't know	8 (4.7%)	8 (2.4%)	16 (3.2%)	
Reasons for not saying overweight/obesity is not a sign of attractiveness(n=)	Ugliness	124 (84.4%)	127 (43.3%)	251 (57.0%)	
	Shamefulness	27 (18.4%)	40 (13.7%)	67 (15.2%)	
	Frustrations	12 (8.3%)	15 (5.1%)	7 (6.2%)	
	A sign of health problem	76 (52.4%)	136 (46.4%)	212 (48.4%)	
Being slim indicates illness or poor health	Yes	24 (14.2%)	13 (3.8%)	37 (7.3%)	
	No	139 (82.2%)	319 (94.4%)	458 (90.3%)	
	I don't know	6 (3.6%)	6 (1.8%)	12 (2.4%)	
Which body size do you like for your spouse?	Obese	7 (4.1%)	2 (0.6%)	9 (1.8%)	<0.001
	Overweight	22 (13.0%)	21 (6.2%)	43 (8.5%)	
	Normal	101 (59.8%)	302 (89.3%)	403 (79.5%)	
	Underweight	6 (3.6%)	10 (3.0%)	16 (3.2%)	
	I do not know	33 (19.5%)	3 (0.9%)	36 (7.1%)	
How would you describe your current body size?	Obese	22 (13.0%)	6 (1.8%)	28 (5.5%)	
	Overweight	29 (17.2%)	68 (20.1%)	97 (19.1%)	
	Normal	99 (58.6%)	242 (71.6%)	341 (67.3%)	<0.001
	Underweight	19 (11.2%)	22 (6.5%)	41 (8.1%)	

	I do not know	-	-		
How do you feel about the size and shape of your body currently?	I like it	124 (73.4%)	261 (77.2%)	385 (75.9%	0.565
	I dislike it	43 (25.4%)	72 (21.3%)	115 (22.7%)	
	I don't know.	2 (1.2%)	5 (1.5%)	7 (1.4%)	
Have you experienced others commenting about your body size and shape?	Yes	82 (48.5%)	144 (42.6%)	226 (44.6%)	<0.001
	No	76 (45.0%)	194 (57.4%)	270 (53.3%)	
	I don't know	11 (6.5%)	-	11 (2.2%)	
What did other people say about your body size and size?	Obese	21 (25.6%)	9 (6.0%)	30 (13.0%)	
	Overweight	19 (23.2%)	76 (52.1%)	95 (41.7%)	
	Normal weight	22 (26.8%)	23 (15.8%)	45 (19.7%)	
	Underweight	21 (25.6%)	47 (32.2%)	68 (29.8%)	
	I do not know	29 (35.4%)	26 (17.9%)	55 (24.2%)	
If you feel or someone told you that you are overweight or obese, what would you do?	I will try to maintain it	44 (40.0%)	66 (60.0%)	110 (21.7%)	
	I will visit a health worker for advice or possible treatment.	76 (59.8%)	51 (40.2%)	127 (25.0%)	
	I will start aerobic physical exercise	33 (23.7%)	106 (76.3%)	139 (27.4%)	
	I will modify my diet.	16 (12.2%)	115 (87.8%)	131 (25.8%)	
Are there any adverse consequences from being overweight or obese?	Yes	131 (77.5%)	313 (92.6%)	444 (87.6%)	
	No	28 (16.6%)	8 (2.4%)	36 (7.1%)	
	I don't know	10 (5.9%)	17 (5.0%)	27 (5.3%)	
Health consequences of	Diabetes	116 (34.9%)	216 (65.1%)	332 (74.3%)	
	Hypertension	115 (29.0%)	282 (71.0%)	397 (88.8%)	
	Heart Diseases	67 (40.9%)	97 (59.1%)	164 (36.7%)	

overweight or obesity	Cancer	45 (90.0%)	5 (10.0%)	50 (11.2%)	
	Others	10 (40.0%)	15 (60.0%)	25 (4.9%)	
Frequent eating of animal products, like raw meat and beef, benefits our body size and shape.	Yes	35 (20.7%)	52 (15.4%)	87 (17.2%)	
	No	132 (78.1%)	280 (82.8%)	412 (81.3%)	0.298
	I don't know	2 (1.2%)	6 (1.8%)	8 (1.6%)	
Frequent eating of plant products like fruits, green leaves and vegetables will negatively affect our body size and shape	Yes	69 (40.8%)	42 (12.4%)	111 (21.9%)	
	No	97 (57.4%)	295 (87.3%)	392 (77.3%)	
	I don't know	3 (1.8%)	1 (0.3%)	4 (0.8%)	

4.3.8 Perception related determinants of Type 2 Diabetes mellitus

Table 4.24 displays the perception-related determinants of T2DM. Variables with a p value <=0.25 in the case of T2DM on crude analysis or bivariate analysis and those believed to have a biological relationship were fitted into the final model after adjusting for potential cofounders. Accordingly, the odds of having T2DM were 13.39 times higher for study respondents who responded that being overweight or obese has no adverse consequences compared to those who did not know anything (AOR 13.39; 95% CI: 3.11, 57.63). Study respondents who stated that frequently feeding plant products, such as fruits and vegetables, had a positive impact on body size and shape had a 93% reduced risk of developing T2DM compared to those who did not know anything (AOR = 0.07; 95% CI: 0.01, 0.71).

Table 4.24: Perception related determinants of T2DM among the respondents in Goba Referral Hospital and Bale Robe General Hospital (N=507)

Variables		Study respondents type		Odds Ratio with 95%		P-value
		Case	Control	COR	AOR	
Overweight/obesity is an indicator of attractiveness	Yes	14 (8.3%)	45 (13.3%)	0.31 (0.099-0.982)	0.380 (0.081-1.778)	

	No	147 (87.0%)	285 (84.3%)	0.516 (0.190-1.402)	1.572 (0.387 - 6.380)	0.219
	I don't know	8 (4.7%)	8 (2.4%)	1(ref)	1	0.527
Being slim indicates illness or poor health	Yes	24 (14.2%)	13 (3.8%)	1.846 (0.494-6.894)	4.594 (.821 -25.69)	0.083
	No	139 (82.2%)	319 (94.4%)	0.436 (0.138-1.375)	0.856 (0.186 - 3.927)	0.841
	I don't know	6 (3.6%)	6 (1.8%)	1	1	
Are there any adverse consequences from being overweight or obese?	Yes	131 (77.5%)	313 (92.6%)	0.712 (0.317-1.595)	1.564 (0. 482 5.070)	0.456
	No	28 (16.6%)	8 (2.4%)	5.950 (1.965-18.017)	13.391 (3.112-57.626)**	**<0.001**
	I don't know	10 (5.9%)	17 (5.0%)	1	1	
Frequent consumption of plant items such as fruits, green leaves, and vegetables that have a negative effect on body size and shape.	Yes	69 (40.8%)	42 (12.4%)	0.548 (0.055-5.437)	0.254 (0.024 - 2.653)	0.252
	No	97 (57.4%)	295 (87.3%)	0.110 (0.011-1.066)	0.070 (0.007-0.708)*	**0.024**
	I don't know	3 (1.8%)	1 (0.3%)	1	1	

Footnotes; 1(Ref): reference, P-value < 0.05 * and <0.000**

4.3.9 Occurrence of the Household Food Insecurity Access Scale Conditions

The proportion of households that worry about not having enough food was 66 (39.05%) in the case group and nine (2.66%) in the control group, respectively. Of the total number of households that worry about not having enough food, 75 (14.8%) were from both the case and control groups. In the four weeks before the interview, 63 (37.28%) of the households from the case group and 8 (2.37%) of the households from the control group, respectively, responded affirmatively when asked if they had been unable to eat their preferred food due to a lack of resources. In the four weeks before the interview, the households that had eaten a limited variety of food due to a lack of resources were 61 (36.09%) of the cases group and eight (2.37%) of the controls group, respectively.

The households in the case group comprised 61 (36.09%) and 12 (7.10%), while the control group comprised 10 (2.96%) and 8 (2.37%); they had eaten smaller amounts at a

meal or fewer meals than they had preferred in the 4 weeks before the interview. In addition, 12 (7.10%) and 14 (8.28%) of the households in the cases group and 8 (2.37%) of the controls group, respectively, responded affirmatively to the severe conditions of going to sleep hungry or going a whole day and night without food. Table 4.25 displays the occurrence of household food insecurity access scale conditions among the study respondents in the 30 days preceding the study.

Table 4.25: The occurrence of Household Food Insecurity Access Scale conditions among the respondents in Goba Referral Hospital and Bale Robe General Hospital (N=507)

The occurrence of Household Food Insecurity Access Scale conditions	Affirmative response (yes)				
	Cases		Controls		Total
	Yes	No	Yes	No	N (%)
	N (%)	N (%)	N (%)	N (%)	
Worried about not enough food	66 (39.05)	103 (60.9)	9 (2.66)	329 (97.34)	75 (14.8)
Unable to eat preferred food	66 (39.05)	103 (60.95)	9 (2.66)	329 (97.34)	75 (14.8)
Ate just a few kinds of food	66 (39.05)	103 (60.95	8 (2.37)	330 (97.63)	74 (14.6)
Ate unwanted kinds of food	63 (37.28)	106 (62.72)	8 (2.37)	330 (97.63)	71 (14.0)
Ate smaller amount than desired at the meal	61 (36.09)	108 (63.91)	10 (2.96)	328 (97.04)	71 (14.0)
Ate fewer meals than desired in a day	43 (25.44)	126 (74.56)	6 (1.78)	332 (98.22)	49 (9.7)
Had no food of any kind for a day	16 (9.47)	153 (90.53)	8 (2.37)	330 (97.63)	24 (4.7)
Went to sleep at night hungry	12 (7.10)	157 (92.90)	8 (2.37)	330 (97.63)	20 (3.9)
Went without food for a day & night	14 (8.28)	155 (91.72)	8 (2.37)	330 (97.63)	22 (4.3)

4.3.10 The proportion of household food insecurity

As presented in Figure 4.16, the overall proportion of household food insecurity was 80 (15.8%). Of this, the cases represented 69 (40.8%) and the controls 11 (3.3%), respectively. Sixty-nine (40.8%) households in the case group had experienced some extent of food insecurity in the four weeks before this study, as compared to 11 (3.3%) households in the control group ($p < 0.0001$). Of this, mildly food insecure 6 (3.6%) of the cases were compared to controls 1 (0.3%), moderately food insecure 38 (22.5%) of the cases were compared to controls 2 (0.6%), and severely food insecure 25 (14.8%) of the

cases were compared to controls 8 (2.4%) ($p < 0.0001$). While 100 (59.2%) of the cases and 327 (96.7%) of the controls were food secure, Figure 4.16 depicts the household food insecurity status of the study respondents in the 30 days preceding the study.

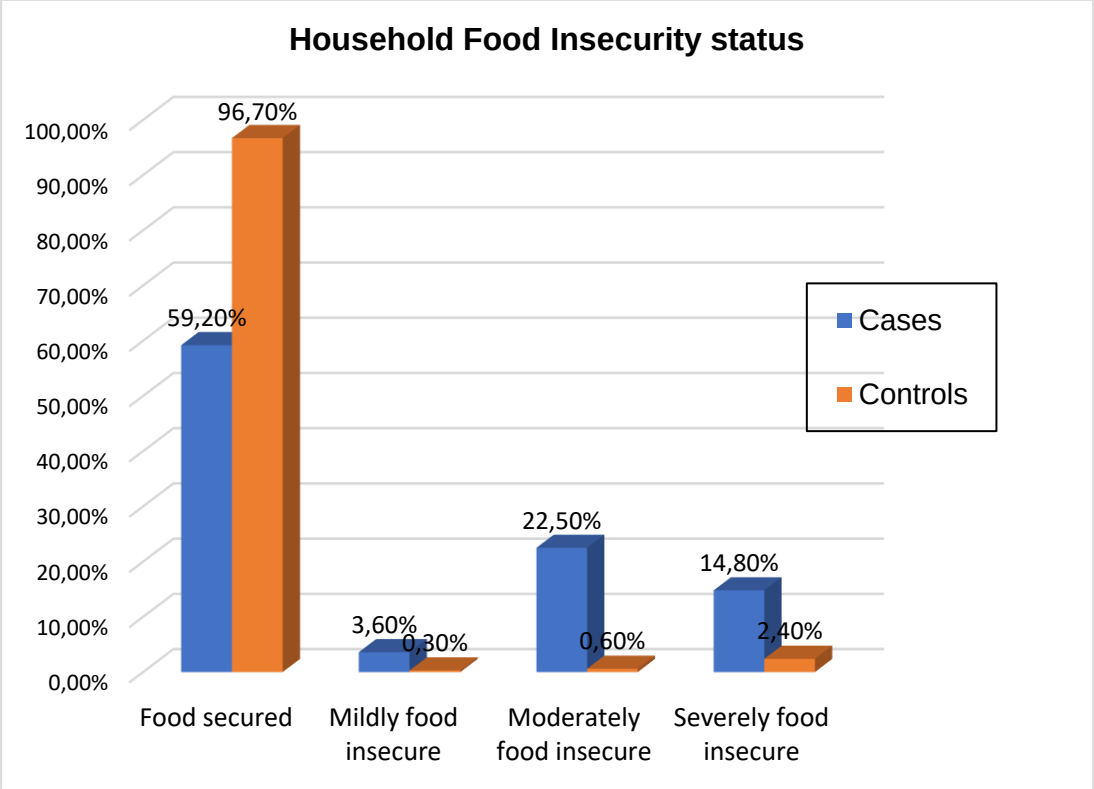

Figure 4.16: Household food insecurity status among the study participants in the 30 days preceding the study in Goba Referral Hospital and Bale Robe General Hospital (N=507)

4.3.11 Distribution of mental stress using SRQ-20 among the respondents

Figure 4.17 shows mental stress using the SRQ-20 of study respondents. The top three signs of mental stress that were commonly observed in respondents were headaches (126 (74.6%) in cases and 146 (43.2%) in controls; a total of 272 (53.6%) experienced headaches in both cases and the control group; the total number of cases and controls who reported feeling anxious, tense, or worried was 118 (69.8%) and 149 (44.1%), respectively. While 125 (74.0%) of cases and 44 (13.3%) of controls reported feeling easily tired, the number of cases and controls who reported sleeping badly was 94 (55.6%) and 33 (9.8%), respectively. Respondents experienced the least level of mental

stress; thus, 29 (17.2%) respondents in the case group explained crying more often than normal.

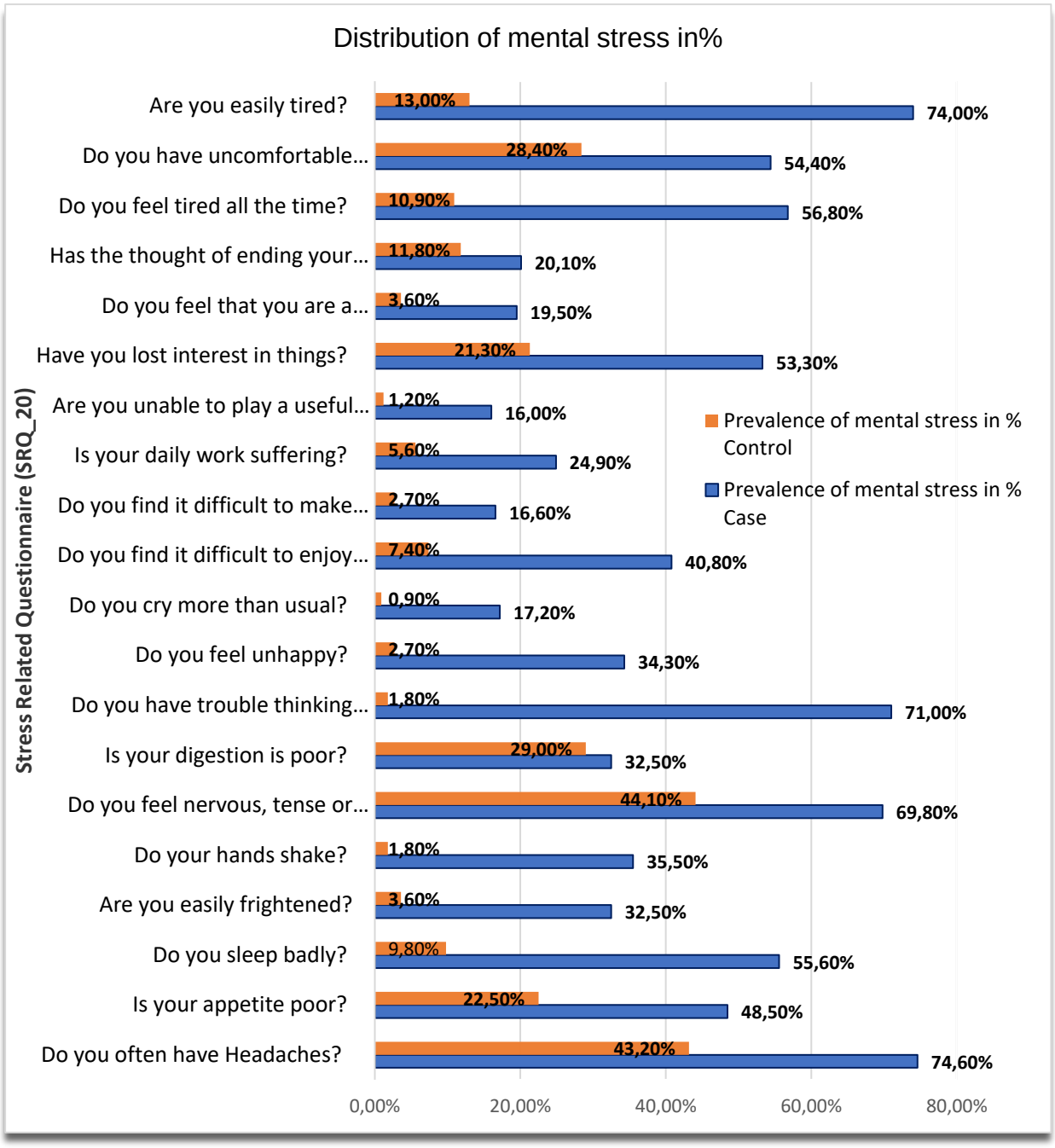

Figure 4.17: Distribution of mental stress using SRQ-20 among the respondents in the 30 days preceding the study in Goba Referral Hospital and Bale Robe General Hospital (N=507)

4.3.12 Distribution of mental stress levels using SRQ-20 among respondents

Mental stress was examined using a self-reporting questionnaire (SRQ-20) that had 20 variables. The distribution of the respondents' levels of mental stress is as follows:

The proportions of mild mental stress were 36 (21.3%) of the cases and 304 (89.9%) of the controls; moderate mental stress was 74 (43.8%) of the cases and 32 (9.5%) of the controls; moderately severe mental stress was 43 (25.4%) of the cases and one (0.3%) of the controls; and very severe mental stress was 16 (9.5%) of the cases and one (0.3%) of the controls (p =0.0001). All categories of mental stress among the cases group are higher than those among the controls group, with the exception of the mild category. Case respondents showed more effects of mental stress than control respondents, as indicated in Table 4.26.

Table 4.26: Distribution of the level mental stress using SRQ-20 among the study participants in Goba Referral Hospital and Bale Robe General Hospital) the 30 days preceding the study (N=507)

Variables	Study respondents type		Total	P-value
	Cases	Controls		
Mental stress score< 5(mild)	36 (21.3%)	304 (89.9%)	340 (67.1%)	
Mental stress score 5-9 (moderate)	74 (43.8%)	32 (9.5%)	106 (20.9%)	<0.001
Mental stress score 10-14 (Moderately severe)	43 (25.4%)	1 (0.3%)	44 (8.7%)	
Mental stress score >=15 (Very severe)	16 (9.5%)	1 (0.3%)	17 (3.4%)	

4.3.13 Mental stress related determinants of Type 2 Diabetes mellitus

Table 4.27 presents the mental stress related determinants of T2DM. Variables with a p value <=0.25 in a case of T2DM on crude analysis or bivariate analysis and those believed to have a biological relationship were fitted into the final model after adjusting for potential cofounders.

Respondents who had a poor appetite had an almost twofold increased risk of having T2DM compared to those who did not have a poor appetite (AOR = 2.152; 95% CI: 1.344, 3.445). Respondents who found it difficult to enjoy their daily activities were five times

more likely to have T2DM compared to those who found their daily activities easy to enjoy (AOR = 5.046, 95% CI: 2.685, 9.484). Respondents who lost interest in things had a nearly three times greater risk of having T2DM than those who did not experience similar feelings (AOR = 2.863; 95% CI: 1.813, 4.519). The study also showed that respondents who experienced discomfort in their stomachs had a twofold increased risk of having T2DM compared to those who did not (AOR = 2.024; 95% CI: 1.263, 3.243). When the other variables were fitted into the final model, there were no statistically significant differences between them.

Table 4.27 : Mental stress related determinants of type 2DM among the respondents from Goba Referral Hospital and Bale Robe General Hospital (N=507)

Variables		Study respondents type		Odds Ratio with 95%		P-value
		Case	Control	COR	AOR	
Is your appetite poor?	Yes	82 (48.5%)	76 (22.5%)	3.249 (2.188-4.824)	2.152 (1.344-3.445) **	0.001
	No	87 (51.5%)	262 (77.5%)		1	
Feel nervous, tense or worried	Yes	118 (69.8%)	149 (44.1%)	2.935 (1.982-4.345)	1.547 (0.970-2.468)	0.067
	No	51 (30.2%)	189 (55.9%)		1	
Find it difficult to enjoy your daily activities	Yes	69 (40.8%)	25 (7.4%)	8.639 (5.188-14.385)	5.046 (2.685-9.484) **	<0.0001
	No	100 (59.2%)	313 (92.6%)	1	1	
Find it difficult to make decisions	Yes	28 (16.6%)	9 (2.7%)	7.259 (3.339-15.780)	1.753 (0.677-4.540)	0.247
	No	141 (83.4%)	329 (97.3%)	1	1	
Is your daily work suffering	Yes	42 (24.9%)	19 (5.6%)	5.552 (3.110-9.913)	1.656 (0.798-3.434)	0.176
	No	127 (75.1%)	319 (94.4%)	1		
Lost interest in things	Yes	90 (53.3%)	72 (21.3%)	4.209 (2.824-6.272)	2.863 (1.813-4.519) **	<0.0001
	No	79 (46.7%)	266 (78.7%)	1	1	
Has the thought of ending your life ever been in your mind	Yes	34 (20.1%)	40 (11.8%)	1.876 (1.138-3.095)	0.536 (0.274-1.048)	0.068
	No	135 (79.9%)	298 (88.2%)			
Do you have uncomfortable feelings in your stomach?	Yes	92 (54.4%)	96 (28.4%)	3.012 (2.051-4.422)	2.024 (1.263-3.243) **	0.003
	No	77 (45.6%)	242 (71.6%)			

Footnotes; 1(Ref): reference, P-value < 0.05 * and <0.000**

4.3.14 Overall independent predictors of Type 2 Diabetes mellitus

The independent predictors of T2DM are presented in Table 4.28. Variables from previous logistic regression analyses that showed statistically significant differences were fitted into the model in an attempt to identify independent predictors.

The odds of developing T2DM were 4 times higher in respondents aged 50 years and older than in respondents under 50 years of age (AOR = 4.13; 95% CI: 1.39, 12.29). The odds of developing T2DM were 3.76 times higher in respondents who were males than in respondents who were females (AOR = 3.76, 95% CI: 1.22–11.64). The odds of being T2DM were reduced by 61% and 78.5% among respondents who had attended primary school and secondary school (grades 9–12) (AOR = 0.17; 95% CI: 0.04, 0.80) and (AOR = 0.22; 95% CI: 0.07–0.68), respectively.

The study also revealed that respondents with a medium wealth index were 91% less likely to develop T2DM than respondents with a low wealth index (AOR = 0.09; 95% CI: 0.02–0.39). The study also indicated that respondents who had ever smoked cigarettes were 5.48 times more likely to develop T2DM than those who did not smoke (AOR = 5.48, 95% CI: 1.31, 22.97).

Respondents who currently drank alcohol had an 89% lower chance of having T2DM than those who did not currently drink (AOR = 0.11; 95% CI: 0.04–0.336). Respondents engaged in vigourous work-related physical activity had a 68.9% reduced risk of having T2DM compared to those who did not engage in such activities (AOR = 0.314; 95% CI: 0.12, 0.79). The study also revealed that respondents who had a family history of DM had about 3.92 times the odds of developing T2DM than their counterparts (AOR = 3.92, 95% CI: 1.05, 14.62).

Moreover, the study indicated that respondents with food insecurity were 6.14 times more likely to develop T2DM compared to those with food security (AOR = 6.14, 95% CI: 1.38–27.35). The odds of being T2DM were 2.81 times higher among those who reported mental stress, like losing interest in things, compared to those who did not (AOR = 2.81; 95% CI: 1.13–6.97).

Table 4.28: Overall independent predictors of T2DM among the respondents from Goba Referral Hospital and Bale Robe General Hospital (N=507)

Variables		Study respondents type		Odds Ratio with 95%		P-value
		Case	Control	COR	AOR	
Permanent residence	Urban	107 (63.3%)	335 (99.1%)	0.015 (0.005-0.050)	0.015 (0.000-0.98) *	**0.049**
	Rural	62 (36.7%)	3 (0.9%)	1(Ref)	1	
Gender	Male	90 (53.3%)	118 (34.9%)	2.124 (1.458-3.093)	3.76 (1.22-11.64) *	**0.021**
	Female	79 (46.7%)	220 (65.1%)	1	1	
Age	<50	87 (51.5%)	269 (79.6%)	1	1	
	>=50	82 (48.5%)	69 (20.4%)	3.674 (2.460-5.488)	4.13 (1.39-12.29) *	**0.011**
Educational status	No formal education	64 (37.9%)	18 (5.3%)	15.704 (7.913-31.164)	1.024 (0.157-6.701)	0.980
	Primary (1-8)	40 (23.7%)	72 (21.3%)	2.454 (1.363-4.417)	0.169 (0.036-0.799) *	**0.025**
	Secondary (9-12) school	41 (24.3%)	142 (42.0%)	1.275 (0.726-2.239)	0.215 (0.068-0.680) *	**0.009**
	Diploma or Higher above	24 (14.2%)	106 (31.4%)	1	1	
Wealth index	Low	144 (85.2%)	151 (44.7%)	1	1	
	Medium	3 (1.8%)	36 (10.7%)	0.087 (0.026-0.290)	0.02 (0.001-0.345) *	**0.008**
	High	22 (13.0%)	151 (44.7%)	0.153 (0.092-0.252)	0.622 (0.217-1.787)	0.378
Ever smoked cigarettes	Yes	24 (14.2%)	12 (3.6%)	4.497 (2.189-9.238)	5.48 (1.308-22.97) *	**0.020**

	No	145 (85.8%)	326 (96.4%)	1		
Currently drinks alcohol	Yes	17 (22.1%)	75 (48.7%)	0.29 (0.160-0.557)	0.11 (0.036-0.37) **	**<0.001**
	No	60 (77.9%)	79 (51.3%)	1		
Work involves vigorous-intensity activity	Yes	92 (54.4%)	96 (28.4%)	1		
	No	77 (45.6%)	242 (71.6%)	0.33 (0.226-0.487)	0.314 (0.123-0.799) *	**0.015**
Food security status	Food secured	100 (59.2%)	327 (96.7%)	1	1	
	Food Insecure	69 (40.8%)	11 (3.3%)	20.51(10.4481-40.269)	6.14 (1.376-27.35) *	**0.017**
Lost interest in things	Yes	90 (53.3%)	72 (21.3%)	4.209 (2.824-6.272)	2.81 (1.130-6.968) *	**0.026**
	No	79 (46.7%)	266 (78.7%)	1		
Find it difficult to make decisions	Yes	28 (16.6%)	9 (2.7%)	7.259 (3.339-15.780)	5.52 (1.745-17.455) *	**0.004**
	No	141 (83.4%)	329 (97.3%)	1		

Footnotes; 1(Ref): reference, P-value < 0.05 * and <0.000**

4.4 CONCLUSION

The results have been provided in this chapter. The prevalence of T2DM, descriptions of risk factors for T2DM, knowledge, attitudes, risky behaviours, and prevention of T2DM have all been addressed in Section one. Moreover, the determinants of type 2 DM related to sociodemographic, behavioural, physical, biological, perception, and mental stress have been described.

CHAPTER 5 - DISCUSSION OF RESEARCH FINDING

5.1 INTRODUCTION

In the previous chapter, the results of the descriptive cross-sectional study and the case-control study were provided in sections one and two, respectively. The results of the study are discussed in this chapter. There are two sections to the discussion: Section I discusses Phase I of the study, which is a descriptive cross-sectional study, and Section 2 discusses Phase II of the study, which is a case-control study.

5.2 DISCUSSION FOR PHASE 1

5.2.1 Socio-demographic characteristics of study respondents

This study found that the majority of males were unavailable at home during the daytime, with 57.6% (n=316) of the respondents being female and 42.2% (n=233) being male. This can probably be attributed to the fact that most females are housewives and so confined to their homes. The current study also found that the majority (28%) of respondents were housewives. This finding is indeed very similar to that of studies carried out in Gondar town, north-west, Ethiopia (Wolde et al 2020:3). The results show that more respondents (37%) are in the middle-age group (28–37). This finding is also consistent with Gondar town, study from north-west Ethiopia (Wolde et al 2020:3).

The average age of the respondents is 36.58 years (SD ± 13.47) where male respondents are slightly older than females in terms of age. The majority of the study respondents (73.2%) are married. Two hundred twelve (38.62%) of the study respondents attended a secondary school. Nearly two-thirds (65.25%) of the total respondents are followers of Orthodox Christianity. From the total number of respondents, two-thirds (65.8%) reported that they belong to the Oromo ethnic group, which is the dominant ethnicity in the area. This is attributable to the location and geographical setting in which the current study was conducted.

The mean family size in the households of respondents was 4.10, with a standard deviation of 1.77 persons, a median of four, and a range of one person to nine. This is in line with Ethiopia's estimated average family size (CSA 2016).

5.2.1 Respondents' knowledge of Type 2 Diabetes mellitus risky behaviour and its prevention

Knowledge of T2DM-related risky behaviours is important to prevent T2DM in the adult population. One of the objectives of this study was to better understand the knowledge of risky behaviour and T2DM prevention activities among the adult population. The results of this study could also be used as a starting point for developing strategies for the prevention of T2DM. In order to develop strategies for T2DM prevention, it is important to determine the level of knowledge and risky behaviours associated with T2DM prevention among the general population (Herath et al 2017:4).

In this regard, the respondents' level of knowledge about DM was assessed using general and specific questions about definition, diagnosis, risky behaviours, prevention, and complications. Answers were given in the form of categorical statements "Yes," "No," and "Don't know." Each correct response was given a score of 1, while wrong responses offered a score of 0.

In the current study, 88.9% (n=488) of respondents when asked about DM replied that they had heard about it. This study was almost similar to a study conducted in Gondar city, north-west Ethiopia, where 90.4% of respondents had heard of DM (Alemayehu et al 2020:5). This finding was also closely comparable to a study from Punjab (Pakistan), where 14% of respondents had never heard the term "DM" before (Gillani et al 2018:5). However, the results of this study were lower than those of a study from southern Sri Lanka, where it was reported that 97% of respondents were aware of DM (Herath et al 2017:4).

More than half of the respondents (55.7%) stated that their main sources of information about DM were television or the media. This result was inconsistent with a study of reproductive-age women from Arba Minch town, south Ethiopia, which showed that 32.5% of them had heard about DM from television or other media. However, in the same study, friends or relatives (47%) were the main source of information regarding DM (Tesfaye et al 2022:4).

In response to a general question on the normal fasting blood glucose level of adults, very few (3.7%, n = 17) respondents provided the correct response, the expected value of 70–110 mg/dl. However, this was considerably lower than a study from southern Benin, where 64.7% of respondents were aware of the normal fasting blood glucose level (Alaofè, Hounkpatin, Djrolo, Ehiri & Rosales 2021:4). The discrepancy in results may be explained by the different study populations between the current study and Benin's, where Benin's study population was composed of diabetic patients with more awareness of the disease than the general population.

This study also revealed that two-thirds of the respondents were aware of the signs and symptoms of DM, including excessive urination (67.7%), excessive thirst and hunger (67.6%), and excessive weight loss (63.6%). This finding was consistent with a study carried out in Debre Berhan town, north-east Ethiopia, in which it was reported that 60.7% of respondents had good knowledge about DM symptoms (Shiferaw et al 2020:6.9). In contrast, the current study results are higher than those of the studies conducted in Nigeria on the knowledge of DM (18.2%) and in Kenya on DM signs and symptoms (29%). This could be due to a lack of T2DM information dissemination as well as a difference in the study population.

In the current study, slightly more than half of the respondents (54.8%) stated that genetic factors may increase the risk of developing DM. This result was almost in line with a study that from Pakistan, where a 51.6% genetic factor may increase the development of DM (Gillani et al 2018:7-9). However, it was much lower than that of a Sri Lankan study, where 73% of respondents said that a family history of DM was a risk factor (Herath et al 207:4).

The study also showed that more than half of the respondents correctly identified DM as an incurable disease (68.1%), a chronic disease (79.2%), and a sudden death (70.3%). This was almost comparable with a study from the Red River Delta region of Vietnam that observed that 63.4% of respondents knew that T2DM can lead to death (Binh, Phuong, & Nhung 2015:10). The finding of this study was also higher than that of a study from Riyadh, Saudi Arabia, which found that 48.6% of respondents aware that DM is not curable had high levels of knowledge (Alqahtani et al 2020:1–14).

In this study, respondents correctly identified several complications of DM, including kidney damage (34.2%), heart disease (64.5%), blindness (65%), and loss of foot sensation (19.7%). This study found, which is much higher than the results of the previous

study from Qatar, that eye damage (49%) and heart disease (35%); (Al-Mutawaa et al 2022:4) In the current study, 65.6% of respondents correctly identified that DM can result in eye damage or blindness, which was considerably higher than that of the Pakistani study by Gillani et al (2018:7-9).

With regard to risk behaviours for developing T2DM, 69.4% of respondents correctly identified excessive sugar consumption as a risky behaviour, followed by physical inactivity (56.8%); 53.4% of respondents correctly identified excessive alcohol consumption; near to above half of respondents (52.2%) correctly identified smoking as a risk factor for T2DM; and 43.9% of respondents correctly identified stress in daily life as a risk factor for T2DM. In this study, risk behaviour for the development of T2DM was lower as compared to a study done in southern Sri Lanka, where more than half of the respondents correctly answered each of the questions on risk factors for DM. For example, a decrease in physical activity may lead to T2DM (84%), and nearly 90% were aware that consuming more sugar might lead to T2DM (Herath et al 207:2).

Likewise, in this study, slightly more than half of the respondents (52.2%) mentioned that cigarette smoking is a risky behaviour for developing T2DM, which was considerably higher than the finding from Qatari nationals and long-term residents, where 88% of respondents were unaware that smoking cigarettes or shisha is the leading cause of T2DM (Al-Mutawaa et al 2022:4). This study also observed that 43.9% of respondents correctly identified daily stress as a risk factor for T2DM, which was much higher than the 19% of Qatari nationals and long-term residents aware of the effects of stress as a risky behaviour for T2DM (Al-Mutawaa et al 2022:4). In the current study, it was also shown that physical inactivity was identified as a risky behaviour by 56.8% of respondents, while 53.4% of respondents correctly identified excessive alcohol consumption, which was higher than the study conducted in Qatar. Other risk factors highlighted by respondents included drinking sugary drinks on a regular basis (39%), and physical inactivity was reported by 32% (Al-Mutawaa et al 2022:4).

Given all of this, respondents were asked if T2DM is a disease that is preventable or not. Of those who responded, 64.8% said that T2DM is a disease that is preventable, leaving the rest, 35.2%, in doubt. This finding was higher than those from a study of Qatari nationals and long-term residents; 49% of respondents stated that T2DM can be prevented, but 51% of respondents did not know that T2DM is a preventable disease (Al-

Mutawaa et al 2022:4). However, this finding was lower than in a previous Sri Lankan study, which found that 83% of people knew that T2DM can be prevented with appropriate measures (Herath et al 207:2–3).

As stated in Chapter 3, a single knowledge variable with three possible ordinal responses was calculated from 26 knowledge questions to indicate the respondents' overall level of knowledge regarding T2DM risky behaviour and prevention. In this regard, a total score of 26 was calculated. Score ranges of 0–13, 14–18, and 19–26, respectively, were used to categorise knowledge into low, medium, and high. A total of 549 respondents (42.6%, n=282) were found to have "low level" knowledge of T2DM risky behaviour and prevention, 38.3% (n=230) to have "medium level" knowledge, and 19.1% (n=100) to have "high level" knowledge. The findings of the current study indicated that T2DM knowledge levels were unsatisfactory, with only 19.1% of respondents having high category knowledge and 38.2% having a medium category knowledge level, as opposed to a much higher 42.6% having a low category knowledge level.

Accordingly, the respondents of the current study, who were categorised as having low knowledge (42.6%) and medium knowledge (38.3%), respectively, are higher than the non-diabetic and diabetic respondents in Bangladesh, which shows that the T2DM subjects had low and medium knowledge scores of 15% and 17%, respectively. However, in the high knowledge category (19.1%), the current study was much lower than the Bangladesh study, which had a high knowledge category of 68% (Fatema et al 2017:5). Similarly, the finding of this study in the low category of knowledge level was much higher than that of a study done among Sri Lanka's general public, which reported a low category of knowledge of 23%. The finding of having medium-category knowledge was consistent with the study done in Sri Lanka (39%). Additionally, in this study, the finding in the high category of knowledge level was much lower than that of the former study, which reported 37% (Herath et al. 2017:4).

Likewise, the findings of the current study indicated that the high category of knowledge was lower than the study of the population of Riyadh, Saudi Arabia, which found that 26.2% of respondents had high levels of knowledge (Alqahtani et al 2020:1–14), and a study of the Jordanian population, where 53.3% of the respondents had high knowledge

levels in Jordan (Alsous, Abdel Jalil, Odeh, Al Kurdi & Alnan 2019:5). This discrepancy could be attributed to sociocultural differences between the populations.

According to the current survey's findings, the medium category of knowledge was slightly higher than the 33.3% found in a study of Jordan's population (Alsous et al 2019:5). This finding was also much lower than, in terms of the medium category of knowledge, a study of the population of Riyadh, Saudi Arabia, which found 46% (Alqahtani et al 2020:1–14).

Besides, the current study findings revealed that the low category of knowledge was far higher than in a study of the population in Riyadh, Saudi Arabia, where 27.8% of the respondents had a low knowledge level (Alqahtani et al 2020:1–14), and a study of the population in Jordan, where 13.1% of the respondents had a low knowledge level (Alsous et al 2019:5). As the aforementioned three categories of knowledge disparities might be explained by differences in the study participants, who were from the general population versus diabetic patients, and due to some differences in the questions that were asked in the various studies.

On the other hand, in this study, the mean knowledge score of the respondents was 14.78, which was classified as a medium level of knowledge. This score was lower than those reported in a pilot study conducted in Sri Lanka (16.5 ± 0.51; and in the population of Jordan (17.9 ± 4.14) (Herath et al 2017:4; and Alsous et al 2019:1–7).

5.3 PERCEPTIONS TOWARDS TYPE 2 DIABETES MELLITUS RISKY BEHAVIOUR AND PREVENTION AMONG ADULTS IN THE BALE ZONE ADMINISTRATIVE TOWN IN TERMS OF THE HEALTH BELIEF MODEL

5.3.1 Perceived susceptibility of T2DM

In this study, perceived susceptibility refers to the respondents' perceptions of behavioural risk factors for T2DM, their likelihood of contracting the disease, and the magnitude of the health problem in Ethiopia. In light of this, only 22% (n=121) of the total respondents (n=549) who were surveyed said that they concurred that everyone is at risk of developing T2DM, and nearly a third (31%) indicated that they were susceptible by responding that they believed they would contract the disease. Besides, 82% (n=450) of the respondents believed that DM was Ethiopia's health problem. Less than a quarter of respondents believed that they might develop T2DM in the future.

With regard to the overall perceived susceptibility of T2DM, the mean score was calculated. The mean score of perceived susceptibility to T2DM in the current study was 14.41 ± 2.95SD). High perceived susceptibility seems to lead to better performance prevention behaviours. Therefore, the presence of this high perceived susceptibility would cause them to take the lead in prevention behaviours. In this regard, the results of the current study showed that 56.8% (n=312) of the respondents were above the mean score, and they perceived themselves as susceptible to T2DM. The result of this study was higher than a study conducted in Debre Berhan town (20.1%) (Shiferaw et al 2020:6–9). The finding of this study was also higher than a study conducted in the Italian population, which reported that more than two-thirds (69.3%) of respondents had a low risk perception of developing DM, and further, their study reported that a large majority of the respondents were not worried about developing DM (Pelullo, Rossiello, Nappi, Napolitano, & Di Giuseppe 2019:3). Moreover, the findings of this study were higher than those of a study done in Rwanda, which revealed that almost a third of respondents (31.2%) perceived that they could not develop DM, and a majority of respondents thought that there was almost no chance, or no chance at all, that they would develop DM in the next 10 years'. This implies a low perceived risk of developing DM among respondents in

the Rwanda study (Mukeshimana & Nkosi 2014:541). This difference may be due to the different methods of analysis between the current study and previous studies. This might be explained by differences in the study population's socioeconomic status, lifestyle, and time gap.

5.3.2 Perceived severity of Type 2 Diabetes mellitus

According to the health belief model, people are more likely to take preventative action if they perceive a health risk as serious, feel personally susceptible, and believe there are fewer costs than benefits to doing so.

In the current study, 86.5% of respondents (n=475) agreed that T2DM is a chronic disease. Likewise, 90.7% of respondents (n=498) and 92.2% of respondents (n=506), respectively, agreed that T2DM causes sudden death and that its complications are dangerous for life. To clarify respondents' perceptions of the severity of T2DM in relation to risky behaviours that are both modifiable and non-modifiable, 80.9% (n=444) respondents agreed that T2DM is a more severe disease in elderly people with non-modifiable factors.

The perceived severity of T2DM was assessed using eleven questions. The mean perceived severity score for T2DM mellitus was 20.2 ± 1.78 SD. The current study revealed that, among HBM constructs, the perceived severity of T2DM was found to be 61%. A similar result was reported from Debre Berhan town, where 62.4% of respondents thought DM was a serious disease (Shiferaw et al. 2020:6).

Conversely, this finding of this study was lower than those of studies conducted in Rwanda (79.4%) of respondents considered DM to be a severe disease (Mukeshimana & Nkosi 2014:541) and Namibia, where 71% reported DM to be a serious disease (Kambinda 2017:34). This may reflect that individuals are not aware of the seriousness of a disease, which may be due to a lack of educational interventions to raise community awareness of these health concerns.

5.3.3 Perceived benefit of preventive activity of Type 2 Diabetes mellitus

Respondents in the study highlighted the benefits of applying T2DM prevention activities. In light of this, nearly two-thirds (64.7%) of respondents agreed that following the suggested behaviours can help prevent T2DM. This result is consistent with a study from Debre Berhan, north-east Ethiopia, where almost 67% of respondents thought that undergoing regular health visits would help detect DM early and save their lives (Shiferaw et al 2020:6).

5.3.4 Perceived barrier to Type 2 Diabetes mellitus prevention measures

The prevention of T2DM may be hindered by several obstacles. In the current study, 61.4% of respondents (n=337) agreed that they lacked knowledge about T2DM preventive activities, and 46.8% (n=257) said that other diseases should take priority over T2DM prevention activities. Almost 18% (n=96) agreed that one of the challenges to taking part in T2DM preventive activities is the difficulty in finding a health institution where they could get tested for blood glucose.

In this study, almost nearly two-thirds 65.0% (n=357) agreed that they are not encouraged by family or friends to engage in T2DM preventive activities, and 55.4% (n=304) said they feel these activities need time, money, and space.

In terms of perceived barriers, the overall perceived barriers of T2DM were calculated using a mean score. The mean score of perceived barriers to T2DM in this study was 6.84 ± 3.59SD. The results of this study show that more than two-fifths of the respondents (42.8%) were above the mean score, and they perceived barriers to applying T2DM prevention activities, which is higher than a study from Debre Berhane Town (27%) of respondents' experiences of barriers to undergoing screening and applying lifestyle modification for DM prevention (Shiferaw et al 2020:6). This difference may be due to the different methods of analysis between the current study and previous studies.

5.3.5 Cues action of Type 2 Diabetes mellitus

The community had received signals to take action on T2DM prevention. As a result, 43.4% of respondents had cues to take action in order to prevent T2DM. The current study showed that a very small proportion of respondents were following the recommended preventative behaviours. For instance, only 11.1% and 23.7% of respondents said they received adequate information about T2DM from mass media, heard from a health extension worker, or were given advice by friends and family, respectively. The discrepancy could be due to differences in the study population's knowledge.

5.3.6 Self -efficacy of Type 2 Diabetes mellitus

Respondents' perceived self-efficacy reflects confidence in their capacity to perform a new health behaviour. A person with a higher level of confidence will be more likely to engage in the recommended activities for preventing T2DM. In this regard, just above half (51.5%) of respondents have the self-efficacy to apply preventive activities for T2DM. The result of the current study showed that slightly more than one-third (35.7%) of the respondents assumed themselves to be confident in their ability to perform behaviours to prevent T2DM. This finding indicated that there are still gaps in beliefs about T2DM prevention activities.

5.3.1 Likelihood of taking part in preventive behaviour for Type 2 Diabetes mellitus

The likelihood of taking part in T2DM preventive behaviour is determined by subtracting the weighted mean scores of the benefits from the weighted mean scores of the barriers among respondents. The current study found that respondents were 56.8% likely to engage in T2DM preventive behaviours. This finding is supported by the findings of previous studies, which showed that perceived benefit was associated with good self-care behaviours and perceived barrier was associated with poor self-care practises (Adejoh 2014:1–6; Melkamu, Berhe & Handebo 2021:2145; Mariye et al 2018:4)

The current study explained T2DM prevention behaviour using HBM components, such as perceived benefits and perceived barriers, and determined 56.7% of the variance, which was higher than studies by Afrasiabi, Aeen & Jahromi (2022:1267), which

determined 19% of the variance for T2DM, and Soltani et al (2017:163), which determined 29% of the variance for treatments in T2DM prevention behaviour. The discrepancy could be the result of different measurement methods, the study population's lifestyles, and variations in the study population's cultural preferences between the prior study population and the current study population.

5.4 BEHAVIOURAL RISK FACTORS OF STUDY RESPONDENTS

The main behavioural risk factors for T2DM in the current study are physical inactivity, an unhealthy diet, obesity, smoking cigarettes, and alcohol intake.

5.4.1 Cigarette smoking, Khat chewing and Alcohol consumption

5.4.1.1 Cigarette smoking

The findings of this study found that 6% and 2.7% of the respondents reported they had smoked cigarettes at some point in their lifetimes and currently smoke cigarettes, respectively. Among current smokers, 80% (n=12) reported being daily smokers. The current smoking rate in this study was 2.7%, which is comparable to the 2.5% found in a study conducted in a selected town in western Ethiopia (Feyisa et al 2022:57). This finding was lower than studies in Jima town, Ethiopia (7.6%) (Yunka et al 2020:2925), in Hossana town, Ethiopia (4.8%); (Dereje et al 2020:4), and in Guji Zone, Ethiopia (4.1%) (Utura & Fikrie 2022:5-8). However, this finding is higher than the study from in Gondar town, Ethiopia, which found 1.94% (Wolde et al 2020:3). This disagreement might result from the studies age difference and the cultural variations across the populations. This could also be partly explained by the fact that self-reported respondents' data indicates a lower smoking prevalence in the current study area.

Furthermore, the current cigarette smoking rate of male respondents (41.2%) was much higher than that of female respondents (0.49%) in this study. There may be a difference in the prevalence of current smoking between males and females because smoking is socially and culturally unacceptable among women. The possibility that female cigarette consumption is underreported cannot be ruled out.

5.4.1.2 Khat chewing

The findings of this study showed that 9.1% (n=50) of study respondents had chewed Khat at some point in their lifetime, and 6.0% (n=33) of respondents reported they currently chew Khat. Of these total current chewers, 24.2% (n=8) of respondents chewed daily, while 57.3% (n=19) reported chewing 3–4 days a week and 1-2 days per week. This was lower than that of Yunka et al (2020:2925), which could be explained by changes in the khat chewing practises due to the increased khat production in the Jimma than Bale Zone. Additionally, the discrepancy in this study might be lower than that in other studies as a result of self-reported data from face-to-face interviews, which may have underreported the prevalence rate of Khat chewing.

5.4.1.3 Alcohol consumption

Regarding respondents' alcohol consumption status, more than one-third (36.4%) of study respondents said that they had drunk during their lifetime. About 28.2% (n=155) of the respondents reported being current alcohol drinkers. Out of the total respondents who currently drink, 58.7% (n=91) reported that they drink 1-2 days per week, followed by 31% (n=48) of them who said they do so 3-4 days per week, and the least was 5.8% (n=9). The study found that about 28.2% of the respondents currently consume alcohol. This was lower than that of the studies in Gondar by Wolde et al (2020:4) and higher than those studies conducted in the Guji Zone, Oromia Region, Ethiopia, where 36.6% of the population is currently drinking alcohol (Utura & Fikrie 2022:4). This finding was also much higher than that of a study from Hosanna Town, south Ethiopia, in which it was found that 15.6% of respondents currently use alcohol (Dereje et al 2020:1–8). The differing cultural backgrounds of the aforementioned populations may be the explanation for these discrepancies.

5.4.2 Dietary factors of respondents

Diet has a significant role in the prevention of the incidence of T2DM. Evidence shows that increased consumption of fruits and vegetables is the main dietary factor in the prevention of T2DM. This study found that most (92%) of the respondents consumed fruits at least once a week, with a mean intake of fruits per week of 3.50 (±0.69) days.

The result of this study is comparably higher than a study on the magnitude of T2DM in adults in selected towns in western Ethiopia. That study showed that the average number of days that respondents consumed fruits and/or vegetables per week was 1.26, with a SD of 1.7, and that 19.2% of respondents revealed that they did not consume fruits and/or vegetables on a daily basis (Feyisa et al 2022:57). This finding was also higher than that of a study from Gondar, Ethiopia, which found that 56.7% of respondents did not eat any fruits in a week (Wolde et al 2020:4). The low consumption of fruits and vegetables may be explained by the cultural context, where people prefer high-calorie diets over fruits and vegetables.

The WHO has recommended the public consume more than 400 g, or five portions, of combined fruit and vegetables each day to lower the risk of dietary factors and reduce the incidence of T2DM(Who & Consultation 2003: 1-149). However, only a very small percentage of respondents (3%) report eating fruit on a daily basis.

With regard to salt consumption, few respondents (10.9%, n=60) reported that they ever add extra salt to their plate after food has been prepared, which was much lower than the study from Guji Zone Ethiopia, where 62.9% of respondents added salt to their plates after food preparation (Utura & Fikrie 2022:5).

5.4.3 Physical activity

Physical inactivity is the fourth-most significant risk factor for NCDs, including T2DM mortality, and is responsible for more than 3.2 million deaths worldwide (Riley, Gouda & Cowan 2017:7; Juma et al 2018:1–12). Increasing physical activity has long been seen as the cornerstone of preventing and managing T2DM (Aune et al 2015:529).

Evidence from multiple studies has shown that engaging in regular physical activity of any kind (resistance exercise, aerobic exercise), intensity (low, moderate, vigorous), and setting (work/home, leisure, commuting) can delay the onset of T2DM and GDM by 25–40% (Aune et al 2015:529; Aune et al 2016:967; Bohn et al 2015:1536).

With respect to physical activity, this study assessed the study respondents' participation in a range of physical activities, including those related to their work, travel, and leisure, as well as the intensity of those activities. In terms of their experience with vigorous physical activity-related work, out of a total of 549 respondents, 43.2% (n=237) reported that they participated in vigorous-intensity physical activity-related work, and of these,

42.2% (n=100) tend to engage in vigorous-intensity physical activity-related work for at least 10 minutes daily. This is higher than the figure from the study on government employees conducted in Guji Zone, Oromia region, Ethiopia (Utura & Fikrie 2022:5-8), which may be explained by differences in the work-related behaviours and experiences of the two demographic groups. Another possible explanation, for instance, is that the Guji Zone study on civil servants observed that their lower levels of physical activity than in the current study may be due to sitting for a longer period of time.

Moreover, only one fifth of respondents (20.2%, n=112) reported that they performed vigorous-intensity sports activity in a week. The finding of this study is also lower than that of a study from Gondar town, in which 64.9% of the respondents had at least moderate physical activity on a typical day (Wolde et al 2020:4). Despite the fact that walking is important for physical activity and a preventative measure against obesity and T2DM, this study shows that some respondents (18.2%) do not even walk for the daily requisite 10 minutes as recommended by the WHO.

5.4.4 Physical measurements

The physical measurements were done to determine the body mass index (BMI), waist-to-hip ratio, blood pressure, and waist and hip circumferences, the distribution of which is shown in Tables 4.9 and 4.10, respectively.

The mean BMI (SD±) for respondents was 22.75 (SD±3.35 kg/m2). The mean BMI of the current study was comparably similar to that of the studies from Bahir Dar city, north-west Ethiopia, by Bantie et al (2019:4), which reported 22.9 (±3.36 kg/m2), and western Ethiopia by Feyisa et al (2022:1–9), which reported 22.69 (± 3.41 kg/m2). This was higher than the mean BMI study from north-west Nigeria by Sabir et al (2017:168), which was reported (21.5 kg/m2 ± 4.0). However, the mean BMI of this study was lower than the mean BMI of the studies reported from Hosanna town, southern Ethiopia, at 23.6 ± 3.4 kg/m2 (Dereje et al 2020: 4-5) and Guji zone, Ethiopia, at 24.41 ± 4.02 kg/m2 (Utura & Fikrie 2022: 5-8). The discrepancy might result from a difference in lifestyle.

On the other hand, the result of this study showed that 20.4% of respondents are either overweight or obese, with females being much more obese (27.22%) than males (12.02%). This is congruent with study results from Gondar town, Ethiopia (Wolde 2020: 3–4). This is higher than a study from southern Ethiopia, which reported 6.5% (Zekewos

et al 2081:455), Hosanna town, Ethiopia, by Dereje et al (2020:4-5), and Bahir Dar city, north-west Ethiopia, which reported 34.5% (Bantie et al 2019:3–4). However, this result was lower than that of studies conducted in Guji Zone, Ethiopia (42%) (Utura & Fikrie 2022:5-8); Mizan-Aman town, south-west Ethiopia, which reported 24.6% (Aynalem & Zeleke 2018:3–4). The disparity in the burden of overweight and obesity across studies might be related to the study population's inadequate intake of fruits and low levels of physical activity. Additionally, a study from the Guji Zone found that government employees had sedentary lifestyles due to an increase in the number of overweight and obese people.

The classifications for male waist circumference (WC) are" < 94 cm=normal" and > = 94 cm = high," whereas the classifications for female WC are "< 80 cm =normal" and > = 80 cm =high," respectively. In this regard, the mean WC among respondents was 83.37 cm (± 9.75 cm), and females had a higher mean WC (84.13 cm ± 9.83 cm) than males (82.34 cm ± 9.83 cm; p <0.0001). The overall proportion of high WC was 46.1%; again, females had a substantially higher proportion than males (70.57% versus 12.88%). This figure was nearly comparable to the finding of a study from Mizan-Aman town, 48.8% (Aynalem & Zeleke 2018:3–4). This result was slightly higher than studies from Dessie town, northeastern Ethiopia (42.8%) (Endris, Worede &Asmelash 2019:2802); China (32.69%) (Li et al 2022:4-6); and Hawassa District, southern Ethiopia (43.3%) (Seifu, Tsegaw, Haji & Ejeso 2020:4573-75). Additionally, the aforementioned finding was much higher than studies in southern Ethiopia, which had a high WC of 14.3% (Zekewos et al 2081:455) and Jimma Town, 23.7% (Yunka et al 2020:2925).

Likewise, the mean waist-to-hip ratio (WHR) for both sexes was 90 (± 6.4 cm). Males showed a significantly (p <0.003) higher level (91.0 ± 6.8 cm) than females (89.0 ± 6.1 cm). A substantial proportion of respondents had a high waist-hip ratio (69.8%), which was found to be higher among females (80.7%) than males (54.94%) and also higher than recommended. This figure was lower than a study by Yunka et al (2020: 2925) from Jimma Town, South-West Ethiopia, which reported 73.4%.

In this study, males were more likely than females to have raised blood pressure. Similar findings were reported in other studies that showed that males had higher blood pressure than females.

A raised blood pressure was identified in 26.2% of the respondents (defined as having SBP >= 140 mmHg and/or DBP >= 90 mmHg or being treated with medication).

In this study, the mean systolic (125.63 (SD ±13.53 mmHg) and diastolic (83.24 (SD ± 8.77 mmHg) blood pressure readings were almost comparable to those found in Bahir Dar city in north-west Ethiopia, which reported mean SBP and DBP scores of 124.2 (SD ±13.53) mmHg and 79.2 (SD 8.3) mmHg, respectively (Bantie et al 2019:3–4). This finding was higher than that of a study from southern Ethiopia, which found mean SBP to be 115 (SD ±19.6) mmHg and mean DBP to be 74.6 (SD ±12.6) mmHg (Zekewos et al 2081:455). However, this finding is lower than a study from north-west Nigeria, where the mean SBP was reported to be 134.5 (SD: 13.9) and the mean DBP was reported to be 82.9 (SD: 13.0) mmHg (Sabir et al 2017:168).

Furthermore, out of the 549 respondents in the study, 16.9% (n = 93) had systolic blood pressure that was greater than or equal to 140 mmHg. This result was higher than that of studies conducted in Dessi town, north-east Ethiopia, at 10.4% (Endris, Worede & Asmelash 2019:2802), and in southern Ethiopia at 12.8% (Zekewos et al 2081:455). Similar to this, 19.9% (n = 109) of respondents had diastolic hypertension, or blood pressure that was >=90 mmHg. This finding was higher than studies done in Dessi town, northeastern Ethiopia, where DBP was 10.4% (Endris, Worede & Asmelash 2019: 2802), and southern Ethiopia, where DBP was 12.8% (Zekewos et al 2018: 455).

As was mentioned above, the proportion of overall hypertension (both diastolic and systolic blood pressure) was 26.2%. This finding was higher than the previous studies in Ethiopia and other countries: Hawassa district, south Ethiopia, 17.8% (Seifu et al 2020: 4573); Jimma town, south-west Ethiopia, 21.2% (Yunka et al 2020: 2925); and Miza-Aman town, south-west Ethiopia, 18.2% (Aynalem & Zeleke 2018: 3–4). However, the finding was lower than that of a study from North India and Punjab (36%) (Tripathy, Thakur, Jeet, Chawla, Jain, Pal, Prasad & Saran 2017:4). The figure was also much higher than findings from Addis Ababa, which reported 9.2% (Sahile & Bekele 2020: 502–503), Gondar Town, northern Ethiopia, 11.6% (Wolde et al 2020: 3–4), Bahir Dar City, northwestern Ethiopia, 8.2% (Bantie et al 2019: 3–4), China's 12.2% (Li et al 2022: 4-6), and Southern Ethiopia's 8.1 %(Zekewos et al 2018: 455). In this study, males were more likely than females to have raised blood pressure. Similar findings were reported in other studies that showed that males had higher blood pressure than females.

This study used fasting capillary blood glucose (FBG) testing for biochemical measurements. In this regard, a person was regarded as having raised blood sugar if their fasting capillary blood sugar was greater than or equal to 126 mg/dL or if they were pre-diabetic and receiving medication for their DM. According to the United States, impaired fasting glucose (pre-diabetes) is defined as a fasting glucose concentration of 100–125 mg/dL (5.6–6.9 mmol/L) (American Diabetes Association 2014:S81–S90).

The mean FBS of respondents was 93.68 (SD ± 19.45 mg/dl), with a minimum of 62 and a maximum of 318. This figure was comparable to that recorded in a study from the Democratic Republic of the Congo (Mawaw et al 2017:4), which was 93.9 (SD ±17.5 mg/dL). Similarly, this study found that 16.7% and 6.7% of respondents had impaired fasting blood glucose (pre-diabetes) and raised blood sugar (DM), respectively.

5.5 PREVALENCE OF TYPE 2 DIABETES MELLITUS

Evidence shows that developing countries like Ethiopia have seen an increase in the prevalence of DM and the related modifiable risk factors (Animaw & Seyoum 2017:1–10; Aikins, de G & C Agyemang 2017:1–8; & Gowshall &Taylor-Robinson 2018:255). A community-based, cross-sectional study was conducted to determine the prevalence of T2DM and related risk factors among residents of two administrative towns in the Bale Zone, south-east Ethiopia. According to this study, the overall prevalence of both diagnosed and undiagnosed T2DM in the adult population was found to be 6.7% [95% CI: 4.64–8.84], which was unacceptable high. Goba town residence had a proportion of 3.83% (95% CI: 5.48, 13.11), and Bale Robe town residence had a proportion of 2.91% (95% CI: 2.57, 7.33). Alarmingly, the majority of individuals with T2DM (92%) did not know they had the disease before the study.

The current study's findings were consistent with those of a previous study in Gondar town, north-west Ethiopia, which found 6.34% (Wolde et al 2020:3–4), Dessie town, north-east Ethiopia, which found 6.8% (Endris, Worede, &Asmelash 2019: 280–2803), and Mizan-Aman town, south-west Ethiopia, which found 6.5% (Aynalem & Zeleke 2018:1–5). The current study finding is, however, higher than the estimated Ethiopian prevalence

of DM (5.2%) provided by IDFA (Atlas, D. 2015:33-35). This result was also higher than studies done in different parts of Ethiopia, including in Addis Ababa at 2.6% (Woldesemayat, Amare & Ataro 2019: 10–11), Hosanna town, Ethiopia, at 5.7% (Dereje et al 2020: 5), Jimma town, south-west Ethiopia, at 3.1% (Yunka et al 2020: 2925–2933), Rural Sidama, Ethiopia, at 1.9% (Zekewos et al 2018: 455), and Guji zone, Ethiopia, at 3.9% (Utura & Fikrie 2022: 8). This is possibly the result of different study settings because the current study only included urban residents, which may increase the prevalence.

In addition, people who live in urban areas are more likely to be exposed to conditions' risk factors than people who live in rural areas are, such as less physical activity and an unhealthy diet, which increase the risk of NCDs such as T2DM.

The observed prevalence rate, however, was lower than the results of previous studies that were conducted in East Gojjam, Ethiopia: 11.5% (Wondemagegn et al 2017: 20); the Democratic Republic of the Congo: 11.7% %(Mawaw et al 2017: 4); Sidama Region, Ethiopia (12.4%) (Seifu et al 2020: 4575); Hawassa City: 12.2% (Kassa & Wondelemayat 2019: 3); and Accra, Ghana (19.1%) (Gyening, Laast, Pambo, Torgbenu, & Yarfi 2019: 117-122). The variation in the prevalence of DM among studies may be due to differences in the study's setting and design, sample sizes, and socio-demographic characteristics.

The prevalence of T2DM in the current study was also much lower than in studies from other countries, including Pakistan (26.3%) (Basit, Fawwad, Qureshi & Shera 2018: 6-7), China (12.47%) (Li et al 2022: 5), Thailand (16.8%) (Apidechkul 2018: 1–17), and Germany (14.4%) (Müller-Wieland, Merkel, Hamann, Siegel, Ottillinger, Woker & Fresenius 2018: 4-5). The possible explanations of the variance include variation, socio-demographic and genetic factors, lifestyle choices, sample size, and the study population's age range differences. Moreover, the measurement tool used to determine fasting blood glucose levels in earlier studies was HbA1c, which was more reliable. For instance, studies in Pakistan and Germany used HbA1c, whereas the current study used capillary fasting blood glucose.

The current study found that the prevalence of T2DM was higher in females (7.3%) than in males (6.0%). Although the observed prevalence by gender does not differ statistically significantly, this result was consistent with a study from Jimma Town, south-west

Ethiopia, which reported that female were more likely than male to have DM (Yunka et al. 2020:2925–2933). However, the current finding was inconsistent with a study conducted in Guji Zone, Oromia, southern Ethiopia, which observed that the prevalence of DM was higher in males than females, at 3.8% and 4.2%, respectively (Utura & Fikrie 2022: 8). The disparity that has been observed could be due to differences in sample size proportions and study populations across the groups.

The findings of this study revealed that the prevalence of previously undiagnosed DM (UDM) was 6.19%, which was comparable to the 5.75% reported in a recent systematic review and meta-analysis by Yitbarek et al (2021:1–10). The prevalence of UDM was also considerably higher in the current study compared to previous studies done in Koladiba, north-west Ethiopia, at 2.3% (Worede, Alemu, Gelaw & Abebe 2017: 4-5), and Hosanna Town, southern Ethiopia, at 2.05%(Dreje et al 2020: 3). However, this finding was lower than that of Bahir Dar city, north-west Ethiopia, at 10.2% (Bantie et al 2019: 4), East Gojjam, north-west Ethiopia, at 11.5% (Wondemagegn et al 2017: 20), and in Kenya at 14.0% (Meme, Amwayi, Nganga & Buregyeya 2015: 4). The disparity could be explained by variations in the study population's composition.

Addition Besides this, the current study found that 16.21% of respondents had pre-diabetes. This finding was consistent with those of other related studies. For instance, a population-based study conducted in Jimma town, north-west Ethiopia, reported 12% (Yunka et al 2020: 2925–2933), Bahir Dar city, Ethiopia, reported 12.8% (Bantie et al 2019: 4), and Koladiba town, reported 14.8% (Worede et al 2017: 4-5). However, the finding was higher than a recent systematic review and meta-analysis by Yitbarek et al. (2021:1–10), which revealed that the pooled prevalence of impaired fasting glucose (IFG) in Ethiopia was 8.94% and Gondar town 9.3% (Wolde et al 2020:4-5). The authors also came to the conclusion that, if the right interventional measures weren't taken, those who had IFG might develop DM. They also imply that, given the risks of developing T2DM from pre-diabetes, the prevalence of DM in the study area may soon rise (Aynalem & Zeleke 2018:1–7), and the sample sizes for different studies may vary.

Similar to this, a higher prevalence of T2DM (23.8%) was reported among respondents who did not eat fruits and vegetables, who were overweight or obese (18.4%), had hypertension (16.7%), had a high waist circumference (11.9%), reported being current alcohol users (7.1%), and who currently smoked (6.7%). This finding is consistent with

studies from Hossana town, southern Ethiopia; selected towns in western Ethiopia; and Guji Zone, Oromia region, southern Ethiopia, where a higher prevalence of DM was observed among respondents who had high blood pressure, were currently alcohol users, and were overweight or obese(Dreje et al 2020:3; Feyisa 2022:59; and Utura & Fikrie 2022:8).

Moreover, the following factors were found to be significantly associated with T2DM after any potential confounding variables were controlled using multivariable logistic regression analysis: not consuming fruit, consuming an animal diet, engaging in vigourous intensity physical activity, being overweight or obese, and having hypertension.

5.6 FACTORS ASSOCIATED WITH THE PREVALENCE OF TYPE 2 DIABETES MELLITUS IN PHASE I

Multiple earlier cross-sectional studies conducted across regions of the world established that the prevalence of T2DM increased with ageing (Mohamed et al 2018:1–11; Wondemagegn et al 2017:21; Hu et al 2017:3–4; Animaw & Seyoum 2017:7; Yunka et al 2020:2928); however, the current analysis found no evidence of a significant association between age and T2DM prevalence.

The current study found that respondents with high blood pressure had a threefold increased risk of having T2DM, which is consistent with previous findings (Feyisa et al., 2022:59; Endris et al 2019:2803-2804; Aynaleem & Zeleke, 2018:4; Tesfaye et al 2016:5; Dereje et al 2020:5–6; Basit et al 2018:7; Tripathy et al 2017:1–8) This connection could be explained by the fact that high blood pressure causes sympathetic nervous system activation, increases insulin resistance, and causes the development of DM. Due to the coexistence of DM and hypertension, secondary prevention (screening, prompt diagnosis, and treatment) of both of these conditions is essential.

Being overweight or obesity are well-established modifiable risk factors for NCDs such as T2DM (Cheung & Li 2012:160–166). The current study found that those with an excessive BMI had a 4.4 times greater risk of developing T2DM than those with a normal BMI. The result of the current study was consistent with earlier published studies from

both developed and developing countries (Little et al 2016:5–6; Barik et al 2016:3–4; Tripathy et al 2017:4; Demilew & Firew 2019:5-8; Dereje et al 2020:5–6; Worede et al 2017:4-5). This could be because adipose tissue from overweight and obese people releases more non-esterified fatty acids, glycerol, hormones, pro-inflammatory cytokines, and other elements that contribute to the development of insulin resistance. The pancreatic islet cells, which release insulin to manage blood sugar levels, become dysfunctional in association with insulin resistance. As a result, determining the risk and progression of DM depends on abnormalities in cell function (Kahn, Hull & Utzschneider 2006:840–846).

Additionally, this association is also likely the result of respondents with a higher BMI typically adopting a western lifestyle, which generally results in increased consumption of high-fat and high-calorie diets, which have a higher risk of exposure to energy-dense foods and a sedentary way of life (Noale et al 206:385–392; Nagaya et al 2005:1107–1111). Since obesity is a significant risk factor for developing T2DM, it is important to develop preventative strategies to reduce obesity, which may help limit the rising prevalence of T2DM, particularly in the study area and Ethiopia.

Diet plays a significant role in the prevention of the incidence of T2DM. Increased fruit and vegetable consumption are the major components of the dietary factors for the prevention of T2DM (Li et al 2014:1–9). In the current study, respondents who did not consume fruits had a higher risk of developing T2DM. This finding was supported by a case-control study conducted in the Mecha district of north-west Ethiopia by Demilew & Firew (2019:5), which found that respondents who did not consume vegetables and fruit had a higher risk of T2DM and hypertension. The findings of previous studies were also consistent with the current study (Feyisa et al 2022:59; Tarekegne et al 2018:35; Schwedhelm et al 2017:363–375). Furthermore, studies that only observed this association between fruit consumption and T2DM (Li et al. 2014:1–9; Wang et al 2016:56–69) corroborated the current findings of the study. Similarly, meta-analysis reports indicated that increasing the consumption of fruits and vegetables prevented the risk of developing T2DM (Halvorsen et al 2021:519). On the other hand, due to their high amount of micronutrients and low calorie density and glycaemic load, fruits and vegetables may help to reduce the occurrence of T2DM (Jenkins et al 1988:248–254). Earlier several supplementation trials have suggested that the antioxidants in fruits and

vegetables can increase insulin sensitivity and prevent T2DM (Liu et al 1999:1073–1075; Ceriello & Motz 2004:816–823).

In the current study, respondents whose work involved vigorous-intensity activity had two times lower odds of developing DM than those whose work did not involve vigorous-intensity activity. The result of this study was in line with previous studies (Demilew & Firew 2019:5; Yunka et al 2020:2928) that revealed that physical activity has a significant impact on the prevalence of T2DM. On the other hand, studies from other countries (Barik et al 2016:3–4; Little et al 2016:5–6; Tripathy et al 2017:4) have suggested that T2DM is associated with a lack of physical activity, which supports the finding of the current study. This is due to the fact that physical activity reduces the risk of hyperglycaemia by boosting insulin-stimulated glycogen synthesis, improving muscle glucose uptake, increasing muscle sensitivity to insulin, and balancing the average caloric intake and expenditure by body cells (Reise & Waller 2009:27–48). Evidence points to the possibility of lowering the risk of obesity, the single most important risk factor for T2DM, through initiatives that emphasise a healthy diet and promote physical activity (Barik et al 2016:3–4).

The odds of developing DM among respondents who consumed animal fat were sixfold higher than their counterparts. Respondents in this study who consumed animal fat had a higher risk of developing T2DM compared to participants who did not consume animal fat. The finding of this study was supported by evidence, which suggests replacing trans-fat with unsaturated fat in meals because trans-fat and saturated fat users have a higher risk of developing NCDs than unsaturated fat users (De Souza et al 2015:351).

5.7 DISCUSSION FOR THE CASE-CONTROL STUDY (PHASE II)

In this case-control study, the researcher examined the determinants of T2DM in two selected public hospitals in the Bale zone of southeastern Ethiopia, namely the Goba referral hospital and the Bale Robe general hospital. In this phase II of the study (case-control study), the researcher was presented with both specific determinants of T2DM and the overall independent determinants of T2DM.

In this case-control study, the researcher was presented with both specific determinants of T2DM and the overall independent determinants of T2DM. Thus, under the category of the specific determinants of T2DM, the following factors were described previously in Chapter 4 of the current study under the case-control study section: socio-demographic characteristics, behavioural patterns, physical measurement, perception-related determinants of T2DM, and mental stress-related determinants of T2DM. More details were presented in Chapter 4 of Phase II of the study.

In this case-control study, the socio-demographic determinants of T2DM were examined, and after controlling any potentially confounding variables using multivariable logistic regression analysis: Age greater than or equal to 50 years, being of male sex, residing in an urban area permanently, having never been married, having no formal education beyond primary school, being retired, working as a daily labourer, having a medium wealth index, and having a family history of DM were found to be significantly associated factors with T2DM.

The behavioural predictors of T2DM were examined after any potentially confounding variables were controlled using multivariable logistic regression analysis. Three factors have been found to be significantly associated with T2DM: ever smoking cigarettes, current alcohol use, and engaging in vigourous, intense physical activity rerated with work.

Regarding the physical measurement determinants of T2DM, multivariable logistic regression analysis was used to account for any potential confounding variables. Accordingly, being overweight or obese, having a higher waist circumference (WC), and

having a high waist-hip ratio (WHR) were found to be significantly associated factors with T2DM.

In terms of the perception-related determinants of T2DM, multivariable logistic regression analysis was used to adjust for any potentially confounding variables. In this regard, respondents who stated that frequently consuming plant items, such as fruits and vegetables, had a beneficial impact on body size and shape were the only statistically significant predictors for T2DM

In Phase II of the study, the researcher further identified overall independent predictors of T2DM, including urban residency, being male, being older than 50 years, attending primary and secondary school, having a medium wealth index, never smoking, currently drinking alcohol, lack of physical activity, experiencing mental stress (such as losing interest in things and finding it difficult to make decisions), and household food insecurity.

5.7.1 The overall independent determinants of Type 2 Diabetes mellitus

This case-control study found a significantly positive association between age and T2DM, with older adults (50 years of age and older) having increased risks of developing T2DM. A case-control study by Demilew & Firew (2019:5) in the Mecha area of north-western Ethiopia and a meta-analysis by Zeru et al (2021:1–15) that indicated that the respondents' age increased the risk of having T2DM were both supportive of this finding. This finding was also consistent with other studies that found that older age is an important predictor of developing T2DM (Bahijri et al 2016:4-6; Mohamed et al 2018:26; Bailey et al 2016:6; Millogo et al 2018:7-8; Wolde et al 2020:4-5). It is possible that skeletal muscle insulin sensitivity declines with age, which elevates the risk of insulin resistance and T2DM (Shou, Chen, & Xiao 2020:1–7). Additionally, the findings of this study showed that males had higher probabilities of developing T2DM than females.

The results of the current case-control study were further corroborated by a systematic review done in Ghana, which identified being a male as a key risk factor for developing T2DM (Asamoah-Boaheng et al 2019:1–10). The current study was also in agreement with previous studies that found men had a considerably higher chance of getting T2DM than did women (Seifu et al 2015:140–140; Yunka et al 2020:2928; Wang et al 2019:10;

Tripura et al 2019:843). However, this finding was in contrast to a cross-sectional study in Senegal, which revealed that women would be more likely to develop DM (Duboz et al 2012:332–336). The presence of significant amounts of visceral fat in men has been linked to a higher prevalence of DM (Nordström et al 2016:3740–3746). Furthermore, females may be more protected from T2DM than males due to their decreased propensity to acquire visceral adiposity (Arnetz, Ekberg & Alvarsson 2014:409).

This case-control study observed that the risk of T2DM was lower among urban residents than among rural residents. However, this finding conflicts with a number of previous studies that indicated that urban inhabitants had a higher risk of developing T2DM than rural residents (Abebe et al 2017:1–9; Shrestha et al 2022:4-5) . The discrepancy could be the result of a different study design; for instance, this study used a case-control study, whereas most of the previous studies used a cross-sectional design.

This case-control study found that the odds of having T2DM were reduced by 78.5% and 61%, respectively, among respondents with primary and secondary education (Grades 9–12), compared with those with no formal education. This finding is in agreement with an exposure-wide umbrella review of meta-analyses, which found that there is highly suggestive evidence for the association between lower educational attainment and higher risk for T2DM (Bellou et al 2018:1–27). Studies also support the finding of the current study that illiteracy increases the risk of developing T2DM (Zeru et al 2021:1–15). However, there were inconsistent findings in the studies that examined the relationship between educational attainment and the likelihood of developing T2DM. Higher education has been reported to be a protective factor against DM, which may be related to awareness of the disease and a propensity to maintain a healthy lifestyle.

The current study found that respondents with a medium wealth index reduced their risk of T2DM by 98% compared with those with a low wealth index. This finding was consistent with a study from western Ethiopia, in which respondents with the poorest wealth index were reported to be significantly associated with T2DM (Feyisa et al 2022:61). However, this finding was in contrast to other studies that found a significant association between a high or richest wealth index and the risk of T2DM and other NCDs. For instance, a study on the prevalence of NCDs conducted in north-west Ethiopia by Abebe et al (2018:8) found that respondents with higher wealth indices had a higher risk of developing NCDs than those with lower wealth indices (OR 1.28; 95% CI 1.02 to 1.59). Additionally, a case-control study on risk factors for T2DM by Gudjinu and Sarfo (2015:4-6) observed that

T2DM was significantly associated with the medium wealth index (OR: 5.03, 95% CI: 1.71–14.74) among out-patients in the capital of Ghana, which contradicts the findings of the current study.

Having smoked cigarettes at some point appeared to be the strongest predictor of the risk of developing T2DM (Luo et al 2015:240–243). This study finding coincides with a meta-analysis of data from 20 cohorts with 5,077,289 respondents and 223,084 incidents of T2DM, indicating that cigarette smoking is a key predictor of incidents of T2DM (Yuan 2019:pp.e169–e176). This finding was also supported by the recent meta-analysis by Zeru et al (2022:1–15), which found that cigarette smoking was significantly associated with T2DM. Although the exact mechanism underlying smokings increased risk of developing diabetes and worsening glucose homoeostasis is yet unknown, the evidence that is currently available suggests that the smoking habit increases insulin resistance.

An interesting finding from the current study was the protective association between respondents' current alcohol consumption and T2DM. The finding of this study showed that respondents who currently drank alcohol had an 89% reduced risk of developing T2DM than those who did not (AOR = 0.11; 95% CI: 0.036–0.336), This finding was supported by an umbrella review of meta-analyses by Bellou et al (2018:1-27), which found that moderate alcohol use had a protective impact against T2DM. Additionally, this finding was consistent with a study done in Ghana by Gatimu et al (2016: 1–12). Besides, a study from China indicates that abstaining from alcohol use and lowering alcohol consumption are both effective ways to lower the risk of developing T2DM (Wu , Liu, Liao, Kang et al 2021:1–10), which corroborates the finding of the current study. However, the results of the previous studies indicated that alcohol use was positively related to T2DM regardless of the amount consumed (Griswold et al 2018: 1015–35; Kim & Kim 2012: 108–115 & Dreje et al 2020: 3). This relationship could be explained by moderate alcohol consumption's effects on enhanced insulin sensitivity, decreased fasting insulin resistance, and decreased glycated haemoglobin concentrations. Additionally, moderate alcohol consumption is a regular component of a balanced food pattern, which lowers the chance of developing T2DM.

As described in the literature review in Chapter 2 of this study, there are inconsistencies and contradictions regarding the relationship between alcohol consumption and the risk of developing T2DM. Some studies indicate that abstaining from alcohol use and lowering

alcohol consumption are both effective ways to lower the risk of developing T2DM (Wu, Liu, Liao et al., 2021:4-5). On the other hand, there is still research that demonstrates that drinking alcohol increases the risk of T2DM regardless of the amount consumed (Griswold, Fullman, Hawley, Arian, Zimsen & Tymeson 2018: 1015–35).

To sum up the link between alcohol consumption and the risk of developing T2DM, this indicates that heavy alcohol consumption is a risk factor for the development of T2DM, while low to moderate alcohol consumption decreases the risk of T2DM regardless of the amount consumed and frequency of alcohol consumption, which supports the findings of the current case-control study.

Furthermore, the logistic regression model's analysis of the significant variables disclosed that the OR for T2 DM was six times higher in respondents with food insecurity compared to those with food security (AOR = 6.14, 95% CI: 1.38–27.35. The study found that respondents with food insecurity were six times more likely to develop T2DM compared to those who had food security. This finding is in agreement with case-control studies in other countries, such as Latin America, which found that the chance of T2DM in very low food-insecure respondents was 3.3 times higher than compared to food-secure respondents (Fitzgerald et al 2011: 328). Furthermore, the result of the current study was supported by a case-control study from university clinics in Shiraz, southern Iran, by Najibi et al. (2019:1–8) and a recent systematic review and meta-analysis by Abdurahman et al (2019:1341–1350), both of which showed that food insecurity is a significant risk factor for T2DM. The result of a very recent case-control study conducted in the capital of Angola also supports the current finding, which shows a relationship between T2DM and severe food insecurity among respondents to healthcare services (Robbiati, Armando, da Conceiço, Putoto & Cavallin 2022:1-6). The fact that people with food insecurity report skipping meals, eating more foods high in energy, and having a lower dietary quality, all of which are linked to obesity and an increased risk of developing T2DM (Gucciardi, Vahabi, Norris, Del Monte, & Farnum 2014: 324–332).

The current study also indicated that adults with T2DM had a higher proportion of severe food insecurity than non-diabetic adults in the study area. According to the researcher, this is the first study on this subject conducted in Ethiopia, and it advances knowledge of how food insecurity and T2DM interact in that country.

In this study, the proportion of cases with mild mental stress was 21.3% versus 89.9% for controls; moderate mental stress was 43.8% versus 9.5% for controls; and severe mental stress was 34.9% versus 0.6% for controls, all with p =0.0001. This finding showed that, except for the mild category of mental stress, patients with T2DM were more affected by mental stress than respondents without T2DM ($p < 0.0001$). This finding was supported by a prospective cohort study on Chinese policemen that found T2DM to be 4.43% more common in respondents who experienced psychological distress compared to respondents who did not.

Further, the multivariate binary logistic regression model's analysis of the significant variables revealed that the OR for T2DM, or the likelihood of having the condition, was 2.81 times higher among respondents who reported mental stress, such as losing interest in things, compared to those who did not (AOR = 2.8; 95% CI: 1.13-6.97). Evidence that stress may contribute to the beginning of T2DM as well as be a prognostic factor for those who currently have the condition and a predictor of T2DM with new onset supports the current study finding (Hackett & Steptoe 2017: 547).

Previous studies also found that the risk of T2DM appeared to be significantly increased by mental distress (Brunner & Kivimäki 2013: 449–450; Mommersteeg, Herr, Zijlstra, Schneider & Pouwer 2012: 1–10; Novak et al 2013: e8–e16; Virtanen et al 2014: 2091–2097). The mechanism of mental stress risk for T2DM postulates that high amounts of stress hormones may impair insulin-producing cells in the pancreas from functioning properly and decrease the amount of insulin they produce. Even though studies have used various methods to assess stress and have found a link between stress and DM, the results of the current study support this. The use of various mental stress measurement tools and diagnostic criteria for DM, including the current study's use of the SRQ-20 self-reported rating, which differed from other studies' measurement tools, may be a contributing factor to the controversy in the literature regarding the relationship between mental stress and T2DM.

5.8 CONCLUSION

Discussions of the findings involved comparisons with similar literature on DM generated globally and in Ethiopia. Based on the findings generated in Chapter 4 and this chapter, prevention strategies for T2DM will be developed and discussed in Chapter 6.

In this chapter, discussions have been presented. The findings on the prevalence of T2DM and its risk factors, adults' knowledge, perceptions, and risky behaviours of T2DM and its prevention have been addressed. The communities' perceived susceptibility, perceived benefits, barriers, cues to action, and self-efficacy to T2DM in order to improve the likelihood of taking action that the community would engage in preventive behaviours of T2DM have been outlined. The socio-demographic, behavioural, physical, biological, perception, and mental stress-related determinants of T2DM have also been addressed. Discussions of the findings involved comparisons with similar literature on DM generated globally and in Ethiopia. Based on the findings generated in Chapter 4 and this chapter, prevention strategies for T2DM will be developed and discussed in Chapter 6.

CHAPTER 6 - STRATEGIES FOR PREVENTION OF TYPE 2 DIABETES MELLITUS AMONG ADULTS

6.1 INTRODUCTION

This chapter discusses the development of strategies for the prevention of T2DM in adults. The findings on the prevalence, knowledge, risky behaviours, perception, and determinants of T2DM in adults were given in Chapter 4 in Phases I and II consecutively. The findings of the study were discussed against relevant literature in Chapter 5. The strategies were informed by the current study's findings, which were relevant aspects of the literature review, the study's theoretical framework, and the researcher's insights. Further the chapter describes the need for developing the strategies as well as the objectives, scope, guiding principles, methodology, strategic objectives, proposed activities, and monitoring and evaluation modalities.

The core aim of developing these strategies is to prevent T2DM in adults in Ethiopia.

These strategies are developed to contribute to the prevention of T2DM in the general population and individuals at high risk for T2DM, the improvement of quality of life in T2DM patients, and the whole adult population. It is designed to inform policies, strategies, and operating procedures that are found in the country.

The content includes guiding principles, scope, objectives, methodology, and strategic objectives, as well as proposed activities.

6.2 PURPOSE AND OBJECTIVE OF STRATEGIES

These strategies have been developed to help reduce the burden of T2DM in adults and improve the quality of life of the adult population and DM patients.

The objective of proposed strategies

The objective is to describe strategies that would help to provide information on relevant determinant factors of T2DM to target beneficiaries, raise community awareness for T2DM prevention, improve T2DM prevention implementation by health care providers, and support policymakers, health managers, and other concerned stakeholders in removing barriers related to T2DM implementation strategies.

Basis for development of prevention strategies

Findings from this study, the literature review, the national NCDs prevention and control strategy of Ethiopia are the basis for the development of these prevention strategies.

6.3 THE SCOPE OF PROPOSED STRATEGIES

The strategies presented will be implemented in communities, primary health care units, district health offices, the zonal health department, the regional health bureau, and the Federal Ministry of Health.

6.4 THE PROCESS OF PROPOSED STRATEGIES DEVELOPMENT

The researcher developed a draft of the strategy based on empirical data gathered during the study's data collection and analysis phase, which was addressed in Chapters 4 and 5. The invited experts also provided feedback on the draft strategies. Finally, the strategies are finalised by incorporating the expert panel's comments until they reach a point of consensus. The primary targets of these strategies are health care professionals, health managers, and policymakers in Ethiopia.

6.5 STRATEGIES DEVELOPED FOR PREVETION OF TYPE 2 DIABETES MELLITUS AMONG ADULTS IN ETHIOPIA

Strategic objective on proposed activities/ actions

The respected experts from the fields of medicine, public health and the researchers working on NCDs and DM provided their insightful opinions and additional information to enrich the draft of strategy in at least two rounds of comments. Thus, the following consolidated strategic objectives and list of proposed activities/actions for T2DM prevention as NCDs in Ethiopia were finalised:

The following strategies were suggested to help the prevention of T2DM in adults. The strategies were organized within four themes.

Themes 1: Primary prevention focus on determinants factors of T2DM

Themes 2: Raising public awareness and community action for T2DM prevention

Themes 3: Improving T2DM prevention activity by health care providers

Themes 4: Providing support to policymakers, health managers, and others

6.5.1 Strategies for Theme 1: Reducing the incidence and prevalence of Type 2 Diabetes mellitus through primary prevention and health promotion.

- Reduce tobacco use.
- Reduce the harmful use of alcohol.
- Increase physical activity.
- Reduce an unhealthy diet.
- Reduce being overweight and obesity.
- Reduce raised blood pressure.
- Reduce food insecurity.
- Reduce mental stress.
- Identify, create awareness, and provide appropriate intervention for pre-diabetes through effective screening, referring, and
- Action on other determinants of T2DM like age and co-morbidity.

Strategy for Theme #1: Primary Prevention of T2DM focuses on determinant factors of T2DM/ reducing the determinant factors of T2DM

Primary prevention is the most cost-effective prevention strategy since it aims to reduce the incidence of T2DM through risk factor reduction.

Objective 1.1: Reduce the number of people smoking cigarettes.

Cigarette smoking is a major contributor to the development of T2DM (Luo et al 2015:240–243). Evidence shows that smokers are up to 30–40% more likely to develop DM than nonsmokers. As detailed in Section 4.2.9 and 5.6, respondents who had smoked cigarettes at some point were nearly six times more likely to have T2DM than those who had never smoked, indicating a very strong association. Smoking is a significant determinant of T2DM prevention, accounting for the lion’s share. So, it must be considered while addressing T2DM prevention.

Strategy 1.1: Promote the implementation of the WHO Framework Convention on tobacco control.

The aim of this strategy was to help strengthen the implementation of WHO's Framework Convention on Tobacco Control (FCTC) II, particularly the rules on the use of health-related tobacco taxation, in low-income countries such as Ethiopia.

The following actions are proposed to reduce smoking cigarette:

- Promote the implementation of the National Tobacco Control Law as well as monitoring and evaluation of the law's enforcement.
- Raising public awareness of tobacco control legislation and advocating for the harmful effects of direct and indirect smoking.
- Raising public awareness of the dangers of tobacco use
- Map a high-risk group and design contextualised tobacco quitting interventions.
- Establish a smoking cessation strategy for smokers.
- Implement further tobacco control measures.
- Promoting the use of non-smoking stickers and pictorial warning signs in situations where smoking is forbidden.
- Ban the single-piece sale of cigarette.
- Establishment and decrease of smoking areas in offices and public places.
- Conduct a regular survey of smoking status and reinforce the reporting mechanism.
- Enhance educational institutions' roles and responsibilities in tobacco control, as well as collaboration in social awareness and family education.
- Conduct community-based smoking cessation on a regular basis.
- Strengthen collaboration with local and international organisations on tobacco control activities.
- Increase tobacco product excise taxes and pricing.
- Adopt and enforce strict bans on tobacco advertising and promotion.
- Increase efforts to eliminate second-hand tobacco smoke exposure in all indoor businesses, public spaces, and public transportation.
- Implement effective mass media efforts to educate the public about the dangers of smoking, tobacco usage, and second-hand smoke.

Objective 1.2: Reduce the number of people involved in harmful alcohol consumption.

Strategy 1. 2: Implement the WHO recommendations for reduction of harmful alcohol use

The purpose of this strategy was to support the country's (Ethiopia's) alcohol control initiative, which helps countries in reducing harmful alcohol use and the associated health, social, and economic implications.

The following actions are proposed to reduce harmful alcohol use:

- Promote further increases in the excise charge on alcoholic beverages.
- Raising public awareness of alcohol control regulations and advocating for the harmful effects of direct and indirect alcohol use.
- Reduce retail alcohol availability by establishing and enforcing restrictions such as shorter hours of sale.
- Strengthen the enforcement of bans or broad restrictions on alcohol advertising exposure (across multiple types of media).
- Devise interventions to raise public awareness about the misuse of alcohol.
- Implement strategies to control alcohol misuse.
- Establish alcohol addiction rehabilitation centres.
- Raising public awareness of alcohol control regulations and advocating for the harmful effects of direct and indirect alcohol use
- People who are unable to stop drinking or who drink regularly should continue to do so moderately and should not consume more than 1 to 2 units of alcohol per day because alcohol influences blood sugar levels.

Objective 1.3: Increase the number of adults engaged in regular physical activity

Physical inactivity is the fourth-most significant risk factor for NCDs, including T2DM mortality, and it is responsible for more than 3.2 million deaths worldwide (Riley, Gouda & Cowan 2017:7; Juma et al 2018:1–12). Evidence from multiple studies has shown that engaging in regular physical activity of any kind (resistance exercise, aerobic exercise), intensity (low, moderate, vigorous), and setting (work/home, leisure, commuting), can delay the onset of T2DM and GDM by 25–40% (Aune et al 2015:529–542; Aune et al 2015:1536–1543). Increasing physical activity has long been seen as the cornerstone of

preventing and managing T2DM (Aune et al 2015:529–542). As detailed in Sections 4.2.9 and 5.6, the current study found that respondents who are not physically active are twice as likely as those who are to develop T2DM.Therefore, the findings of this study and previous studies imply that physical activity is important in preventing T2DM.

Strategy 1.3.1: Create a conducive environment for physical activity.

- Initiate mass physical exercises in communities.
- Build and maintain public places with exercise equipment and encourage the use of those places.
- Collaborate with community partners to promote more physical activity and less sedentary behaviour.
- Implement strategies for increasing physical activity as part of the population health plan.
- Promote opportunities for physical activity in shared communal green spaces.
- Promote physical activity options outside of work and school for overweight and obese adults.
- Promote initiatives that improve the built environment to connect people to common destinations such as work, school, parks, and green areas.

Strategy 1.3.2: Improve public awareness regarding regular physical exercise

- Increase awareness of the benefits of all types of physical activity, with a focus on the at-risk population.
- Promote physical activity in communities through the media.
- Encourage adults to engage in at least 150 minutes of moderate-intensity physical exercise per week or 75 minutes of vigorous-intensity physical activity per week.
- Encourage people to visit a health care worker about recommended activities before beginning an exercise programme for types of physical activity, duration, and intensity.
- Promote individuals' engagement in more physically active leisure activities than passive ones like watching television.
- Strengthen the physical education programme in all grades of schools.

- Improve the knowledge and skill of health care providers to prescribe appropriate physical exercise for at-risk groups.

Objective 1.4: Improve healthy dietary habits in the public

Diet has a significant role in the prevention of the incidence of T2DM. Evidence shows that increased consumption of fruits and vegetables is the main dietary factor for the prevention of T2DM (Li et al 2014:1–9). The current study includes the same report that corroborates the previously stated fact, as detailed in Section 5.6. Hence, it must be given due attention when considering T2DM prevention.

The aim of this strategy is to strengthen efforts to maintain optimal nutrition in accordance with WHO recommendations, such as by minimising salt, sugar, saturated fats, and trans fats and achieving metabolic demands.

Strategy 1.4.1: Increase fruit and vegetable intake and reduce consumption of salt, sugar, and trans-fatty acids.

- Encourage individuals to add fruits and vegetables to each meal (if applicable, at least five servings per day).
- Promote a lower intake of fats, processed meats, refined carbohydrates, and sugary and sweetened beverages.
- Identify local sodium-containing foods.
- Use community-wide healthy nutrition messages to increase awareness and knowledge of healthy eating.
- Counselling and caloric restriction are indicated for adults who are overweight or obese in order to achieve and maintain weight loss.
- Advocate for legislation that creates incentives for supermarket businesses to provide inexpensive, healthy food options.
- Promote and reduce the content of free sugar in food and alcoholic beverages.

Strategy 1.4.2: Promote healthy meal planning.

- Advocate reduction of portions of meal size.
- Promote a regular daily meal schedule.

Objective 1.5: Reduce the number of adults with overweight and obesity

Being overweight and obesity are well-established modifiable risk factors for NCDs such as T2DM (Cheung & Li 2012:160–166). According to several studies from both developed and developing countries, having a higher BMI is one of the key risk factors for T2DM (Little et al 2016:5–6; Barik et al 2016:3–4; Tripathy et al 2017:4; Demilew & Firew 2019:5-8; Dereje et al 2020:5–6; Worede et al 2017:4-5). As indicated in Section 5.6 of the current study, those with an excessive BMI had a 4.4 times higher risk of developing T2DM than those with a normal BMI, which is the same report as the aforementioned fact. As a result, recognising, meaning, and monitoring what weight versus height should be is crucial for adults' health (Dua et al. 2014:92).

Strategy 1.5.1: Maintain a normal BMI or a healthy weight

The following action are proposed to maintain a normal BMI or a healthy weight

- Raising awareness and intervening about the harms of being overweight or obese.
- Address the public's misconceptions about being overweight or obese.
- Promote the balance of healthy eating and physical exercise to maintain or achieve optimal body weight.
- Informing a person of a weight-loss technique that balances a person's physical, emotional, and behavioural demands boosts the chances of long-term weight maintenance.
- Encourage the community to refer overweight adults to a health care facility for counselling.
- Influence health policymakers to establish weight management centres.
- Promote annual overweight and obesity screening practises among the public.
- Raising awareness of the necessity of obesity screening and management among members of high-risk groups
- Promote the public's use of digital health technologies (like mobile health and telehealth) to maintain a healthy body weight.

- Establish nutrition counselling services through health centres and health extension programmes in health care posts and improve nutrition counselling.
- Integrate and engage health extension workers (HEWs) to screen for and refer to weight reduction and diabetes preventive programmes.
- Introduce school-based BMI screening and/or surveillance methods.
- Encourage self-measuring and the implementation of BMI.
- Informing people about the benefits of maintaining a healthy BMI and waist circumference.

Objective1.6: Reduce the number of adults with high blood pressure (hypertension).

Studies suggest that hypertension is a major risk factor for developing T2DM. For instance, different studies have reported that individuals with hypertension have a greater risk of developing DM than those with normal blood pressure (Tesfaye et al 2016:5; Aynaleem & Zeleke 2018:4; Endris, Worede & Asmelash 2019:2803-2804; Tesfaye et al 2019:107838; Feyisa et al 2022:59; Dereje et al 2020:5-6; Basit et al 2018:7; Tripathy et al 2017:1-8). In the current study, respondents with high blood pressure had a threefold greater risk of developing T2DM (as seen in detail in Section 5.6). This study's findings also share the aforementioned facts. Therefore, measures to minimise or prevent the occurrence of hypertension are required to prevent T2DM.

Strategy 1.6.1: to reduce/ prevent hypertension

The following actions are proposed to reduce/ prevent hypertension:

- Raising awareness about the effects of high blood pressure on T2DM using all modes of communication
- The community should be made aware of the importance of regular blood pressure measurements through a number of communication channels.
- Raising awareness of the impact of cigarette use, alcohol consumption, overweight/obesity, family history, physical inactivity, and poor diet on hypertension
- Strengthen community-based screening for blood pressure and outreach campaigns by healthcare professionals.
- Rising awareness among the public about the consequences of high blood pressure

- Promote hypertension screening in primary care by referring those who require confirmation and the start of an intervention plan, and providing advice.
- Ensuring the availability and operation of hypertension screening equipment in health centres and health posts by health care providers and health extension workers.
- Encourage all clients and patients with raised blood pressure to visit health care facilities for detailed advice as well as physical and biochemical examinations from health care professionals.
- Encourage people with hypertension to seek and receive lifestyle counselling or behaviour change communication.
- Promote and enforce the use of validated automated blood pressure equipment for blood pressure measurement at the individual level.
- Strengthen the follow-up management services, such as monthly medication supply, blood pressure measurements and monitoring, and referral for complications.
- Advocates limit their intake of dietary sodium.
- To reduce the risk of hypertension, the community should better educate itself and implement salt restriction.
- Increased community knowledge and practise of salt reduction are necessary to lower the risk of hypertension.

Objective 1.7: Improve the number of adults with household food security

Strategy 1.7.1: Improve household food security

Multiple previous studies have found that food insecurity is a predictor of T2DM (Fitzgerald et 2011:328; Najibi et al 2019:1–8; Abdurahman et al 2019:1341–1350). As detailed in Section 5.2 of the case control study discussed, the current study also shows that respondents with food insecurity were nearly six times more likely to develop T2DM than those who had food security, which is the same as the reports above facts. Moreover, the current study indicated that adults with T2DM had a higher proportion of severe food insecurity than non-diabetic adults in the study area. Therefore, this needs to be taken into account while addressing T2DM prevention.

The following actions are proposed to improve household food security

- Strengthen the adoption of healthy eating methods as part of population health plans, as well as address food insecurity in collaboration with community-based food and meal providers, such as organisations.
- Map aid and development organisations to ensure the food security of needy populations.
- Promotion of sustainable agriculture systems to improve household food security.
- Strengthen the collaboration between the government and other stakeholders to overcome household food insecurity.
- Improve the awareness of health care providers and the public regarding the role of food insecurity in the development of NCDs, including T2DM.

Objective 1.8: Reduce the number of adults with mental stress

Strategy 1.8.1: Improve mental health

Evidence suggests that stress may contribute to the development of T2DM, both as a prognostic factor for people who already have the disease and as a predictor of T2DM with new onset (Hackett & Steptoe 2017:547). The current study report also confirms the aforementioned fact. Therefore, the findings of the current study and several other studies indicate that mental stress or any psychological distress is a significant risk factor for developing T2DM. Moreover, the current case-control study indicated that, with the exception of mild mental stress, T2DM respondents experienced all categories of mental stress at higher rates than non-diabetic respondents. Hence, actions to reduce mental stress are required to prevent T2DM.

The following actions are proposed to reduce mental stress:

- Stress reduction can help prevent the occurrence of diabetes-related complications while also enhancing mental stability and well-being.
- Regardless of the severity, individuals suffering from mental stress should seek the appropriate care and counselling services in a health facility.
- No matter how serious their illness, those who are under mental stress should receive the appropriate medical care and counselling from medical facilities.

- People who are under mental stress should receive the necessary medical care and counselling from medical facilities, regardless of how serious their condition is.
- Promotion of physical activity is needed to reduce mental stress.
- Raising awareness of approaches to stress reduction and management through exercise, meditation, and relaxation therapy
- It is important to increase community awareness of T2DM prevention in order to lessen mental strain.
- raise public awareness reduce mental stress to prevent type 2 diabetes
- Increased public awareness and lowered mental stress will help prevent T2DM.
- Strengthen and provide mental health services at various levels in healthcare facilities.
- Improve socialisation in the public to discuss mental health issues.
- Reduce mental stress by improving individuals' socioeconomic and health situations.
- Promote access to mental health services to provide emotional and psychological assistance to persons at risk.
- Promote the benefits of all forms of physical activity, with a particular emphasis on the at-risk group.
- Encourage the public to engage in religious practise to reduce mental stress.

Objective 1.9: Identify, create awareness, and provide appropriate intervention for pre-diabetes through effective screening and referral

Pre-diabetes is defined as blood glucose levels that are higher than normal but not high enough to be classified as diabetes. Individuals with pre-diabetes are more prone to develop T2DM (American Diabetes Association 2014:S81-S90). Diabetes development is not inevitable in pre-diabetics. Research shows that people with pre-diabetes who lose weight and improve their physical activity can prevent or delay diabetes and return their blood glucose levels to normal. The National Diabetes Prevention Programme (NDPP) found that changing one's lifestyle lowered the risk of getting diabetes by 58% over a three-year period. The reduction was significantly bigger, at 71%, among adults aged 60 and above. According to their studies, interventions to prevent or delay T2DM in adults with prediabetes are feasible and cost-effective. Furthermore, studies have shown that

lifestyle modifications are less expensive than medications (Diabetes 2014). According to the current study, 16.6% of respondents have pre-diabetes. A diabetes prevention strategy aimed at high-risk populations has the potential to reduce the incidence of diabetes. Hence, in order to reverse or halt the progression of T2DM, appropriate prediabetes interventions were required as primary prevention.

The following actions are proposed to reduce or prevent the progression of pre-diabetes to T2DM:

- Collaborate with communities to raise prediabetes awareness.
- Design and conduct a national effort to increase prediabetes awareness, diagnose prediabetes, and implement prediabetes education/prevention programmes.
- Promote health policymakers efforts to support the development of data collection activities for analysing new data sources in order to monitor prediabetes at the local, regional, and national levels.
- Assist healthcare providers and health care professionals to conduct pre-diabetes screening and linkage to appropriate management.
- Influence the federal ministry of health to collaborate with partners to establish a National Diabetes Prevention Program.
- Promote healthcare facilities to conduct organised diabetes education programmes.
- Collaborate with partners to create evidence for diabetes prevention outcomes in new and existing weight management and reduction programmes.
- Engage health facilities/centres to refer individuals at risk of diabetes to health-care providers and community-based risk-reduction activities.
- Create a data source to track adults who are screened for diabetes or prediabetes during routine health care visits.
- Collaborate with partners, such as academia, to obtain insights for diabetes preventive outcomes on new and existing weight management and loss initiatives.

Objective 1.10: Action on other determinants of T2DM such as age and co-morbidity

Strategy 1.10: Age

The aim of this strategy is to emphasise ageing as one of the non-modifiable factors in the prevention of T2DM.

Several studies conducted across the world, including the current case-control study in Phase II findings, have demonstrated a strong association between T2DM and increasing age.

The following actions are proposed to improve life style of ageing individuals to reduce the burden of T2DM and improve quality of life:

- Older adults should be regularly checked for T2DM and hypertension, and the results must be communicated to them so they can improve their lifestyle.
- Encourage older individuals to adopt and maintain a healthy lifestyle.
- Increasing support for this cause can help older persons develop and maintain healthy behaviours.
- Encourage the elderly to refrain from or stop risky behaviours such as smoking, drinking, and sitting down all day.

6.5.2 Strategies for Theme 2: Raising public awareness and community action for Type 2 Diabetes mellitus prevention

2.1 Susceptibility to T2DM in adults
2.2 Severity of T2DM in Adults
2.3 Provision of information on T2DM Prevention
2.4 Knowledge of self-blood glucose testing
2.5 Wrong perceptions of body shape and size
2.6 T2DM prevention means

Strategy 2.1: Susceptibility of T2DM in adults

The findings of the current study show that 43.2% of respondents had a poor perception of the behavioural risk factors for T2DM and their susceptibility. As a result, it is plausible that the community's perception of its susceptibility to T2DM should be considered.

- Increase awareness in the adult community and the general population about T2DM as a whole concern.
- Increase the adult population's awareness of diabetes signs and symptoms so that they can seek treatment as soon as possible.

- Conduct community-based health education, employing health care providers and health extension workers, to increase community awareness and knowledge of signs and symptoms, causes, complications, and risk factors that predispose to disease, as well as prevention strategies for T2DM and other NCDs.
- Encourage the community to engage in behaviour modification to prevent the development of T2DM.
- Create a community mobilisation to promote awareness about T2DM and its complications.
- Use the media to disseminate information about the burden of diabetes and how to prevent T2DM.
- Conduct a mass-media advocacy campaign.

Strategy 2.2: Severity of T2DM in adults

Type 2 diabetes mellitus increases the risk of the following common medical conditions: heart attack, heart failure, kidney disease, vascular disease, and stroke (Einarson, ACS, & Ludwig & Panton 2018:1–19). Thus, the community's perception of the seriousness of T2DM plays a crucial role in managing the condition properly.

The reason behind developing these strategies is that examining how people perceive the severity of T2DM can motivate community members to prioritise early healthcare-seeking behaviour and maintain a normal, healthy lifestyle.

- Raise community awareness and knowledge that T2DM is related to a number of other medical disorders, including renal failure, diabetic emergencies, stroke, cardiovascular disease, and hypertension, all of which are difficult to treat.
- Create awareness about the need for early detection and treatment of T2DM.
- Promote diabetes screening services, which should be offered at the lowest levels of health service delivery using simple, low-cost methods such as measuring urine sugar levels.
- Promote the use of simple, affordable techniques, such as measuring urine sugar levels, to provide diabetes screening services at the lowest levels of health service delivery.
- Offer diabetes screening services utilising basic, affordable techniques like measuring urine sugar levels at the lowest levels of health service delivery.

Strategy 2.3: Provision of information on T2DM prevention

The purpose of this strategy is to promote the dissemination of T2DM prevention information. People must first have adequate information about the disease and understand how to use it in order to be successful in disease prevention. Health care providers are preferred to provide information to the community on a regular and consistent basis since this is first-hand knowledge that recipients may easily accept. According to the current study, 11% of respondents had not heard any information about diabetes. Furthermore, 27% of respondents received diabetes information from a health care worker.

The following actions are proposed to provide information by health workers to the community:

- Consider and conduct morning health education in a health-care facility targeted at T2DM prevention.
- All clients visiting health facilities should receive information on T2DM prevention from health care professionals.
- Prevention of T2DM should be addressed in health education schedules at health facilities and during outreach.

Strategy 2.4: Knowledge about self-blood glucose testing

This strategy is intended to help remove barriers and inform adults about their blood glucose levels. As detailed in chapters 4 and 5, the vast majority of respondents with high blood glucose levels were newly screened, implying that they had DM but were unaware of their status. Moreover, 16.6% of respondents had pre-diabetes.

- Strengthen physical and biochemical awareness through all modes of communication, with a focus on high-risk groups.
- Encourage all clients and patients to visit health care facilities for detailed advice as well as physical and biochemical examinations like fasting blood glucose from health care professionals.
- Promote the habit of seeking out a health facility to check their blood glucose level.

Strategy 2.5: Wrong perceptions of body shape and size

The rationale of the strategy: the wrong perceptions of T2DM have a paramount impact on the activities to be done for its prevention.

As indicated the detail of perception of body shape and size in the phase II of the current study, the respondent had wrong perception of body shape and size which lead to T2DM have a paramount impact on the activities to be followed for its prevention.

- Strengthen interventions to raise awareness about body size and shape through all forms of communication, with a focus on high-risk groups.
- The public should be aware that T2DM is a disease that affects the whole community.
- Wrong perceptions of body shape and size that there is nothing to be done to prevent diseases like T2DM should be avoided.
- Raise awareness of the public being slim is not a sign of illness
- Increase awareness of the public being overweight or obesity is not sign of a health.

Strategy 2.6: T2DM prevention means

This strategy will help in the prevention of T2DM by providing knowledge and prompt action. As described in Section 5.3.2, the community's knowledge and awareness of T2DM preventative methods is unsatisfactory. So, the implementer should have knowledge of T2DM prevention means.

The following means of T2DM prevention are proposed:

- The community should be aware of T2DM prevention means.
- Community awareness about means of preventing T2DM should be advocated.
- Individuals who may use T2DM prevention methods should be identified.
- Maintain a healthy body weight through physical activity.
- Adopt a healthy eating habit by eating more fruits and vegetables and consuming less fat, salt, and sugar.
- Avoid excessive alcohol consumption.
- Develop healthy thoughts and reduce stressful situations.

The following are some ways to reduce the risk of developing T2DM:

- Reduce the total calorie intake of individuals.
- Advocate for regular physical activity.
- Advocating that people drink water as their primary beverage
- Take the opportunity to lose excess weight.
- Stop smoking
- Reduce the size of meal portions.
- Reduce sedentary behaviours such as getting little physical activity or sitting for most of the day.
- Following a high-fibre diet is beneficial for gut health, weight management, and diabetes prevention.
- Optimise vitamin D levels because they are essential for blood sugar regulation.
- Minimise individuals' use of highly processed foods.
- Drinking coffee or tea as part of an individual's diet may help prevent T2DM.

The community should act promptly on the knowledge they have gained about T2 DM prevention means.

6.5.3 Strategies for Theme 3: Improve T2DM prevention activity by health-care providers

Strategy 3.1: Capacity building of health care providers

This strategy is intended to strengthen the capacity building of health care providers in T2DM prevention activities through training and supportive supervision. Health care professionals were a valuable resource for the community's information on disease prevention. The capacity of health care workers should be strengthened in order to improve community perception and awareness of T2DM prevention activities.

The following activities are proposed to enhance the capacity of health care providers to help in T2DM prevention:

- All health care workers and health service managers should receive short-term training on diabetes and ways to prevent T2DM.

- Capacity building was a strategy used to help hospitals and health centres provide training for service providers on T2DM prevention and screening.
- Organise and conduct training on T2DM risk factors and prevention for health care providers.
- Provide on-the-job training for health care professionals.
- Conduct T2DM prevention and risk reduction workshops for health care providers.
- Refresher training should be delivered on a regular basis to strengthen the dedication of health professionals.
- Refresher courses should be offered on a regular basis to increase the commitment of health care providers.
- Provide health care workers with available materials and guidelines.
- Offers ICT materials to facilitate their information.
- Mentoring and supportive supervision should be offered on a regular basis to HCPs using a standard checklist to improve service delivery of the T2DM prevention strategy.
- Improve the capacity to avert the burden of T2DM and evaluate actions to prevent and control DM.

6.5.4 Strategies for Theme 4: Support to policymakers, health managers, and others

4.1 Provision of T2DM preventative services
4.2 Collaboration at the intersection and participation of partners in T2DM prevention
4.3 Coordination of T2DM prevention-related activity among organisations
4.4 The media's role in T2DM prevention
4.5 Integration of T2DM prevention with the Health Extension Programme

Strategy 4.1: Provision of T2DM preventative services

- Advocate for regular training and certification for healthcare professionals and health extension workers who perform blood glucose testing on a regular basis.
- Advocate for ongoing training and certification for healthcare professionals and health extension workers who undertake routine blood glucose testing.

Strategy 4.2: Collaboration at the intersection and participation of partners in T2DM prevention

- Encourage community engagement in healthy living and the reduction of T2DM risk factors by supporting social mobilisation, public education, and advocacy.
- Facilitate the implementation of the WHO Framework Convention on Tobacco Control, the global plan to reduce alcohol damage, and the global strategy for diet, physical activity, and health.

Strategy 4.3: Coordination of T2DM prevention-related activity among organisations

Promote team-based collaboration in T2DM prevention at health care facilities.

- Strengthen existing diabetic associations and establish new associations for T2DM prevention.
- Coordination is required to improve social support for adults with T2DM.
- Allocate a sufficient budget for the coordination of T2DM prevention activities.

Strategy 4.4: Media role in T2DM prevention

Programs in media-based health communication have aimed to change the public's health-related behaviours by promoting preventative actions like vaccination use and raising public knowledge of these issues. The mass media is the most extensively used communication channel for persuading people to change their behaviour.

The following action are proposed for Strategy 4.4 above

- T2DM prevention education must receive appropriate media attention.
- As an incentive, free service provision for T2DM prevention should be promoted in the media.
- Sections on T2DM preventive education must be prepared in a way that is understandable to the community and appropriate for the media.
- Advertisements for alcohol and other packaged foods with high calorie counts should be regulated in the media.
- Select a sensitive medium with broad coverage at a moment when the majority of individuals are engaged in message transmission.

Strategy 4.5: Integration of T2DM prevention with health extension programming

Health extension workers (HEWs) assigned to kebeles surrounding health centres should intensify house-to-house visits and integrate the health extension programme, which is a well-known community-based approach to disease prevention.

Health extension workers play an important role in raising community awareness of T2DM prevention. The following interventions are proposed to strengthen the health extension programme:

- A well-formulated T2DM prevention strategy must be devised and implemented as part of the health extension package.
- Provide technical assistance to health extension workers so that they can incorporate T2DM prevention initiatives into their programmes.
- Provide capacity-building training to health extension workers so that they can offer community counselling and health education on T2DM prevention.
- Create and implement a monitoring system for health extension workers' activities in order to ensure consistent performance in terms of education and counselling on lifestyle changes to prevent T2DM and other NCDs.
- Promote the use of health extension workers to send individuals to hospitals or health centres for diabetes screening, particularly if they are at high risk.
- Strengthen contact with the local population to support health extension workers' efforts in raising awareness and preventing T2DM through lifestyle changes.
- Empower their information by providing ICT resources.
- Ensure that supplies, resources, and technical assistance are available for DM screening programmes.
- Equip health posts with appropriate devices such as blood pressure monitors, weight scales, and glucometers with calibrated strips to ensure reliability.
- Develop and disseminate various task aids and protocol manuals to aid with DM screening.
- Create and disseminate protocols for referral networks and feedback mechanisms.

6.6 VALIDATION OF PROPOSED STRATEGIES

The researcher employed the Delphi method after the first draft of the strategies was developed to validate and review the final draft of the proposed strategies. The Delphi technique is well known to be based on the assumption that group opinion is more valid than individual opinion (Keeney, Hasson, & McKenna 2011:3). The Delphi technique is employed for the purpose of determining priorities and, more significantly, for reaching a consensus on any combination of ideas or concerns (Keeney et al., 2011:5). The selected expert panel can be contacted via mail, email, or face-to-face interviews; two to three rounds of comment-seeking are required (Keeney et al 2011:7).

Selection of the experts for Delphi study

Purposively selecting an expert who is knowledgeable in line with the drafted strategy is one of the key steps in the Delphi method (Keeney et al., 2011:7). Thus, first, the researcher developed and drafted the strategies based on the key research findings and literature reviewed to prevent T2DM among adults in Ethiopia. Following that, eight experts were identified and selected. Experts were selected based on their profession, qualification area, and strategy development experience. Hence, the experts were selected from amongst university lecturers who are key experts in diabetic research and other NCDs, public health experts on the prevention of diseases, and hospital clinicians who treat DM and other NCDs and have skills and expertise in developing different guidelines and strategies.See Table 6.1.

After the experts were selected, the researcher contacted them by phone or face-to-face and briefly discussed the objective of the study and the key findings with them. Additionally, each expert disclosed the anonymity of their feedback and explained that they were free to withdraw from the Delphi study group at any time. Each panellist was given an equal opportunity to express and respond to ideas without being influenced by the identities of the other experts on the panel by ensuring their anonymity (Keeney, Hasson, & McKenna 2011:9).

Table 6.1: Basic biography of the experts validating the strategies.

S No	Profession	Education	Qualification	Work place
1	Internist	Medical Doctor, Assistant professor	OPD /In-patient care	Hospital
2	Adult health nursing specialty	MSc	Chronic care clinic	Hospital
3	Public health specialty	MPH (Master of Public health)	Public health Advisor	Zonal health Bureau
4	Public health specialty	MPH (Master of Public health)	Public health Advisor	NGO
5	Assistant professor	PHD	Researcher	University
6	Nutritionist	MSc, PHD candidate	Researcher & nutrition advisor	University
7	MPH, Assistant professor	Assistant professor	Lecturer & Researcher	University
8	MSc, Assistant professor	Assistant professor, PHD candidate	Researcher	University

Communication modality

Once the initial consent to take part in the reviewing process was obtained, strategies were sent to eight experts or professionals, who reviewed and scored each strategy based on given criteria to the experts, together with an abstract, an ethical clearance form, and a researcher consent form. The questions came with clear instructions on how to evaluate the strategies. Further, display the criteria for evaluation of drafts of strategies for final validation in Tables 6.2 and 6.3.

6.6.1 Description of the evaluated strategies

Table 6.2: Scores and evaluation criteria of strategies for prevention of T2DM among adults in Ethiopia

Score	Criteria Description
4	Complete ,clear , well formulated and highly applicable
3	Applicable , but needs reformulation
2	Unclear, applicability questionable
1	Irrelevant , totally not applicable

Table 6.3: Criteria for validation on each proposed for prevention of T2DM among adults in Ethiopia

Criteria	4	3	2	1
Completeness				
Applicability: The target user are clearly defined as described in the scope of strategies				
Clarity: The specific strategy is precise, simple and easily understandable				
Relevance's strategy is appropriate for prevention of T2DM				

The experts scored each strategy out of 16 points, and the researcher accepted the strategies as valid if the mean score was 12 (or higher than 75%). However, any strategies that resulted in a mean score of less than 12 were reviewed in light of the comments from the experts. In the meantime, some feedback from the experts was incorporated into the strategy. The experts were asked to explain their scores if needed. The feedback from the experts is summarised in Table 6.4.

The 4-point Likert scale was used according to the following calibrations: 1=irrelevant, not applicable at all; 2=unclear, applicable questionable; 3=applicable but needs reformulation; and 4=complete, clear, well formulated. The Likert scale determines a subject's opinion or attitude and contains a series of declarative statements with a scale after each statement. The Likert scale is the most commonly used scaling technique in nursing and health care studies (Grove et al. 2013:430). Ratings that registered 4s were accepted, the 3s and 2s were re-formulated, and the 1s were deleted. Most raters scored 4s, and few strategies that scored 2s or 3s were reformulated; when strategies were repeated, the repeated strategy was deleted. The revised/ reformulated strategies were reflected in this chapter as the final ones from the whole study.

Based on the given criteria, all eight experts submitted their opinions to the researcher. The evaluations were then put together in accordance with that (see Table 6.4). Although there were individual disparities in the scores given, the majority of the group supplied scores that were similar. If necessary, the experts were asked to give some explanations for their scores. In their evaluation, the experts gave the researcher input. The experts' comments are compiled in Table 6.4.

Table 6.4: Average score of validation results for each proposed strategy as per experts

Thematic area	Strategy	Evaluators(Eval)								Average score
		Eval 1	Eval 2	Eval 3	Eval 4	Eval 5	Eval 6	Eval 7	Eval 8	
Thematic 1	Strategy 1.1	15	16	16	16	15	16	16	14	15.5
	Strategy 1.2	16	16	15	14	15	14	15	14	14.88
	Strategy 1.3	12	16	14	15	10	14	15	12	13.5
	Strategy 1.4	14	16	16	13	16	14	16	13	14.75
	Strategy 1.5	16	12	16	16	16	16	15	14	15.13
	Strategy 1.6	15	16	14	13	12	14	13	14	13.88
	Strategy 1.7	12	12	13	15	10	14	13	12	12.63
	Strategy 1.8	12	13	14	15	10	8	15	12	12.38
	Strategy 1.9	12	13	14	15	10	14	15	12	13.13
	Strategy 1.10	14	16	16	13	16	14	16	16	15.13
Thematic 2	Strategy 2.1	12	13	14	15	12	10	15	12	12.88
	Strategy 2.2	12	13	14	15	13	12	15	12	13.25
	Strategy 2.3	12	15	15	16	14	13	15	13	14.13
	Strategy 2.4	12	15	14	15	12	15	15	14	14
	Strategy 2.5	12	13	14	15	10	8	15	12	12.375
	Strategy 2.6	16	16	14	15	16	15	15	16	15.38
Thematic 3	Strategy 3.1	16	16	15	14	15	14	15	14	14.88
Thematic 4	Strategy 4.1	15	16	14	13	12	14	15	16	14.38
	Strategy 4.2	13	15	14	16	14	12	15	13	14
	Strategy 4.3	16	13	14	15	12	10	15	12	13.38
	Strategy 4.4	15	15	14	16	14	13	15	13	14.38
	Strategy 4.5	15	16	14	13	12	14	15	15	14.25

6.6.3 Follow-up of experts

Withdrawal from membership and/or low response rates are common characteristics that are encountered in the final round of the Delphi technique (Keeney et al., 2011:12). Therefore, during the entire process, the researcher encouraged the experts to offer their valuable feedback to improve the draft strategies by phone call or text message.

Monitoring and Evaluation

Implementation of the proposed strategies would begin immediately upon completion of this study and will require measurement of outcomes, effectiveness, and impact through periodic monitoring and a final evaluation. Considering the results and relevant scientific literature and working papers, the researcher proposed the following prevention strategies after categorising them into four themes in response to T2DM in Bale Zone, Oromia Regional State, and Southeast Ethiopia. Moreover, monitoring and evaluation are critical components of the proposed strategy for prevention of T2DM in adults, which is incorporated into Ethiopia's NCD prevention and control strategic action.

6.7 CONCLUSION

Following that, strategies were developed and validated by experts, and final strategies established monitoring and evaluation for the prevention of T2DM. The strategies can be used by health professionals, policymakers, and health care managers. Further, the researcher is confident that the strategy will contribute to the prevention of T2DM and thereby reduce the burden of the disease in Ethiopia.

CHAPTER 7 - CONCLUSIONS, RECOMMENDATIONS AND LIMITATIONS

7.1 INTRODUCTION

This chapter summarises the findings, along with the contributions and limitations of the study any conclusions and recommendations are also presented. The aim of the study was to develop strategies for the prevention of T2DM among adults in Bale Zone, southeast Ethiopia.

This chapter also presents the limitations and recommendations made on the prevalence of T2DM, the distribution of risk factors for T2DM, the knowledge, perception, and prevention of risky behaviours in adults, and the determinants of T2DM that help in developing strategies to prevent T2DM.

A quantitative, descriptive cross-sectional design was used for the Phase I study, while an unmatched case-control study design was used for the Phase II of this study.

This will aid policymakers to make informed decisions about implementing effective public health interventions to reduce the burden of T2DM through risk factor modification and enhance community knowledge and awareness of T2DM prevention activities.

7.2 CONCLUSION OF THE STUDY

7.2.1 Summary of research findings for the cross-sectional study (Phase I)

In an effort to assess the prevalence of T2DM, the study found that the prevalence of the disease was high (6.7%). Furthermore, the high proportion of undiagnosed DM and pre-diabetes (16.2%) during the study demonstrates that regular screening is inadequate and that pre-diabetes requires intervention to prevent progression to T2DM.

Cigarette smoking

This study shows that just 6% and 2.7% of respondents had ever smoked a cigarette in their lifetime and currently smoke cigarettes, respectively, which is not high. The majority

(80%) of current smokers were daily smokers. Men also had a higher rate of current cigarette smoking than women.

Khat chewing

The proportion of respondents who had ever chewed Khat was low (9.1%).

Alcohol consumption

The proportion of respondents who had ever consumed alcoholic beverages was high (36.4%). Respondents who currently consumed alcohol in the current study were moderate (28.2%).

Dietary Habit

The average number of days consumed fruit in a typical week was slightly moderate (3.5 days).

Physical activity

A small proportion of respondents (18.2%) reported engaging in at least 10 minutes of work-related vigourous physical activity per day.

Physical measurements

Physical measurements included raised blood pressure or hypertension, body mass index (BMI), waist circumference (WC), and waist-to-hip ratio (WHR)**.** The following summary would be made for each physical measurement:

Raise blood pressure/ hypertension

The proportion of overall hypertension (both diastolic and systolic blood pressure) was high (26.2%). Only a small proportion (16.2%) of respondents had their blood sugar levels measured in their lifetime. However, the prevalence of diabetes in history has been relatively high (6.2%).

Body Mass Index (BMI)

The proportion of individuals who had BMIs of 25 kg/m2 or above was high (20.4%). Females had a higher proportion of being overweight or obese than males.

Waist circumference (WC) and waist-to-hip ratio (WHR)

The proportion of raised WC in both sexes was considerably high (46.1%); females had a much higher proportion than males (70.57% versus 12.88%). The overall proportion of WHR increased was also quite high (69.8%). The WHR was higher in females than men.

7.2.2 Factors associated with Type 2 Diabetes mellitus in a cross-sectional study (Phase I)

- Factors such as not eating fruit, eating animal fat, not engaging in vigorous-intensity physical activity related to work, having a higher BMI, and having high blood pressure (hypertension) have all been strongly associated with T2DM.

7.2.3 Knowledge of respondents of Type 2 Diabetes mellitus risky behaviour and prevention.

Eleven percent (11%) of respondents did not receive any information about diabetes. Among the remaining respondents who did receive information about diabetes, 57% received it from media such as television, and a minor percentage (27%) received it from health workers.

- The proportion of adults who knew the normal range of fasting blood glucose levels was only 3.7% (n = 17).
- One-fifth of respondents (20.8%) are unaware that T2DM is a chronic disease.
- Over one-third of respondents do not know if T2DM is preventable or not.

After computing the knowledge assessment questions into a single variable and categorising them as "low level of knowledge", "medium level of knowledge" and "high level of knowledge”, the majority of respondents (42.6%, n = 234) in the study fell under the "low level of knowledge" group.

7.2.4 Perception towards Type 2 Diabetes mellitus based on the Health belief model

Perceived susceptibility

According to the findings of this study, 43.2% of respondents did not consider themselves at risk of contracting T2DM (perceived susceptibility). The researchers have come to the conclusion that the community's perception of its susceptibility to T2DM has to be addressed.

Perceived severity

In terms of perceived severity, 61% of respondents agreed with the statements related to the seriousness of T2DM.

Perceived benefit of preventive activity of T2DM

Regarding the perceived benefits of applying preventative activity, approximately two-thirds of the respondents agreed that engaging in the advised behaviours can help prevent T2DM, indicating a favourable perception of T2DM prevention measures.

Perceived barrier to T2DM prevention measure

The findings of this study show that more than two-fifths of the respondents (42.8%) perceived barriers to applying T2DM prevention activities. T2DM prevention will be difficult with such a poor perception, resulting in low adherence to advised interventions.

Cue for action of T2DM

The findings of this study on the cue to act in the T2DM prevention activity show that only 23.1% of respondents had a high perception of the cue to act, which will limit the possibility that the preventive activity will be easy to do.

In conclusion, the HBM constructs revealed that adults' perceptions of T2DM risky behaviour and community prevention were low.

7.2.5 Summary of research findings for the case control study (Phase II)

This section highlights the determinants of T2DM.

The determinants of T2DM include socio-demographic, behavioural, physical, perception-related, mental stress-related, and biological factors.

Socio-demographic determinants of T2DM

- Being older increases the risk of developing T2DM.
- Being male increases the risk of developing T2DM.
- No formal education and primary education increases the odds of T2DM.
- Being in the middle wealth index reduced the risk of T2DM.
- Vigorous work-related physical activity was found to increase the risk of T2DM.

Behavioural determinants of T2DM

- Being engaged in vigorous work-related physical activity was found to increase the odds of T2DM.
- Having smoked cigarettes at some point was found to increase the odds of T2DM.
- Current alcohol consumption lowers the risk of developing T2DM.
- A family history of DM was found to increase the risk of developing T2DM.

Physical measurement determinants of T2DM

- Having a BMI (kg/m2) of 25 kg/m2 and/ or above was proven to increase the risk of developing T2DM.
- Having a higher waist circumference (WC) was found to increase the risk of developing T2DM.
- Having a raised waist-hip ratio (WHR) was found to increase the risk of T2DM.

Perception related to the determinants of T2DM

- The perception of frequently consuming plant products, such as fruits and vegetables, having a positive impact on body size and shape was the only variable that appeared to have statistical significance with T2DM; that is, perceiving that

consuming plant products on a regular basis, such as fruits and vegetables, had a good impact on body size and shape reduced the risk of having T2DM.

Mental stress related determinants of T2DM

- Having a poor appetite increases the odds of being T2DM.
- Feeling uncomfortable in their stomachs increased the odds of having T2DM.
- Feeling it was difficult to enjoy their daily activities increased the odds of being T2DM.
- Feeling of lost interest in things increased the risk of T2DM.

Overall independent determinants of T2DM

Being older than 50 years old, being male, having smoked cigarettes at some point, having food insecurity, and experienced mental stress such as losing interest were all associated with a higher risk of T2DM, whereas the following factors were protective for having T2DM: Being in primary and secondary education, having a medium wealth index, currently drinking alcohol, and engaging in vigorous physical activity related to work

- Being older increases the risk of developing T2DM.
- Being male increases the risk of developing T2DM.
- Ever-smoked cigarettes were found to increase the odds of T2DM.
- Being engaged in vigorous work-related physical activity was found to increase the odds of T2DM.
- Having food insecurity was found to increase the risk of developing T2DM.
- Feeling it was difficult to enjoy their daily activities increased the odds of being T2DM.
- Feeling a loss of interest in things increased the risk of T2DM.
- The T2DM risk was reduced by attending primary and secondary school.
- Being in the middle wealth index reduced the risk of T2DM.
- Currently, drinking alcohol reduces the risk of developing T2DM.

7.3 RECOMMENDATIONS OF THE STUDY

The following recommendations are made based on the findings of the study:

Recommendations are made as suggestions for healthcare professionals, policymakers, and health managers to implement, in addition to calling for further research by researchers.

Recommendations directed to federal ministry of health

The following recommendations have been forwarded to the Federal Ministry of Health:

- It is necessary to establish the National Programme for Prevention and Control of T2DM, which will concentrate on disease prevention among high-risk populations and health promotion among the general population.
- The WHO PEN (World Health Organization Package of Essential NCD Interventions) needs to be implemented in health facilities.
- Preventive measures for those with pre-diabetes must be given priority by the Federal Ministry of Health and other stakeholders.
- Arrange training and a workshop on T2DM and its risk factors for health care professionals.
- There is a need to modify the regulations and levies already in place to reduce consumption of alcohol, tobacco, unhealthy foods and beverages (ban on tobacco advertising; promotion and sponsorship; taxation on alcohol; cigarettes and other tobacco products; development of the Alcohol and Deity Policy).
- Enforcing the regulations of the Tobacco Control Act at the national level will strengthen the Framework Convention on Tobacco Control's (FCTC) implementation.
- Adapt the global harmful consumption of alcohol reduction strategy.
- Enacting laws governing food and beverage production, packaging, and responsible marketing will help people eat less unhealthy food.
- Introduce the physical activity toolkit across the country to promote the adoption of active lifestyles and decrease sedentary behaviour.

- Implementing DM and its risk factor screening in health facilities is urgently necessary for the early detection of individuals at risk for T2DM.
- To prevent this epidemic, there needs to be an adequate budget allocated for T2DM prevention and control.
- Increasing training and research capacity for the healthcare system
- Create community education and awareness programmes to raise awareness of diabetes, focusing on the signs, complications, risk factors, and preventative measures of T2DM.
- Promote community mobilisation by using health care providers and health extension workers to increase awareness of T2DM screening and prevention activities.
- The use of the media is necessary to inform the community about T2DM.
- Health facilities must be equipped with enough glucometers in order to support T2DM prevention activities.
- Through health promotion activities, emphasising control and prevention strategies for these modifiable risk factors connected to diabetes and prediabetes may help reduce the prevalence and effects of T2DM.
- Raise community awareness through the media of the importance of a healthy diet and regular physical activity for preventing NCDs like T2DM.
- Persistent community awareness campaign and activity to reduce the modifiable risk factors for NCDs like T2DM mellitus: unhealthy diets, physical inactivity, harmful alcohol use, cigarette use, and exposure to tobacco smoke.
- Establish wellness clinics at all locations to promote the early detection and screening of T2DM diabetes and to act as educational tools for prevention and health promotion.
- The promotion of healthy lifestyles through various media and education may help reduce the prevalence and incidence of T2DM in the general population.

Recommendations directed to Oromia Regional Health Bureau:

- In order to identify individuals who are highly at risk of T2DM, including T2DM risk factors, screening at the community level is required. Through targeted, ongoing outreach programmes, this can be accomplished successfully.
- Strengthening the management system for DM to include regular monitoring, training, and reporting

- Recommendations direct to heath care professionals
- Health professionals must make a concerted effort to raise public awareness of T2DM mellitus, its risk factors, and effective prevention means.

Future research

This study has to be replicated at the national level to provide a picture of T2DM and its risk factors at the national level.

An observational study will be undertaken to find out how T2DM affects hypertension and how hypertension affects T2DM.

There should be an assessment of the strategies used to raise awareness and improve T2DM screening.

Further observational and interventional research will be conducted to examine the relationship between T2DM and food insecurity, mental stress, and other determinants of overweight or obesity and T2DM.

7.4 LIMITATION OF THE STUDY

This study has some limitations that need to be considered.

Even though this study has a different research design, it shares the same methodological limitations in each of the phases of the current study.

Phase I

Firstly, due to the cross-sectional nature of this study, it is difficult to establish temporal associations and causality between T2DM and the epidemiological risk factors for T2DM. It would be useful to conduct further community-based longitudinal research that would provide further exploration of the risk factors for T2DM.

Second, only two urban participants were recruited for the study, which may not adequately reflect reality in the Bale area, especially for rural residents.

Third, the identification of DM using a glucose metre from capillary blood was limited because it was less accurate and reliable than plasma glucose measurement determined by a spectrophotometer. In addition, due to uncertainty regarding participant compliance with the 8-hour fasting requirement, utilising FBG to diagnose DM may have resulted in some cases being incorrectly diagnosed. But the researchers strictly followed the WHO's recommendations for fasting blood glucose and anthropometric measurements, and the data was collected by well-trained health workers.

Fourth, due to a budget constraint, HbA1C and lipid profiles may not have been done, which could have decreased the strength of this study. It is suggested that future studies use HbA1C and other parameters to obtain more accurate data and establish the prevalence of T2DM and other risk factors in the adult population.

Fifth, alcohol, cigarette, and other substance use behaviours were solely assessed through interviews or self-report, which may not have been accurate due to recall bias.

Phase II

Some of the limitations of this study must also be addressed in Phase II.

Firstly, the recall bias in the case-control study was inevitable. Recall bias and social desirability bias were limitations of this study that might have affected the accuracy of the

information, as the respondents were asked questions about some of their previous health-related events.

In addition, the case-control study design poses a risk of information bias. Particularly, case study participants are more likely than controls to report or recall several exposures. It is difficult to determine cause-and-effect relationships in this case-control study.

This case-control study also shares the limitations of the cross-sectional study mentioned above. For example, the self-reported behavioural risk factors in this study, including fruit and vegetable consumption, alcohol and tobacco use, and physical activity, may underestimate or overestimate the levels of these risk factors.

Finally, the current study did not collect data on medication use and adherence, which could have provided better clinical information.

7.5 CONCLUDING REMARKS

The prevalence of T2DM was found to be alarmingly high in this study, and it has been rising exponentially. This study has clearly indicated the risk factors for T2DM that exist with varying magnitudes, some of them at alarming rates. The community's knowledge and perception regarding T2DM, its risky behaviours, and prevention were found to be unsatisfactory. Furthermore, there were prevalent misconceptions and negative attitudes towards certain behaviours, including their impact on body shape and size. The determinants of T2DM were identified, emphasising the urgent need for innovative prevention strategies targeting individuals at high risk. Effective measures should be implemented to prevent and control T2DM and its consequences, particularly among those with modifiable risk factors such as high blood pressure, smoking history, and large waist circumference. Regular screening for the disease in these individuals is of utmost importance.

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APPENDIX A: CERTIFICATE OF CLEARANCE FROM THE UNIVERSITY OF SOUTH AFRICA HEALTH STUDIES HIGHER DEGREES COMMITTEE

UNISA university of south africa

RESEARCH ETHICS COMMITTEE: DEPARTMENT OF HEALTH STUDIES

REC-012714-039 (NHERC)

27 March 2017

HSHDC/682/2017
Mr TA Tadesse
Student: 5855-228-6

Supervisor: Prof LV Monareng
Qualification: D Litt et Phil
Joint Supervisor: -

Dear Mr TA Tadesse

Decision: Ethics Approval

Name: Mr TA Tadesse

Proposal: Prevention of risk factors of type 2 diabetes mellitus amongst the adults of Bale Zone South East Ethiopia.

Qualification: DPCHS04

Thank you for the application for research ethics approval from the Research Ethics Committee: Department of Health Studies, for the above mentioned research. Final approval is granted for the duration of the research period as indicated in your application.

The application was reviewed in compliance with the Unisa Policy on Research Ethics by the Research Ethics Committee: Department of Health Studies on 27 March 2017.

The proposed research may now commence with the proviso that:

1) *The researcher/s will ensure that the research project adheres to the values and principles expressed in the UNISA Policy on Research Ethics.*

2) *Any adverse circumstance arising in the undertaking of the research project that is relevant to the ethicality of the study, as well as changes in the methodology, should be communicated in writing to the Research Ethics Review Committee, Department of Health Studies. An amended application could be requested if there are substantial changes from the existing proposal, especially if those changes affect any of the study-related risks for the research participants.*

University of South Africa
Preller Street, Muckleneuk Ridge, City of Tshwane
PO Box 392 UNISA 0003 South Africa
Telephone: +27 12 429 3111 Facsimile: +27 12 429 4150
www.unisa.ac.za

3) *The researcher will ensure that the research project adheres to any applicable national legislation, professional codes of conduct, institutional guidelines and scientific standards relevant to the specific field of study.*

4) *[Stipulate any reporting requirements if applicable].*

Note:
The reference numbers [top middle and right corner of this communiqué] should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants, as well as with the Research Ethics Committee: Department of Health Studies.

Kind regards,

Prof L. M. Roets

Prof L Roets
CHAIRPERSON
roetsl@unisa.ac.za

Prof MM Moleki
ACADEMIC CHAIRPERSON
molekmm@unisa.ac.za

ANNEXURE B: SUPPORT LETTER FROM UNISA REGIONAL LEARNING CENTRE TO CONDUCT THE STUDY

UNISA university of south africa

14 May, 2021

UNISA-ET/KA/ST/29/14-05-2021

OROMIA REGIONAL HEALTH BUREAU

ADDIS ABABA

Dear Madam/Sir,

The University of South Africa (UNISA) extends warm greetings. By this letter, we want to confirm that Tesfaye Assefa Tadesse (student number 58552286) is a PhD student in the Department of Health Studies at UNISA. Currently, he is at the stage of data collection on his doctoral research entitled "***Prevent risk factors of type 2 diabetes mellitus amongst the adults of Bale Zone, South East Ethiopia***."

This is therefore to kindly request your cooperation in assisting the student in any way that you can. We would like to thank you in advance for all the assistance that you would provide to the student. Attached, please find the ethical clearance that the student secured from the Department.

Sincerely,

Dr. Tsige GebreMeskel Aberra

Director

UNISA: ETHIOPIA REGIONAL LEARNING CENTRE
P.O. BOX 13836 ADDIS ABABA, ETHIOPIA
TEL +251-912-191483
+251-978-033159
+251-978-033432

University of South Africa
Regional Learning Center
P.O. Box: 13836, Addis Ababa, Ethiopia
Telephone: +251 11 435 2244 / +251 11 435 0078
Facsimile: +251 11 435 1242/ 43/ 44
Mobile: +251 912 19 1483
www.unisa.ac.za

UNISA university of south africa

14 May, 2021

UNISA-ET/KA/ST/29/14-05-2021

Madda Walabu University Goba Referral Hospital

Goba

Dear Madam/Sir,

The University of South Africa (UNISA) extends warm greetings. By this letter, we want to confirm that Tesfaye Assefa Tadesse (student number 58552286) is a PhD student in the Department of Health Studies at UNISA. Currently, he is at the stage of data collection on his doctoral research entitled "***Prevent risk factors of type 2 diabetes mellitus amongst the adults of Bale Zone, South East Ethiopia***."

This is therefore to kindly request your cooperation in assisting the student in any way that you can. We would like to thank you in advance for all the assistance that you would provide to the student. Attached, please find the ethical clearance that the student secured from the Department.

Sincerely,

Dr. Tsige GebreMeskel Aberra

Director

UNISA: ETHIOPIA REGIONAL LEARNING CENTRE
P.O. BOX 13836 ADDIS ABABA, ETHIOPIA
TEL +251-912-191483
+251-978-083159
+251-978-003432

University of South Africa
Regional Learning Center
P.O. Box: 13836, Addis Ababa, Ethiopia
Telephone: +251 11 435 2244 / +251 11 435 0078
Facsimile: +251 11 435 1242/ 43/ 44
Mobile: +251 912 19 1483
www.unisa.ac.za

ANNEXURE C: LETTER OF PERMISSION RUQUSET TO OROMIA REGIONAL HEALTH BUREAU

Permission seeking letter to conduct research.

To: Oromia regional health bureau

Finfinnee, Ethiopia

Subject: Request for Research Permission in Bale Zone, Southeast Ethiopia.

I, the undersigned applicant, am currently pursuing a PhD in Health Studies at the University of South Africa, Department of Health Studies. As an Assistant Professor specializing in Adult Health Nursing at Madda Walabu University, I wish to conduct a research study entitled "**Strategies for Prevention of Type 2 Diabetes Mellitus among the Adults of Bale Zone, Southeast Ethiopia."** This study aligns with the requirements for obtaining a doctoral degree in Health Studies.

The outcomes of this research will significantly contribute to the existing knowledge on prevention of chronic non-communicable diseases like type 2 diabetes mellitus additionally, the prevention strategies derived from this study will serve as a valuable resource for the regional health bureau's efforts in combating Type 2 Diabetes Mellitus.

I kindly request the permission of the health bureau to conduct this study at the following locations: Bale Robe Town Administration, Goba Town Administration, Bale Robe General Hospital, and Goba Referral Hospital. The research findings will be shared with the health bureau, Bale Robe Town Administration, Bale Robe General Hospital, Goba Town Administration, and Goba Referral Hospital. Please provide me with a permission letter to proceed with the proposed research

Tesfaye Assefa Tadesse (Student number: 58552286)

58552286@mylife.unisa.ac.za

Dr Zodwa Margarert Manyisa (Supervisor)

manyizm@unisa.ac.za

ANNEXURE D: ETHICAL CLEARANCE FROM OROMIA REGIONAL HEALTH BUREAU

Biiroo Eegumsa Fayyaa Oromiyaa
Oromia Health Bureau
Saarbet (Calcalii) - Finfinnee

የኦሮሚያ ጤና ጥበቃ ቢሮ
ሳርቤት(ጨልጨሊ) - ፊንፊኔ

Lakk/Ref.NO BEFO/HBTFH/1-16/10317
Guyyaa/Date 11/09/2013

Hospitaala Riifraala Goobaa tiif

Wa/Eg/Fa/Go/Baalee tiif

Wa/Eg/Fa/Bu/Mag/Roobee tiif

B/J

Dhimmi: Xalayya Deggersa Ilaala

Akkuma beekamu Biiroon Keenya Ogeyyii , dhabbilee akkasumas namoota qorannoo geggessuuf propozaala dhiyeffatan propoozaala isaanii madaaluun akkasumas iddo biratti ilaalchisani fudhatama argatan (approved) dhiyeffatan, propoozaala isaanii ilaaluudhaan waraqa deggersa ni kenna. Haaluma kanaan mata duree **"PREVENT RISK FACTORS OF TYPE 2 DIABETES MELLITUS AMONGST THE ADULTS OF BALE ZONE, SOUTH EAST ETHIOPIA."** jedhamu irratti Kaadhimamaa barataa digirii Sadafaa Yuunivarsitii UNISA Godina/Magaalaa/Hospitaala keessan keessatti qorannoo geggessuuf propoozaala isaanii koree **"Health Research Ethical Review Commite"** Biiroo keenyatti dhiyeffatani jiru. Haaluma kanaan koreen "Health Research Ethical Review Committee" Biiroo keenya piropoozaal kana ilaaluun mirkanesse qorannoon kun akka hojii irra oolu murtesse jira.

Kanaafuu, hojii qorannoo kana irratti deggersa barbaachisaa ta'e akka gootanii fi hordoftan jechaa, **Obboo TESFAYE ASSEFA TADESSE** tiis qorannoon kun qacceffamee eerga xumurame booda firii isaa koppii tokko BEFO tiif akka galii godhan galagalcha xalayaa kanaan isiniif beeksifna.

Nagaa Wajiin !

Mallattoo________________

Maqaa: **TESFAYE ASSEFA TADESSE**

Bilbila **+251-9 11034995**

G/G

TESFAYE ASSEFA TADESSE tiif

011-371-72-77 befokom2008@gmail.com *or* ohbhead@telecom.net.et Tin NO 0001298233
011-371-72-27 *Oromia Regional Health Bureau* 24341 www.orhb.gov.et

Biiroo Eegumsa Fayyaa Oromiyaa
Oromia Health Bureau
Saarbet (Calcalii) - Finfinnee

የኦሮሚያ ጤና ጥበቃ ቢሮ
ሳርቤት(ጨልጨሎ) - ፊንፊኔ

Lakk/Ref.NO BEFO/HBTFH/1-16/10317
Guyyaa/Date 11/09/2013

Hospitaala Riifraala Goobaa tiif

Wa/Eg/Fa/Go/Baalee tiif

Wa/Eg/Fa/Bu/Mag/Roobee tiif

B/J

Dhimmi: Xalayya Deggersa Ilaala

Akkuma beekamu Biiroon Keenya Ogeyyii , dhabbilee akkasumas namoota qorannoo geggessuuf propozaala dhiyeffatan propoozaala isaanii madaaluun akkasumas iddo biratti ilaalchisani fudhatama argatan (approved) dhiyeffatan, propoozaala isaanii ilaaluudhaan waraqa deggersa ni kenna. Haaluma kanaan mata duree **"PREVENT RISK FACTORS OF TYPE 2 DIABETES MELLITUS AMONGST THE ADULTS OF BALE ZONE, SOUTH EAST ETHIOPIA."** jedhamu irratti Kaadhimamaa barataa digirii Sadafaa Yuunivarsitii UNISA Godina/Magaalaa/Hospitaala keessan keessatti qorannoo geggessuuf propoozaala isaanii koree **"Health Research Ethical Review Commite"** Biiroo keenyatti dhiyeffatani jiru. Haaluma kanaan koreen "Health Research Ethical Review Committee" Biiroo keenya piropoozaal kana ilaaluun mirkanesse qorannoon kun akka hojii irra oolu murtesse jira.

Kanaafuu, hojji qorannoo kana irratti deggersa barbaachisaa ta'e akka gootanii fi hordoftan jechaa, **Obboo TESFAYE ASSEFA TADESSE** tiis qorannoon kun qacceffamee eerga xumurame booda firii isaa koppii tokko BEFO tiif akka galii godhan galagalcha xalayaa kanaan isaan beeksifna.

Nagaa Wajiin !

Mallattoo________________

Maqaa: **TESFAYE ASSEFA TADESSE**

Bilbila_ **+251-9 11034995**

G/G

·TESFAYE ASSEFA TADESSE tiif

011-371-72-77 befokom2008@gmail.com or ohbhead@telecom.net.et Tin NO 0001298233
011-371-72-27 Oromia Regional Health Bureau 24341 www.orhb.gov.et

ANNEXURE E : ENGLISH VERSION OF LETTER FROM OROMIA REGIONAL HEALTH BUREAU GRATINIG TO CONDUCT THE STUDY

TAJAAJILA TURJUMAANAA ISTAADIYOOMII
STADIUM TRANSLATION SERVICE
ስታድየም የትርጉም ሥራ አገልግሎት
+251 0930-098302/+251 0913488211 Fax: +251 0115522226 E-mail: stadiumtrans30@gmail.com

Emblem
Oromia Health Bureau
Sarbet (Chelcheli) – Addis Ababa

Ref. No. **BEFO/HBTFH/1-16/10317**
Date: **19/05/2021**

To Goba Referral Hospital
To Bale zone Health Office
Robe City Health Office
Whereabouts

Subject: **Regards Issuance of Support Letter**

It is known that our Bureau provides support letter for the individuals or companies by assessing their research proposal as well, the individuals or companies who have got approval at another place.

Accordingly, the UNISA PHD candidate has presented his research proposal entitled **"PREVENT RISK FACTORS OF TYPE 2 DIABETES MELLITUS AMONGST THE ADULTS OF BALE ZONE, SOUTH EAST ETHIOPIA"** to Health Research Ethical Review Committee of our office to carry out research in your zone/town/hospital. Hence, Health Research Ethical Review Committee of our bureau as examined this research proposal and approved the same so that the candidate can carry out the research.

Thus, we notify to provide the necessary support and cooperation for the researcher and further we notify the researcher **MR. TESFAYE ASSEFA TADESSE** to provide copy of the result of the research upon the completion of the research.

With regards
Signed
Gemechu Shumi
Public Health Emergency, Research and Study
Directorate Director

Signature: _____
Name: TESFAYE ASSEFA TADESSE
Tel No. +251-9 11034995
CC

- **TESFAYE ASSEFA TADESSE**

Seal
Oromia Regional Health Bureau Public Health Emergency Management & Health Research Directorate

Ka/June 1, 2021

ዳንኤል ኃ/የሱስ ዋና
ዋና ሥራ አስኪያጅ
Daniel H/Yesus Wana
General Manager

ANNEXURE F: ENGLISH VERSION OF LETTER PERMISSION FROM MADDA WALABUUNIVERITY ACADEMIC DIRECTORATE OFFICE PERMISSION TO MADDA WALABU UNIVERSITY GOBA REFERRAL HOSPITAL TO COLLECT

TAJAAJILA TURJUMAANAA ISTAADIYOOMII
STADIUM TRANSLATION SERVICE
ስታድየም የትርጉም ሥራ አገልግሎት
+251 0930-098302/+251 0913488211 Fax: +251 0115522226 E-mail: stadiumtrans30@gmail.com

Emblem
Goba Referal Hospital Academy & Research Directorate
Bale Goba Ethiopia

Ref No.: ***003/2/6527***
Date: ***May 26, 2021***

To: MWU (Meda Welabu University)

GRH Chief Clinical Directorate Office

GRH

Subject: ***Regards Requesting Cooperation***

Mr. Tesfaye Asefa who is PHD student at UNISA requested us to provide him support regarding his academic research entitled ***"Prevent Risk of type 2 diabetes mellitus amongst the adult of Bale Zone, Zone, South East Ethiopia"*** presenting support letter from UNISA Ethiopia Regional Learning Center and Oromia Health Bureau. Thus, we kindly request to provide him the necessary support and cooperation by issuing evidences and information related with the research topic.

With Regards,
Signed
Mohammed Aman Mama Hussen
Academic & Research Directorate

CC

- To MWU GRH Chief Executive Directorate
- To MWU GRH Academic & Research Directorate
- To Mr. Tesfaye Assefa
  GRH (Goba Referral Hospital)

SEAL

Meda Welabu University Goba Referral Hospital

Daniel H/Yesus Wana
General Manager

June 1, 2021 FF

ANNEX G : LETTER FROM MADDA WALABUUNIVERITY ACADEMIC DIRECTORATE OFFICE PERMISSION TO MADDA WALABU UNIVERSITY GOBA REFERRAL HOSPITAL

Madda Walabu University
Goba Referral Hospital
Academic and Research
Directorate

መደ ወላቡ ዩኒቨርሲቲ ጎባ ሪፈራል ሆስፒታል የአካዳሚክ እና ምርምር ዳይሬክቶሬት

Bale –Goba Ethiopia
ባሌ–ጎባ ኢትዮጵያ

Ref.No/ ቁጥር 003/2/6527
Date/ ቀን 18/9/2013

ለመወዩ ጎሪሆ ቺፍ ኪሊኒካል ዳይሬክተር ጽ/ቤት

ጎሪሆ

ጉዳዩ፡- ትብብር እንዲደረግላቸዉ ስለመጠየቅን፤

ከላይ በርዕሱ ለመጥቀስ እንደተሞከረዉ በደቡብ አፍሪካ ዩኒቨርሲቲ (UNISA) የ3ኛ ዲግሪ (PhD) ተማሪ የሆኑት መ/ር ተስፋዬ አሰፋ "Prevent risk of type 2 diabetes mellitus amongst the adult of Bale Zone, South East Ethiopia" በሚል ርዕስ ትምህርታዊ ጥናት ድጋፍ እንዲደረግላቸዉ ከUNISA Ethiopia Regional Lerning Center እና ከኦሮሚያ ጤና ቢሮ በደብዳቤ ጠይቀዉናል፡፡ ስለሆነም ለጥናቱ የሚሆን መረጃ ለመስጠት በእናንተ በኩል አስፈላጊዉ ትብብር ሁሉ እንድታደርጉላቸዉ በትህትና እንጠይቃለን፡፡

ከሠላምታ ጋር

Mohammedaman Hama Hussen
Academic & Research Director

ግልባጭ//
☆ ለመወዩ ጎሪሆ ቺፍ ኤክስኪዩቲቭ ዳይሬክቶሬት
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☆ ለመ/ር ተስፋዬ አሰፋ
ጎሪሆ

ቢአ +251-226-610-559 302 +2512-266- 610-559
2013 E.C

ANNEXURE H: PERMISSION LETTER FROM BALE ZONE OFFICE TO CONDUCT FIELDWORK TO GOBA TOWN

WAAJJIRA EEGUMSA FAYYAA GODINA BAALEE **BALE ZONE HEALTH OFFICE**
ባሌ ዞን ጤና ጥበቃ ጽ/ቤት

Lakk EFG/29355
Guyyaa 13/09/2013

Waajjira Eegumsa Fayyaa Magaalaa Goobbaa tiif

Goobbaa

Dhimmi: - **Deeggarsaa Gaafachuu ilaala.**

Akkuma mata duree irratti ibsuuf yaalametti **Obbo Tasfayee Asaffaa** kan jedhaman mata duree **'PREVENT RISK OF TYPE 2 DIABETES MELLITUS AMONGST THE ADULTS OF BALE ZONE, SOUTH EAST ETHIOPIA'** jedhu irratti Magaalaa keessan irratti qorannoo gaggeesuudhaaf gama **BEFO** tiin ergamani jiru.

Haaluma kanaan, Ogeessa maqaan isaani armaan olitti caqafame kana gara Magaalaa keessanitti kan ergaman ta'u beektani degarsaa barbachisaa ta'e akka gotaniif isiin beeksifna.

Nagaa Wajjiin

Seytaddin Muhammed
Hooggaanaa Wajjira Eegumsa Fayyaa Godina Baalee

G.G//

-Adeemsa HQN waajjira keenyatiif

Roobee.

Lakk ____________

Tel. 0226650851/1432/1327/0226651325/ 0226651326 /0226651433 email :- bzhoplan@gmail.com Address:-BALE ROBE/OROMIYA/ETHIOPIA

ANNEXURE I: ENGLISH VERSION LETTER OF PERMISSION FROM BALE ZONE OFFICE TO CONDUCT FIELDWORK TO GOBA TOWN

TAJAAJILA TURJUMAANAA ISTAADIYOOMII
STADIUM TRANSLATION SERVICE
ስታድየም የትርጉም ሥራ አገልግሎት
+251 0930-098302/+251 0913488211 Fax: +251 0115522226 E-mail: stadiumtrans30@gmail.com

Logo
Bale Zone Health Office

Ref. No.: ***EFG/29355***
Date: ***May 21, 2021***

To Goba Town Health Office

Goba

Subject: ***REGARDS REQUESTING SUPPORT***

As indicated above Mr. Tesfaye Assefa has been sent from Oromia Health Bureau to carry out the research entitled ***"Prevent Risk of type 2 diabets mellitus amongst the adult of Bale Zone, Zone, South East Ethiopia"*** in your town.

Thus, we notify you to provide the necessary support and cooperation for the expert stated above so that he can smoothly carry out research in your town.

With Regards,
Signed
Seifedin Mohammed
Bale Zone Health Office

CC

- To Human Resource Administration Department of our Office

Robe

Seal

Oromia Health Bureau Bale Zone Health Office

ዳንኤል ኃ/የሱስ ዋና
ዋና ሥራ አስኪያጅ
Daniel H/Yesus Wana
General Manager

June 1, 2021 FF

ANNEXURE J: LETTER OF PERMISSION FROM GOBA TOWN HEALTH OFFICE TO KEBELES

Lakk EF/1-4/3001779

Guyyaa 18/09/2013

- Buufata Fayyaa Harawaa Sinjatiif
- Bulchiinsa Ganda Odaa Bahaa Magaala Goobbaatiif
- Bulchinsa Ganda Caffee Horaa Magaala Goobbaatiif

Goobbaa

Dhimmi;Deeggarsa gaafachuu ilaala:

Akkuma mata duree irratti ibsuuf yaalametti Barsiisaa Univarsiitii Madda walaabuu Kan ta'an **Obbo Tasfaayee Asaffaa** mata duree **"PREVENT RISKOF TYPE2 DIABETES MELLITUS AMONGST THE ADULTS"** jedhu irratti akka Magaala keenyatti Buufata Fayyaa Harawaa Sinjaa, Ganda Odaa Bahaa fii Ganda Caffee Horaa irratti akka qorannoo kana akka geegessu Waajjirri Eegumsa Fayyaa Godina Baalee xalayaa lakk **EFG/29355 Guyyaa 13/09/2013** barreefameen gara keenya erganii jiru.

Haaluma Ogeessa Maqaa isaanii asiin olitti tuqame kanaaf deeggarsa barbaachisu hunda akka gootaniif isin beeksifna.

Nagaa Wajjin

Sr.Mahfuzaa Jamaa, A/Barii

G/G

- Obbo Tasfayee Asaffaatiif

ANNEXURE K: PERMISSION LETTER FROM ROBE TOWN HEALTH OFFICE TO CONDUCT FIELDWORK TO EACH KEBELE

TAJAAJILA TURJUMAANAA ISTAADIYOOMII
STADIUM TRANSLATION SERVICE
ስታድየም የትርጉም ሥራ አገልግሎት
+251 0930-098302/+251 0913488211 Fax: +251 0115522226 E-mail: stadiumtrans30@gmail.com

Logo
Bale Zone Health Office
Goba Town Health Office

Ref. No.: ***EF/1-4/3001779***
Date: ***May 26, 2021***

To Harawa Sinja Health Station
To Goba Town East Oda Kebele Administration Office
To Goba Town Chefe Hora Kebele Administration Office
Goba

Subject: ***Regards Requesting Support***

Via the letter referenced EFG/29355 dated May 21, 2021 Bale Zone Health Office sent us Mr. Tesfaye Assefa who is lecturer at Meda Welabu University requesting to provide him support so that he can carry out research in our town at Harawa Sinja Health Station, Oda Beha Kebele and Chefe Hora Kebele with his research proposal entitled ***"Prevent Risk of type 2 diabets mellitus amongst the adults"***.

Accordingly, we notify to provide the necessary support and cooperation for the expert stated above.

With Regards,
Sister Mahfiza Jemal
Head of Goba Town Health Office

CC
To Mr. Tesfaye Assefa

SEAL
Bale Zone Health Office
Goba Town Health Office

Daniel H/Yesus Wana
General Manager

June 1, 2021 FF

ANNEXURE L: PERMISSION LETTER FROM ROBE TOW HEALTH OFFICE TO CONDUCT FIELDWORK TO EACH KEBELE

Lak 733/2-/02/2013

Guyyaa 17/9/2013

Hospitaala Waliigalaa Baalee Roobeetiif

Buufata Fayyaa Baha Biiftuutiif

Bulchiinsa Ganda Baha Biiftuutiif

Bulchiinsa Ganda Caffee Donsaatiif

Bulchiinsa Ganda Odaa Roobeetiif

B/J

Dhimmi; Xalayaa Deeggarsa Kennuu Haala

Akkuma seensa irratti ibsuuf yaalametti BEFO Xalayaa Lakk/Ref.No BEFO/HBTFH/1-16/10317 Gaafa Guyyaa 11/09/2013 nuuf barresseen piropozaala qorannoo mata duree **''PREVENT RISK FACTORS OF TYPE 2 DIABETES MILLITUS AMONG THE ADULTS OF BALE ZONE, SOUTH EAST ETHIOPIA''** jedhamu irratti kaadhimamaa barataa **Digrii Sadaffaa Yuunivarsitii UNISA** Kan ta'e Obbo **TESFAYE ASSEFA TADESSE** tiin Hospitaala,Buufata Fayyaa fi Ganadoota Magaalaa keenya keessatti qorannoo geggessuuf propoozaala isaani Koree '' **Health Research Ethical Review Commite''** BEFOtin mirkanaahee qorannoon kun akka hojii irra oolu xalayaadhaan nu beeksisee jira.

Kanaafuu hojii qorannoo kana irratti Hospitaalli **Waliigalaa Baalee Roobee**, **Buufata Fayyaa Baha Biiftuu** fi **Gandoota Magaalaa** keenyaa argamu keessatti qorannoo kana irratti deeggarsa barbaachisaa ta'e akka gootanii fi hordoftan kabajaadhan beeksifna.

''Nagaa Wajjiin''

Abubakar Muhaammad Ganamoo
HO,MPH-RH

G/G

✓ Obbo Tasfaayee Assaffaa Tadassaa tiif

IT/G/W/E/ Fyyaa

ANNEXURE M: ENGLISH VERSION LETTER OF PERMISSION FROM ROBE TOW HEALTH OFFICE TO CONDUCT FIELDWORK TO EACH KEBELE

TAJAAJILA TURJUMAANAA ISTAADIYOOMII
STADIUM TRANSLATION SERVICE
ስታድየም የትርጉም ሥራ አገልግሎት
+251 0930-098302/+251 0913488211 Fax: +251 0115522226 E-mail: stadiumtrans30@gmail.com

Logo
Oromia National Regional State
Bale Zone Health Office

Ref. No.: ***733/2-/02/2013***

Date: ***May 25, 2021***

To: **Bale Robe General Hospital**

To: **Beha Biftu Health Station**

To: **Beha Biftu Kebele Administration Office**

To: **Chefe Donsa Kebele Administration Office**

To: **Oda Robe Kebele Administration Office**

Subject: ***Regards issuance of support letter***

Via the letter referenced BEFO/HBTFH/1-16/1031 dated May 19, 2021 Oromia Health Bureau has notified us that the Health Research Ethical Review Committee of Oromia Health Bureau has approved the research proposal entitled ***"Prevent Risk of type 2 diabets mellitus amongst the adult of Bale Zone, South East Ethiopia"*** presented by Mr. Tesfaye Assefa Tadesse who is PHD student at UNISA so that he can carry out the research in the Hospital, Health Station and Different Kebele's in your town.

Hence, we kindly request to provide him the necessary support and cooperation so that he can carry out his research at Bale General Hospital, Health Station & Kebele's in your town.

With Regards,
Signed
Abubeker Mohammed

CC

- Mr. Tesfaye Assefa Tadesse

Seal
Oromia National Regional State
Bale Zone Health Office

Stadium Translation Services

June 1, 2021 FF

Daniel H/Yesus Wana
General Manager

ANNEXURE N: INFORMATION SHEET ENGLISH VERSION

CLIENT INFORMATION LEAFLET for Phase 1 of the Population-Based Study

RESEARCH STUDY TITLE: Strategies for the Prevention of Type 2 Diabetes Mellitus among Adults in Bale Zone, Southeast Ethiopia - Community-Based Study (Phase 1)

Dear Prospective Participants,

Greetings! My name is _____. I am conducting a research study titled "Strategies for Prevention of Type 2 Diabetes Mellitus among Adults in Bale Zone, Southeast Ethiopia".

My name is _____. I am representing the research team led by Tesfaye Assefa Assefa, a doctoral student at the University of South Africa. The study aims to assess prevalence of T2DM, the knowledge, perception, and risky behavior of adults towards T2DM and its prevention.

The questionnaire will consist of three parts: face-to-face interviews, physical measurements (such as blood pressure, waist circumference, hip circumference, weight, and height), and a small blood sample taken from the tip of your finger to test blood glucose levels.

Your participation in this study is crucial for collecting information related to these issues. Thus, we kindly request your participation.

While there are minimal risks associated with having your finger pricked for blood collection, such as a very remote chance of infection, minor pain, or bleeding, these risks are extremely rare.

INTRODUCTION

As the researcher, I will provide adequate information about the research protocol and procedures in a comfortable and private setting, using understandable language. In this study, I will explain the research protocol and procedures to the participants in a comfortable setting. As an adult permanent resident over the age of 18, you have been randomly selected to participate voluntarily in this research project, which will be conducted in the Bale Robe and Goba town administration.

The purpose of this leaflet is to help you make an informed decision about volunteering to participate. Before deciding, it is essential that you clearly understand what is involved in the study during your participation period. The following paragraphs explain the most important points. If there is any information missing, inadequately explained, or unclear in this leaflet, please do not hesitate to ask the investigator. You may contact me, Tesfaye Assefa Tadesse, at +251911034995, if you have any further questions or need additional information. Please only agree to participate if you are completely satisfied with all the procedures involved.

PURPOSE OF THE STUDY

The purpose of this study is to develop strategies for the prevention of Type 2 Diabetes Mellitus among adults in Bale Zone, Southeast Ethiopia.

RESEARCH QUESTION

What can be done to prevent T2DM as a non-communicable disease?

ETHICAL APPROVAL

The study protocol has been submitted to the Unisa Health Studies Department Higher Degrees Committees in the College of Human Sciences. The committees have granted written approval for the ethical soundness of the study.

EXPECTATIONS FROM YOU

If you agree to participate in the study, you will be required to dedicate one hour of your time to the data collector. During this session, you will be interviewed about your personal information and lifestyle. Additionally, measurements such as blood pressure, weight, and height will be taken. Please note that you will be asked to remove heavy clothing and shoes for accurate weight and height measurements. You may also be

asked about your perception of body shape and image, mental stress, and food insecurity.

YOU'RE RIGHTS AS A PARTICIPANT IN THIS STUDY

Your participation in this study is entirely voluntary. You have the right to decline participation if you choose not to be involved. If you decide to participate initially but later change your mind, you are free to withdraw from the study without facing any negative consequences. If at any point you do not wish to provide certain information, you have the right to refuse.

DISCOMFORT CAUSED BY STUDY PROCEDURES

The study and its procedures do not involve any expected physical or psychological discomfort. However, if you do experience any discomfort during the study, it is important to promptly inform the researchers. We are fully prepared to offer the necessary support and counseling to address any discomfort you may encounter.

RISKS INVOLVED IN THIS STUDY

This study does not present any visible or predictable risks to you or your family.

CONFIDENTIALITY

All information collected during this study will be treated as strictly confidential and securely stored. Your identity will not be disclosed in any scientific journals reporting the study. The data will be kept in a secure location and will not be shared with any unauthorized individuals without your express permission. After five years from the publication of this study, the data will be destroyed.

Did you understand the aim of the study? Yes ( ) No ( ). Are you willing to participate in the study? Yes ( ) No ( ).

Signature of the participant…….

If you have question or concern regarding the study or questionnaire you may contact Mr. Tesfaye Assefa Tadesse: 0911034995

The supervisor of this PhD project is Dr Zodwa Manyisa

Section I: Demographic and Socio -Economic data

No	Questions Response	Response	Remark
101a	Permanent residence	1. Urban 2. Rural	
102a	Sex	1. Male 2. Female	
103a	Age	Age in completed years _____	
104a	Marital status	1. Single/not married 2. Married 3. Divorced 4. Widowed	
105a	Educational status? /In the completed year/	1. Can't read and write 2. Only read and write 3. Primary (1-8) 4. Secondary (9-12) 5. Diploma and above	
106a	What is your religious affiliation?	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Other specify ------	
107a	Ethnicity	1. Oromo 2. Amahra 3. Tigary 4. Other	
108a	What is your current occupation?	1. Employee (GO/NGO) 2. Daily-laborer 3. Merchant 4. Farmer 5. Housewife 6. Retired 7. others(specify)_____	
109a	What is your family size?	_____ Number	
110a	Family type	1. Living alone 2. Nuclear 3. Extended	
111a	How much is your family average total monthly income?	Approximate_____Eth.birr	
112a	Financial source for healthcare	1. Out of pocket 2. Health insurance 3. Family members 4. Other (specify): _____	

113a	Owner ship of house?	1. Personal/private 2. Rental	
114a	Does your household have:		
A	Electricity	1. Yes 2. No	
B	Cell phone	1. Yes 2. No	
C	Bicycle	1. Yes 2. No	
D	Motor bike	1. Yes 2. No	
E	Table	1. Yes 2. No	
F	Chair	1. Yes 2. No	
G	Bed with mattress	1. Yes 2. No	
H	Television	1. Yes 2. No	
I	Radio	1. Yes 2. No	
J	An electric stove for injera/bread	1. Yes 2. No	
K	A kerosene lamp/pressure lamp	1. Yes 2. No	
L	Bank or microfinance saving account	1. Yes 2. No	

Section II : Knowledge and Behaviours toward T2DM, its risk factors

	Knowledge regarding T2DM mellitus and its risk factors among the respondents		
No	Questions	Response	
201a	Have you ever had heard about diabetes mellitus?	1. Yes 2. No	
202a	From where you received the information regarding your health or diabetes (more than one answer is possible)	1. Newspaper and magazine 2. Social function 3. Television and radio 4. Health facility/ health care providers? 5. Church, Mosque 6. Posters) 7. Family and friends 8. Other sources	
203a	Diabetes is a condition of insufficient insulin production	1. Yes 2. No 3. I don't know	
204a	Diabetes is when there is too much sugar in the blood	1. Yes 2. No 3. I don't know	
205a	The symptoms of diabetes are frequent urination, increased thirst hunger and unexplained weight loss	1. Yes 2. No 3. I don't know	
206a	Even if I have diabetes, I can live a normal life	1. Yes 2. No	

		3. I don't know	
207a	Diabetes does not damage your heart	1. Yes 2. No 3. I don't know	
208a	Diabetes can cause Blindness	1. Yes 2. No 3. I don't know	
209a	Diabetes cannot cause loss of sensation in your feet	1. Yes 2. No 3. I don't know	
210a	Diabetes Mellitus is hereditary	1. Yes 2. No 3. I don't know	
211a	Diabetes affects only older people	1. Yes 2. No 3. I don't know	
212a	Can T2DM be transmitted from one person to another?	1. Yes 2. No 3. I don't know	
213a	T2DM is a chronic disease	1. Yes 2. No 3. I don't know	
214a	DM is not curable	1. Yes 2. No 3. I don't know	
215a	Can T2DM be prevented and controlled?	1. Yes 2. No 3. I don't know	
216a	Diabetes Mellitus may cause sudden death	1. Yes 2. No 3. I don't know	
217a	Do you know where to get measured for blood Glucose?	1. Yes 2. No 3. I don't know	
218a	If yes to question 517a ask where the respondent can get measured. Circle yes if he/she mentioned one or more of this (more than one answer is possible)	1 Health post 2 Health centres /clinics 3 Hospital 4 Home 5 other speficy--- _____	
219a	Do you know the normal blood Glucose value for adult?(check if he/she say less than 70 - 120gm/dl)	1. Yes 2. No 3. I don't know	
220a	Do you know the risk behaviour for developing diabetes?	1. Yes 2. No 3. I don't know	
221a	If yes to question 521a, what are the risk behaviours for developing diabetes? (more than one answer is possible)	1. Cigarette smoking 2. Physical inactivity 3. Excessive alcohol consumption 4. Eat animal fat frequently	

		5. Excess sugar Consumption 6. Excessive salt Consumption 7. Stressful life	

Section III: Health belief model scores of respondents in Bale Zone, southeast Ethiopia.

Perceived susceptibility						
Please tell me your level of agreement or disagreement using the following number as I read the statements for you. 1. strongly disagree 2. disagree 3. neutral 4. agree 5. strongly agree						
301a	My chances of getting diabetes in next few years is great	1	2	3	4	5
302a	I feel I will get diabetes sometime during my life	1	2	3	4	5
303a	I believe all population are equally likely to develop diabetes	1	2	3	4	5
304a	Everybody is at risk of diabetes	1	2	3	4	5
305a	Cigarette smokers are more prone to contract T2DM	1	2	3	4	5
306a	Physically inactive peoples are more prone to contract T2DM	1	2	3	4	5
307a	People being obese/overweight more prone to contract T2DM	1	2	3	4	5
308a	Excessive alcohol consumers are more prone to contract T2DM	1	2	3	4	5
309a	People consuming animal fat frequently are more prone to contract T2DM	1	2	3	4	5
310a	People using excess sugar are more prone to contract T2DM	1	2	3	4	5
311a	Diabetes is health problem of Ethiopia.	1	2	3	4	5
Perceived severity						
Please tell me your level of agreement or disagreement using the following number as I read the statements for you. 1. strongly disagree 2. disagree 3. neutral 4. agree 5. strongly agree						
312a	If I had diabetes, I would be worried and depressed	1	2	3	4	5
313a	If I had diabetes, I would have to have my diabetes taken off by medication	1	2	3	4	5
314a	T2DM Mellitus can be a serious disease if you don't prevent it	1	2	3	4	5

315a	T2DM Mellitus may cause sudden death	1	2	3	4	5
316a	Complications of diabetes are dangerous in life	1	2	3	4	5
317a	I believe that diabetes is chronic disease	1	2	3	4	5
318a	I would rather have any other illness than diabetes	1	2	3	4	5
319a	T2DM Mellitus is more severe disease in old adults	1	2	3	4	5
320a	T2DM Mellitus is more severe disease in obese /overweight peoples	1	2	3	4	5
321a	T2DM Mellitus is more severe disease among cigarette smokers	1	2	3	4	5
322a	T2DM Mellitus is more severe disease among high alcohol consumers	1	2	3	4	5
323a	T2DM Mellitus is more severe disease among peoples consuming high sugar	1	2	3	4	5
324a	T2DM Mellitus is more severe disease among peoples consuming high animal fat food	1	2	3	4	5
325a	T2DM Mellitus is more severe disease among peoples with stressful life	1	2	3	4	5

Perceived benefits

Please tell me your level of agreement or disagreement using the following number as I read the statements for you.
1. strongly disagree
2. disa\ree
3. neutral
4. agree
5. strongly agree

326a	T2DM Mellitus can be cured easily	1	2	3	4	5
327a	Regular health care visit can help finding T2DM Mellitus early and save my life	1	2	3	4	5
328a	Eating low sugar snacks & low-fat meals prevent T2DM Mellitus in the future	1	2	3	4	5
329a	Regularly physical exercise will help to prevent T2DM Mellitus	1	2	3	4	5
330a	Healthy lifestyle prevents T2DM Mellitus	1	2	3	4	5
331a	Weight reduction activities to maintain normal body weight helps to prevent developing T2DM Mellitus	1	2	3	4	5
332a	Quitting cigarette smoking helps to prevent developing T2DM Mellitus	1	2	3	4	5
333a	Limiting alcohol consumption helps to prevent developing T2DM Mellitus	1	2	3	4	5
334a	Consuming a diet that is rich in fruits and vegetables and in low fat helps to prevent developing T2DM Mellitus	1	2	3	4	5

Perceived barriers

Please tell me your level of agreement or disagreement using the following number as I read the statements for you.
1. strongly disagree
2. disagree
3. neutral
4. agree
5. strongly agree

335a	I think having a regular health check-up takes too much time	1	2	3		
336a	No treatment will be effective in curing T2DM	1	2	3	4	5
337a	There are several diseases of my priorities than diabetes	1	2	3	4	5
338a	I have no adequate knowledge to protect myself against T2DM	1	2	3	4	5
339a	Health facilities are not access able to get tested for blood Glucose	1	2	3	4	5
340a	I don't like to think about any disease while I am healthy	1	2	3	4	5
341a	I am busy with my daily routine activities I don't think it is worthy thinking about T2DM prevention activities	1	2	3	4	5
342a	I am not encouraged by family and/or friends to perform T2DM prevention activities	1	2	3	4	5
343a	perform T2DM prevention activities needs me to have enough time &space	1	2	3	4	5
344a	It is embarrassing to go for health check-ups	1	2	3	4	5

Cue to action			
	Question	Response	Remark
345a	After I get adequate information on media, I try to apply T2DM prevention.	1. not at all 2. rarely 3. sometimes 4. always	
346a	Fear of T2DM being chronic disease motivates me to involve in T2DM prevention.	1. not at all 2. rarely 3. sometimes 4. always	
347a	Health care workers counsel me on T2DM prevention	1. not at all 2. rarely 3. sometimes 4. always	
348a	Friends' and family's advice provokes me to involve in activities of type 2 prevention	1. not at all 2. rarely 3. sometimes 4. always	
349a	Individuals near to me who have diabetes makes me to involve in diabetes prevention	1. not at all 2. rarely 3. sometimes 4. always	

Self-efficacy			
No	Question	Response	Remark
350a	I am confident that I can manage performing T2DM prevention activities easily	1. Strongly disagree 2. disagree 3. neutral 4. Agree 5. Strongly agree	
351a	I am able to actively work on a healthy lifestyle to prevent T2DM	1. Strongly disagree 2. agree	

		3. neutral 4. Agree 5. Strongly agree	
352a	I attend health assessments to prevent T2DM	1. Strongly disagree 2. disagree 3. neutral 4. Agree 5. Strongly agree	
353a	I have information on how to prevent T2DM	1. Strongly disagree 2. disagree 3. neutral 4. Agree 5. Strongly agree	
354a	There is a lot I can do to reduce my chances of getting an T2DM related illness	1. Strongly disagree. 2. disagree 3. neutral 4. Agree 5. Strongly agree	

Section IV: Behavioural Measurements			
Cigarettes use			
No.	Question	Response	Remark
401a	Have you ever smoked cigarettes?	1. Yes 2. No	
402a	Do you smoke currently?	1. Yes 2. No	
403a	If yes for Q202, how frequent do you smoke cigarettes?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
404a	On average, how much cigarettes do you smoke in this days?	_____ Number	
405a	For how long have you been smoking?	_____ In Years	
Alcohol consumption			
406a	Have you ever consumed an alcoholic drink	1. Yes 2. No	
407a	Do you drink alcoholic drink currently?	1. Yes 2. No	
408a	If yes for Q207 how frequent do you drink alcoholic drink?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
409a	If yes to Q207, how much glass at one time? (300ml for beer, tea cup for local drink)	_____Number	
410a	For how long have you been drinking?	_____ Years	
Chat chewing			
411a	Have you ever chewed chat	1. Yes 2. No	
412a	Do you chew chat currently?	1. Yes 2. No	
413a	If yes for Q212, how frequent do you chew chat?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
414a	For how long have you been chewing chat?	_____In Years	
Coffee consumption			
415a	Do you drink coffee	1. Yes 2. No	
416a	If yes for Q215 how frequent do you drink coffee	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	

417a	How many cups of coffee do you drink	_____cup in number	
418a	What do you use to give taste when you are drinking coffee	1. Salt 2. Sugar 3. Nothing	
Diet			
419a	In which time of serving do you eat more?	1. Breakfast 2. Launch 3. Dinner 4. Snacks	
420a	Do you eat fruit?	1. Yes 2. No	
421a	If yes for Q220 how many days do you eat fruit in a week?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
422a	Do you eat vegetables?	1. Yes 2. No	
423a	If yes for Q222 how many days do you eat vegetables in a week?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
424a	Do you eat animal fat (butter, fatty meat)?	1. Yes 2. No	
425a	How many days do you eat animal fat in a week?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
Salt consumption			
426a	Do you use additional top added salt on plate after food is prepared with sufficient amount of salt?	1. Yes 2. No	
Physical activity			
427a	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like (carrying or lifting heavy loads, digging or construction work) for at least 10 minutes continuously?	1. Yes 2. No	
428a	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
Travel to and from places			
429a	Do you walk for at least 10 minutes a day continuously to get to and from places?	1. Yes 2. No	
430a	In a typical week, many days do you walk for at least 10 minutes continuously to get to and from places?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
431a	What do you use to go and come from place to place	1.On foot 2. bicycle	

		3. engine using vehicle	
Recreational activities			
432a	Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously?	1. Yes 2. No	
433a	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
Section V. History of raised Blood Glucose and co-morbidity			
No.	Question	Response	Remark
501a	Have you ever had your blood glucose measured by a doctor or other health worker?	1. Yes 2. No	
502a	Have you ever been told by a doctor or other health worker that you have diabetes?	1. Yes 2. No	
503a	Are you currently receiving any medication, treatments/advice for T2DM prescribed by a doctor or other health worker	1. Yes 2. No	
504a	Is there anyone from your family (father, mother or siblings) who have history of diabetes	1. Yes 2. No	
505a	Have you ever been told by a doctor or health worker that you have hypertension?	1. Yes 2. No	

Section VI: WHO Step wise approach for Blood Pressure, Physical measurement and Blood Glucose

Height and Weight			
601a	Height in meter	----------meter	
602a	Waist circumference	--------- centimeter	
603a	Hip circumference	--------- centimeter	
604a	Weights in kilogram	----------kg	
Blood pressure measurements with 15 minute interval			
605a	Reading 1	---------- Systolic in mmHg ---------- Diastolic in mmHG	
606a	Reading 2	- ---------- Systolic in mmHg ---------- Diastolic in mmHG	
607a	Reading 3	---------- Systolic in mmHg ---------- Diastolic in mmHG	
Blood glucose measurement			
608a	Blood glucose level after fasting at least for 8 hours	----------mg/dl FBS	

Thank you for participation!!!

ANNEXURE O: INFORMATION SHEET ENGLISH VERSION (PHASE II)

RESEARCH STUDY TITLE: Strategies for the Prevention of Type 2 Diabetes Mellitus among Adults in Bale Zone, Southeast Ethiopia (Deteminant of Type Type 2 Diabetes Mellitus among in Bale Zone, hospital case- control

INTRODUCTION

The researcher must ensure that participants are well informed about the research protocol and procedures in a comfortable, private setting, and using language that is easily understandable. As part of this study, participants will receive information about these aspects in a comfortable environment. Individuals are selected at random to voluntarily participate in a research study to be conducted at Goba Referral Hospital and Bale Robe General Hospital. This selection is based on being an adult T2DM mellitus patient (above 18 years old) who has received follow-up care at the hospital. The information provided in this leaflet is designed to help you make an informed decision about volunteering for the study. Prior to making a decision, it is important that you fully understand what will be involved during your participation. The following paragraphs outline the key points you should consider. If there are any aspects that are not covered, not fully explained, or unclear in this leaflet, please do not hesitate to seek clarification from the investigator. If you have further questions or need additional information, you may contact Tesfaye Assefa Tadesse at +251911034995. It is crucial that you do not agree to participate without fully understanding the study's details.

PURPOSE OF THE STUDY

The purpose of this study is to develop strategies for the prevention of Type 2 Diabetes Mellitus among adults in Bale Zone, Southeast Ethiopia.

RESEARCH QUESTION

What can be done to prevent T2DM as a non-communicable disease?

ETHICAL APPROVAL

The study protocol has been submitted to the Unisa Health Studies Department Higher Degrees Committees in the College of Human Sciences. The committees have granted written approval for the ethical soundness of the study.

EXPECTATIONS FROM YOU

If you agree to participate in the study, you will be required to dedicate one hour of your time to the data collector. During this session, you will be interviewed about your personal information and lifestyle. Additionally, measurements such as blood pressure, weight, and height will be taken. Please note that you will be asked to remove heavy clothing and shoes for accurate weight and height measurements. You may also be asked about your perception of body shape and image, mental stress, and food insecurity.

YOUR RIGHTS AS A PARTICIPANT IN THIS STUDY

Your participation in this study is entirely voluntary. You have the right to decline participation if you choose not to be involved. If you decide to participate initially but later change your mind, you are free to withdraw from the study without facing any negative consequences. If at any point you do not wish to provide certain information, you have the right to refuse.

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The study and its procedures do not involve any expected physical or psychological discomfort. However, if you do experience any discomfort during the study, it is important to promptly inform the researchers. We are fully prepared to offer the necessary support and counseling to address any discomfort you may encounter.

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This study does not present any visible or predictable risks to you or your family.

CONFIDENTIALITY

All information collected during this study will be treated as strictly confidential and securely stored. Your identity will not be disclosed in any scientific journals reporting the

study. The data will be kept in a secure location and will not be shared with any unauthorized individuals without your express permission. After five years from the publication of this study, the data will be destroyed.

Did you understand the aim of the study? Yes ( ) No ( ). Are you willing to participate in the study? Yes ( ) No ( ).
Signature of the participant…….

If you have question or concern regarding the study or questionnaire you may contact Mr. Tesfaye Assefa Tadesse: 0911034995

The supervisor of this PhD project is Dr Zodwa Manyisa

Identification

Q001b. Questionnaire code----------

Name of data collectors ----------signature----------date----------

Section I b: Socio-demographic and economic characteristics

No	Questions Response	Response	Remark
101b	Permanent residence	1. Urban 2. Rural	
102b	Sex	1. Male 2. Female	
103b	Age	Age in completed years _____	
104b	Marital status	1. Single/not married 2. Married 3. Divorced 4. Widowed	
105b	Educational status? /In the completed year/	1. Can't read and write 2. Only read and write 3. Primary (1-8) 4. Secondary (9-12) 5. Diploma and above	
106b	What is your religious affiliation?	1. Orthodox 2. Muslim 3. Protestant 4. Catholic 5. Other specify ------	
107b	Ethnicity	1. Oromo 2. Amahra 3. Tigary 4. Other	
108b	What is your current occupation?	1. Employee (GO/NGO) 2. Daily-laborer 3. Merchant 4. Farmer 5. Housewife 6. Retired 7. others(specify)_____	
109b	Family type	1. Living alone 2. Nuclear	

		3. Extended	
110b	What is your family size?	_____	
111b	How much is your family average total monthly income?	Approximate_____Eth.birr	
112b	Financial source for healthcare	1. Out of pocket 2. Health insurance 3. Family members 4. Other (specify): _____	
113b	Owner ship of house?	1. Personal 2. Rental	
114b	Does your household have:		
A	Electricity	1. Yes 2. No	
B	Cell phone	1. Yes 2. No	
C	Bicycle	1. Yes 2. No	
D	Motor bike	1. Yes 2. No	
E	Table	1. Yes 2. No	
F	Chair	1. Yes 2. No	
G	Bed with mattress	1. Yes 2. No	
H	Television	1. Yes 2. No	
I	Radio	1. Yes 2. No	
J	An electric stove for injera/bread	1. Yes 2. No	
K	A kerosene lamp/pressure lamp	1. Yes 2. No	
L	Bank or microfinance saving account	1. Yes 2. No	

Section IIb: Behavioural Measurements			
Cigarettes use			
No.	Question	Response	Remark
201b	Have you ever smoked cigarettes?	3. Yes 4. No 5. I don't know	
202b	Do you smoke currently?	3. Yes 4. No 5. I don't know	
203b	If yes for Q202 how frequent, do you smoke cigarettes?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
204b	On average, how much cigarettes do you smoke in this days?	_____ Number	
205b	For how long have you been smoking?	_____ In Years	
Alcohol consumption			
206b	Have you ever drunk Alcohol?	3. Yes 4. No	
207b	Are you currently drinking alcohol?	3. Yes 4. No	
208b	If yes for Q207 how frequent do you drink alcoholic drink?	5. daily 6. 5-6 days per week 7. 3-4 days per week 8. 1-2 days per week	
209b	What kind of Alcohol do you drink oftentimes? (Tick all that are applicable)	Yes No *1. Beer,* *2. Tella/Sewa(Local beer)* *3. Tej(local Wine)* *4. vodka* *5. wine* *6. Araque (local vodka)* *7. Whisky* 8. Others, Specify___	
209b	How much glass at one time? (300ml for beer, tea cup for local drink)	_____Number	
210b	For how long have you been drinking?	_____ Years	
Chat chewing			
211b	Have you ever chewed chat	3. Yes 4. No	

212b	Do you chew chat currently?	3. Yes 4. No	
213b	If yes for Q212 how frequent do you chew chat?	5. daily 6. 5-6 days per week 7. 3-4 days per week 8. 1-2 days per week	
214b	For how long have you been chewing chat?	_____In Years	
Coffee consumption			
215b	Do you drink coffee	3. Yes 4. No	
216b	If yes for Q215 how frequent do you drink coffee	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
217b	How many cups	_____cup in number	
218b	What do you use to give taste when you are drinking coffee	1. Salt 2. sugar 3. No thing	
Diet			
219b	In which time of serving do you eat more?	1. Breakfast 2. Launch 3. Dinner 4. Snacks	
220b	Do you eat fruit?	3. Yes 4. No	
221b	If yes for Q220 how many days do you eat fruit in a week?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. -2 days per week	
222b	Do you eat vegetables?	3. Yes 4. No	
223b	If yes for Q222 how many days do you eat vegetables in a week?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
224b	Do you eat animal fat (butter, fatty meat)?	3. Yes 4. No	
225b	How many days do you eat animal fat in a week?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
Salt consumption			
226b	Do you use additional top added salt on plate after food is prepared with sufficient amount of salt?	3. Yes 4. No	
Physical activity			

227b	Does your work involve vigorous-intensity activity that causes large increases in breathing or heart rate like (carrying or lifting heavy loads, digging or construction work) for at least 10 minutes continuously?	3. Yes 4. No	
228b	In a typical week, on how many days do you do vigorous-intensity activities as part of your work?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
Travel to and from places			
229b	Do you walk for at least 10 minutes a day continuously to get to and from places?	3. Yes 4. No	
230b	In a typical week, many days do you walk for at least 10 minutes continuously to get to and from places?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
231b	What do you use to go and come from place to place	1.On foot 2. bicycle 3. engine using vehicle	
Recreational activities			
232b	Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously?	3. Yes 4. No	
233b	In a typical week, on how many days do you do vigorous-intensity sports, fitness or recreational (leisure) activities?	1. daily 2. 5-6 days per week 3. 3-4 days per week 4. 1-2 days per week	
Section IIIB: History of raised Blood Glucose and co-morbidity			
No.	Question	Response	Remark
301b	Have you ever had your blood glucose measured by a doctor or other health worker?	3. Yes 4. No 5. I don't know	
302b	Have you ever been told by a doctor or other health worker that you have diabetes?	3. Yes 4. No 5. I don't know	
303b	Are you currently receiving any medication, treatments/advice for type 2 diabetes prescribed by a doctor or other health worker	1. Yes 2. No 3. I don't know	
304b	Is there anyone from your family (father, mother or siblings) who have history of diabetes	3. Yes 4. No 5. I don't know	

305b	Is there any thing that makes you stressful?	1. Yes 2. No 3. I don't know	
306b	If yes Q305 how many hour do you sleep within 24 hours	Hrs : min--------	
307b	If yes to Q305 do you have symptom like sadness, anxiety lack of motivation or focus, etc.	1. Yes 2. No 3. I don't know	
308b	If yes to Q306 do you have symptom like drug or alcohol use, tobacco use, overeating or under eating, social withdrawal?	1. Yes 2. No 3. I don't know	
309b	Time since raised blood glucose diagnosed	---------years	
310b	Frequency to follow up	1. Monthly 2. Every two month 3. Every three month	
311b	Comorbid condition	1. Hypetension 2. Cardiovascular disease 3. Chronic kidney disease others	
332b	Family history of hypertension/diabetes(your actual father/mother; full brother/sister and full child	1. Yes 2. No 3. I don't know	

Section Vb: WHO Step wise approach for Blood Pressure, Physical measurement and Blood Glucose

Height and Weight			
401b	Height in meter	----------meter	
402b	Waist circumference	--------- centimeter	
403b	Hip circumference	--------- centimeter	
404b	Weights in kilogram	----------kg	
Blood pressure measurements with 15 minute interval			
405b	Reading 1	---------- Systolic in mmHg ---------- Diastolic in mmHG	
406b	Reading 2	- ---------- Systolic in mmHg ---------- Diastolic in mmHG	
407b	Reading 3	---------- Systolic in mmHg ---------- Diastolic in mmHG	
Blood glucose measurement			
408b	Blood glucose level after fasting at least for 8 hours	----------mg/dl FBS	

Section Vb: Questionnaire on Perception of Body size and Shape

Perceptions of the interviewee on body size and shape			
	Perceptions	*Response*	*Remark*
501b	Overweight/obesity is a sign of good health.	1. Yes 2. No 3. I don't know	
502b	If someone is overweight or obese he/she is most likely to be wealthy.	1. Yes 2. No 3. I don't know	
503b	Overweight/obesity is a sign of attractiveness.	1. Yes 2. No 3. I don't know	
504b	If your response to question number503b is no, what is your reason for saying no?	1. Ugliness 2. Shamefulness 3. Frustrations 4. Others 5. (specify_____)	
505b	Being slim is a sign of illness or poor health	1. Yes 2. No 3. I don't know	
506b	What do you like to be the body size of your spouse?	1. Obese 2. Overweight 3. Normal 4. Underweight 5. I do not know	
507b	How do you describe your body size currently?	1. Obese 2. Overweight 3. Normal 4. Underweight 5. I don't know.	
508b	How do you feel about your current body size and shape?	1.I like it 2. I dislike it 3. I don't know.	
509b	Have you experienced others comment about your body size and shape?	1. Yes 2. No 3. I don't know	
510b	If your response to Question number 9 is yes, What was their comment?	1. Obese 2. Overweight 3. Normal 4. Underweight 5. I don't know	
511b	What will you do if you are feel or told that you are overweight or obese?	1. I will try to maintain it 2. I will visit a health worker for advice or possible treatment.	

		3. I will start aerobic physical exercise 4. I will modify my diet. 5. Other specify _____	
512b	Is there any consequence as the result of overweight or obesity?	1. Yes 2. No 3. I don't know	
513b	If your response to the above Question 512b is yes, would you mention some?	Yes No 1. Diabetes 2. Hypertension 3. Heart Diseases 4. Cancer 5. Other specify_____	
514b	Frequent feeding of animal products including raw meat/beef is beneficial to our body size and shape.	1. Yes 2. No 3. I don't know	
515b	Frequent feeding of plant products like fruits, green leaves and vegetables will negatively affect our body size and shape	1. Yes 2. No 3. I don't know	

Section VIb Household Food Insecurity Assessment Scale (HFIAS) Occurrence Questions (Circle on your response

No	Questions	Response	Remark
601b	In the past 4 weeks (30 days), did you worry that your household would not have enough food?	1. No 2. Yes, rarely (1-2 times) 3. Yes, sometimes (2-10 times) 4. Yes, often (> 10 times)	
602b	In the past 4 weeks (30 days), were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	1. No 2. Yes, rarely (1-2 times) 3. Yes, sometimes (2-10 times) 4. Yes, often (> 10 times)	
603b	In the past 4 weeks (30 days), did you or any household member have to eat a limited variety of foods due to a lack of resources?	1. No 2. Yes, rarely (1-2 times) 3. Yes, sometimes (2-10 times) 4. Yes, often (> 10 times))	
604b	In the past 4 weeks (30 days), did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	1. No 2. Yes, rarely (1-2 times) 3. Yes, sometimes (2-10 times) 4. Yes, often (> 10 times)	
605b	In the past 4 weeks (30 days), did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food?	1. No 2. Yes, rarely (1-2 times) 3. Yes, sometimes (2-10 times) 4. Yes, often (> 10	
606b	In the past 4 weeks (30 days), did you or any household member have to eat fewer meals in a day because there was not enough food?	1. No 2. Yes, rarely (1-2 times) 3. Yes, sometimes (2-10 times) 4. Yes, often (> 10 times)	
607b	In the past 4 weeks (30 days), was there ever no food to eat of any kind in your house because of lack of resources to get food?	1. No 2. Yes, rarely (1-2 times) 3. Yes, sometimes (2-10 times) 4. Yes, often (> 10 times)	

608b	In the past 4 weeks (30 days), did you or any household member go to sleep at night hungry because there was not enough food?	1. No 2. Yes, rarely (1-2 times) 3. Yes, sometimes (2-10 times) 4. Yes, often (> 10 times)	
609b	In the past 4 weeks (30 days), did you or any household member go a whole day and night without eating anything because there was not enough food?	1. No 2. Yes, rarely (1-2 times) 3. Yes, sometimes (2-10 times) 4. Yes, often (> 10 times)	

Section VIIb: Mental Stress (risk factors) for T2DM using SRQ20 instrument

No	Questions			
		Yes	No	Remark
701b	Do you often have Headaches?			
702b	Is your appetite poor?			
704b	Do you sleep badly?			
705b	Are you easily frightened?			
707b	Do your hands shake?			
708b	Do you feel nervous, tense or worried?			
709b	Is your digestion is poor?			
710b	Do you have trouble thinking clearly?			
711b	Do you feel un happy?			
712b	Do you cry more than usual?			
713b	Do you find it difficult to enjoy your daily activities?			
714b	Do you find it difficult to make decisions?			
715b	Is your daily work suffering?			
714b	Are you unable to play a useful part in life?			
715b	Have you lost interest in things?			
716b	Do you feel that you are a worthless person?			
717b	Has the thought of ending your life been in your mind?			
718b	Do you feel tired all the time?			
719b	Do you have un comfortable feelings in your stomach?			
720b	Are you easily tired?			

Thank you for your participation!

ANNEXURE P: INFORMED CONSENT FORM IN AFAAN OROMO LANGUAGE(PHASE I)

BARREEFFAMA ODEEFFANNOO MAAMILEE : Population-based cross-sectional study(Phase I) Marsaa 1ffaa keessatti

Ibsa Hayyamamaa ta'uu fi Qabxilee barbbachisoo.

Maqaa Projectii: qorannoo waa,ee *Tooftaalee Ittisa Dhukkuba Sukkaaraa Gosa lammaffaa Ga'eessota akka goodina Goodina Baaleetii , Kibba Baha Itoophiyaa irratti hundaa'e*

Gaaffii kutaa 1: gaaffilee *dhukkuba sukkaaraa gosa lammaffaa, sababoota nama saaxilsilsiisan, beekkumsaa, ilaalcha fi amaloota ittiin ittisa ialaallatan*

Kabajamoo hirmaataa/hirmaattuu

Ani maqaan koo_____kan jedhamu qorannoo obbo Tasfaayee Asaffaatiin hogganamu barataa PHD (digrii 3ffaa) yuniversiistii Afrikaa kibbaa (UNISA) kan ta'e, kan hogganamu irratti odeeffannoo sassaabaa ta'een hojjachaa jira. Aniis ragaalee **Tooftaalee Ittisa Dhukkuba Sukkaaraa Gosa lammaffaa namoota Ga'eessota akka goodina Goodina Baaleetii , Kibba Baha Itoophiyaa** irrattti xiyyeffate akka goodina baaleetti, kibba baha Itiyoophiyaatti kanan funaanudha. Qorannoon kun sababoota dhukkuba sukkaara isa lammaffaaf nama saaxilan adda baasuuf akka galteetti ni gargaaramaloota dhukkuba sukkaaraa ittiiin offirraa ittisan irrattii odeeffannoo ni sassaabna. Gaaffiileen dhihaatan kutaa sadii qabu isaaniis: gaaffiilee fulduraan gaafataman (gafiif deebii, safara dhiibbaa dhiigaa, safara nannawa mudhii fi luqqeettuu, safara ulfaatinaa fi dheerinaa kan qabatu ta'a. Gaaffiilee sasalphoo tokko tokko isin gaafanna. Maqaa fi wantootni adda baafannoo garagaraa asirrattii hin barraahu, akkasumas deebii deebisuuf hin dirqissifamtan. Yeroo barbaadanitti deebii deebisuu dhaabuu ni dandeessu, haa ta'u malee deebiin isin nuuf kennitan sababoota dhukkuba sukkaaraaf nama saaxilan adda basuu keessatti fi dhukkuba kana ittisuu irratti gahee olaanaaa qaba. Wantootni siniif hin mijoofne yoo jiraate yeroo kamuu adda kutuu ni dandeessu. Gaaffilee kana xumuruuf hanga daqiiqaa 20 ykn 35 fixachuu danda'a. Yaadni isin nuuf laattan kallattidhaan kan isin fayyaduu ta'uu baateyyuu, qophaa'ina tarsiimoo fi sagantaa dhukkuba sukkaraa hir'suu irratti ga'ee guddaa qaba. Biiroon Fayya Oromiyaa qoranno kana hayyamee jira.

Gaafiiwwan armaa gaditti ka’ame hirmanan koo barbachisa ta’u isaatti fi Iciitin koo egamaa, akkasumas qo’annoo kanaaf qofa kan olluu ta’u isaa hubadheen jira. Qoranno kana irratii hirmachuu kessanif midhaan qamaas ta’e xiin-sammuu isirra gahuu gonkuma hin jiru.

KAAYYOO QORANNOO

Kaayyoon qorannoo kanaa tooftaalee ittisa dhukkuba sukkaaraa gosa 2ffaa ga’eessota Goodina Baalee , Kibba Bahaa Itoophiyaa keessatti argaman qopheessuudha.

GAAFFII QORANNOO

Dhukkuba Sukkaaraa Gosa 2ffaa akka dhukkuba daddarboo hin taaneetti ittisuuf maaltu godhamuu danda’a?

RAGAA NAAMUSAA

Pirootokooliin qorannichaa Kolleejjii Saayinsii Namaa keessatti Koreewwan Digirii Olaanoo Kutaa Qo’annoo Fayyaa Unisaatti dhiyaateera. Koreewwan kunneen naamusa qorannichaaf hayyama barreeffamaa kennaniiru.

SIN IRRAA EEGGAMA

Qorannicha irratti hirmaachuuf yoo walii galte, yeroo kee keessaa sa’aatii tokko nama odeeffannoo walitti qabuuf kennuu qabda. Kutaa kana keessatti waa’ee odeeffannoo dhuunfaa fi akkaataa jireenya keessanii gaaffii fi deebii ni taasifama. Dabalataanis safartuuwwan akka dhiibbaa dhiigaa, ulfaatina qaamaa fi dheerina qaamaa ni fudhatamu. Ulfaatinaafi olka’iinsa sirritti safaruuf uffata ulfaataa fi kophee akka baastan isin gaafatamuu hubadhaa.

MIRGA KEE AKKA HIRMAATA QORANNOO KANA KEESSATTI

Qo’annoo kana irratti hirmaachuun keessan guutummaatti fedhii keessaniiti. Hirmaannaa hirmaachuu dhiisuu yoo filatte hirmaannaa diduudhaaf mirga qabda. Jalqaba irratti hirmaachuuf yoo murteessite boodarra garuu yaada kee yoo jijjiirte, bu’aa badaa tokko malee osoo hin mudatin qorannicha keessaa ba’uuf bilisa taate. Yeroo kamiyyuu odeeffannoo murtaa’e kennuu yoo hin barbaanne, diduudhaaf mirga qabda.

RAKKOO HOJII QORANNOO IRRATTI ARGAMU

Qorannoon kun fi hojimaanni isaa miira qaamaa ykn sammuu irraa eegamu kamiyyuu kan of keessaa qabu miti. Haa ta’u malee, yeroo qorannichaa miira namaa kan hin tolle

yoo si mudate, qorattootaaf hatattamaan beeksisuun barbaachisaadha. Rakkoo isin mudachuu danda'u kamiyyuu furuuf deeggarsa fi gorsa barbaachisaa ta'e kennuudhaaf qophii guutuu qabna.

BALAA QORANNOO KANA KEESSATTI ARGAMAN

Qorannoon kun balaa mul'atu ykn tilmaamamuu danda'u siif ykn maatii keetiif hin dhiyeessu.

ICCITII

Odeeffannoon qorannoo kana keessatti walitti qabame hundi akka iccitii cimaatti kan ilaalamu fi haala nageenya qabuun kan kuufamu ta'a. Joornaalota saayinsii qorannoo kana gabaasan kamiyyuu keessatti eenyummaan kee hin ibsamu. Daataan kun bakka nageenya qabutti kan kaa'amu yoo ta'u, hayyama ifa ta'e keessan malee namoota hayyama hin qabne kamiifuu hin qoodamu. Qorannoon kun erga maxxanfamee waggaa shan booda ragaan ni barbadaa'a.

Kaayyoon qorannichaa hubattee? Eeyyee ( ) Lakki ( ). Qo'annaa kanarratti hirmaachuuf fedhii qabdaa? Eeyyee ( ) Lakki ( ).

Mallattoo hirmaataa----------

Qorannicha ykn gaaffilee ilaalchisee gaaffii ykn yaaddoo yoo qabaattan Obbo Tasfaayee Assaffaa Taaddasaa

Bilbila : 091134995, obbo Tasfaayee Asaffaa

Email: tessssfu@gmail.com

Supparvayizriin qorannoo Digrii sadafaa(PHD) kanaa Dr Zodwa Manyisaa jedhamu

Q001a. Koodii gaaffilee---------- .

Maqaa walitti qabatoota deetaa ----------mallattoo----------guyyaa----------

Kutaa 1: Dhimma hawaasummaa fi dinagdee ilaalchisee ()Population-based cross-sectional study(Phase I) Marsaa 1ffaa keessatti

Lak.	Gaaffii	Deebii	Yaada
101a	Iddoo jireenyaa Dhabbataa	1. Magaalaa 2. Baadiyaa	
102a	Saala	**1.** Dhiraa **2.** Dubaratii	
103a	Umuriin kee meeqa?	---------- waggaadhan	
104a	Halaa gaa'eelaa	1. Kan hin fuune/hin heerumne 2. Kan fuudhe/heerumte 3. Kan hike/hikte 4. Kan jalaa du'e/duute	
105a	Sadarkaa Barumsa /Yeroo darbee kessati wagga Sadarkaa Barumsa Xumurtee/	1. Dubbisuu fi barreessuu kan hin dandenye 2. Dubbisuuf fi barreessuu kan danda'u/chu 3. Sadarkaa 1ffaa(1-8) 4. Sadarkaa Lammaffaa(9-12) 5. Dippiloomaa fi Sanaa ol	
106a	Amaantaa kee maali	1) Oritoodoksii 2) Musilimaa 3) Proteesitaanti 4) Kaatooliikii 5) Kan biroo ibsi_____	
107a	Qoomoo/sabni kee maali	1. Oromoo 2. Amahara 3. Tigree	

		4. Gaammoo 5. Kan biroo ,haa ibsamu_____	
108a	Haala Hojji/ maal hojjataa jiraatta/	1. Qaxaramee kan hojjatu/ motumma ykn dhuunfaa/ 2. Hojii humnaa 3. Daldala 4. Qotee bulaa 5. Hadhaa manaa 6. Kan soorama bahee 7. Kan biroo haa ibsamu_____	
109a	Baayina maatii lakkofsaan	_____	
110a	Gosa maatii	1. Kan qofaa jiraatu/ttu 2. Hadhaa, abbaa fi ijoollee 3. Haadha, abbaa, ijoollee fi fira dabalatee	
111a	Giddu galeessaan Ji'atti qarshii/mallaqa hangam argattu/ akka maatiitti/?	Giddu galeessaan _____qarshii	
112a	Manni kessa jiraattan abbumma isaa.	1 Kan dhunfaa 2 kan kiireefatame	
113a	Ittii aansuudha waantoota ibsaman kessaa kan mana keessan kessatti argaamu "Eyyeen" kan hin jirre immo "Lakki" jechuudha deebisaa		
A	Ibsaa /sararra ibsaa/elektiriikii/	**1.** Eeyye	

		2. Lakkii	
B	Reediiyoonii	**1.** Eeyye **2.** Lakkii	
C	Teeleviizyiinii	**1.** Eeyye **2.** Lakkii	
D	Firijii	**1.** Eeyye **2.** Lakkii	
E	Bilbiila /moobaayilaa ynk biliblaa manaa/	**1.** Eeyye **2.** Lakkii	
F	Biisikileetii	**1.** Eeyye **2.** Lakkii	
G	Doodoqee/bayskilii mootoraa/	**1.** Eeyye 2. Lakkii	
H	Konkoolata/ makinaa	**1.** Eeyye **2.** Lakkii	
I	Minjaala	**1.** Eeyye **2.** Lakkii	
G	Tessoo/ barcummaa	**1.** Eeyye 2. Lakkii	
K	Siree firaashii wajjin	**1.** Eeyye 2. Lakkii	
L	Eelee elatiriikaan hojjatu	**1.** Eeyye 2. Lakkii	
M	Butaa gaazii / meeshaa elatiriikaan nyaata bilcheessan/	**1.** Eeyye **2.** Lakkii	
N	Dabtara baankii	**1.** Eeyye **2.** Lakkii	

Kutaa 2 ፡ Waa’ee dhukkuba sukkaaraa gosa lammaffaa, sababoota nama saaxilan irrattii beekkumsa fi amaloota hirmaattotaa ilaalchisee gaafilee gaafataman

Lak	Gaaffii	Deebii	Yaada
201a	Waa’ee dhukkuba sukkaaraa dhageessani beektuu?	1. Eeyyee 2. Lakkii	
202a	Odeeffannoo waa’ee fayyaa keetii yookan dhukkuba sukkaara eessaa argatta?	1. Gaazexaa 2. Media sabqunnamtii hawaasaa 3. Televizyiinii and radiyoonii 4. Waajjira fayyaa/ hojjettoota fayyaa 5. Mana amantaa/ masgiida, baskaana, charchii/ 6. Postarii maxxane irraa 7. Maatii fi hiriyoota irraa 8. Kan biro -------	
203a	Dhukkubni sukkaaaraa hormoniin insuliinii yoo gahaan hin oomishamne dhufa	1. Eeyyee 2. Lakkii 3. Hin beeku	
204a	Dhukkubni sukkaaraa jechuun sukkaarri dhiiga keessatti baayyachuudha	1. Eeyyee 2. Lakkii 3. Hin beeku	
205a	Mallattooleen dhukkuba sukkaaraa fincaan yerootti fincaanuu, haalaa malee dheebochuu fi beela’uu akkasumas garmalee ulffatina hir’isuudha.	1. Eeyyee 2. Lakkii 3. Hin beeku	

206a	Dhukkuba sukkaaraa yoo qabaadheeyyuu haala gaariin jiraachuu nan danda'a	1. Eeyyee 2. Lakkii 3. Hin beeku	
207a	Dhuukkubni sukkaaraa onnee hin miidhu	1. Eeyyee 2. Lakkii 3. Hin beeku	
208a	Dhukkubni sukkaaraa ija ni jaamsa	1. Eeyyee 2. Lakkii 3. Hin beeku	
209a	Dhukkubni sukkaaraa quba miilaa irratti miira nama hindhabamsiisu	1. Eeyyee 2. Lakkii 3. Hin beeku	
210a	Dhukkubni sukkaaraa maatiin ni daddarba	1.Eeyyee 2.Lakkii 3 Hin beeku	
211a	Dhukkubni sukkaaraa namoota dullooman qofa miidha	1. Eeyyee 2. Lakkii 3. Hin beeku	
212a	Dhukkubni sukkaara gosa lammaffaan nama tokkoo gara nama biraa ni dadaarbaa?	1. Eeyyee 2. Lakkii	
213a	Dhukkubni sukkaaraa dhukkuba yeroo dheera/ chronic/ dha.	1. Eeyyee 2. Lakkii 3. Hin beeku	
214a	Dhukkubni sukkaaraa fayyuu hin danda'u	1. Eeyyee 2. Lakkii 3. Hin beeku	
215a	Dhukkuba sukkaaraa ittisuun yookan to'achuun ni danda'amaa?	1. Eeyyee 2. Lakkii 3. Hin beeku	
216a	Dhukkubni sukkaaraa tasa nama ajjeesuu danda'a	1. Eeyyee 2. Lakkii 3. Hin beeku	
217a	Hamma sukkaara dhiiga keessaa eessatti akka safaran beektuu	1. Eeyyee 2. Lakkii	

218a	Gaffii lakk. 417a debiin kee eeyye yoo ta'ee bakka itti keenamu(debiin tokkoo oli deebiisun ni dandaa'amaa)	1. Keellaa fayyaa 2.Bufata fayyaa/kiilinikii 3 Hoospiitaala 4.Mana kessati 5.Kan biroo----------	
219a	Hangi sukkaara dhiiga kessa jiru kan nama fayyaa sirriin meqa akka ta'e ni beektu ? (debii 72-100 gm/dl ta'e debisuu isaanii mirkaaneessaa)	1. Eeyye 2. Lakkii	
220a	Amaloota dhukkuba sukkaaraaf nama saaxalisisu ni beektu?	1. Eeyye 2. Lakkii	
221a	Gaffii lakk. 4201a debiin kee eeyye yoo ta'ee waantoota ykn amalootni nama saaxalisisu maal maalfaadha (debiin tokko o'oli deebiisun ni dandaa'amaa)	1. Sigaraa xuxuu 2. jajjabenyaa qaamaa hojjachuu dhiisuu/ 3. hanga heyyamamee ol alkoolii dhuguu 4. Nyaata cooma itti baayate nyaachu 5. Soogidda baayisani fayyadamuu 6. Jireenya dhiphinaan jiraachuu	
Kutaa 3 : Dhukkuba sukkaara gosa lammaffaan waajjin walqabatee muudannoo fi dhibeelee isaan walqabatan			
Lakk	Gaaffii	Deebii	Yaadaa
301a	Dhukkuba sukkaaraa gosa lammaffaa haakiima ykn oggeesa fayyaa biratti ilaalamtani beektu?	1. Eeyye 2. Lakkii	

302a	Dhiiga kee keessa sukkaarri dabale jedhmee siiti hiimamee beekaa?	1. Eeyye 2. Lakkii	
303a	Hamma dhukkuba sukkaaraa to'aachuuf qorichaa ykn goorsa yaalaa haakiim ykn oggeesa fayyaa biratti kan siif ajajamee jiraa?	1. Eeyye 2. Hin fayyadamuu	
304a	Maatii kee keessaa dhukkuba sukkaaraa kan qabuu jiraa? Abba/hadha obbolessa/oboleettii	1. Eeyye 2. Lakkii	
304a	Ogeessi fayyaa dhukkuba sukkaara ni qabda jedhee sitti himee beeka?	1. Eeyye 2. Lakkii	

Kutaa 4: Gaaffiwwan hubanno haala fayyaa irratti hundaa'an

Hubannoo saaxilamummaa dhukkuba sukkaaraa /Perceived susceptibility						
kabajamoo maamila keenya, gaaffilee armaan gaditrti ibsaman erga dubbiftanii booda Sirritti morma, Nan morma , hin beeku, waliin nangala ykn Sirrittin walii gala iddioo jedhanitti filannoo keessan nuuf guutaa. Ibsa 1. Sirritti morma 2. nan morma 3. hin beekku 4. walii nan gala 5. Sirrittin walii gala						
401a	Carran koo dhukkuba sukkaaraa gosa lammaffaatiif saaxlamu guddaadha	1	2	3	4	5
402a	Jireenya koo kessat yeroo tokko dhukkuba sukkaaraa gosa lammaffaatiin naa qabachun isaa nati dhaagahaamma	1	2	3	4	5
403a	Namni hundu dhukkuba sukkaaraa gosa lammaffaatiif saaxlamaadha	1	2	3	4	5
404a	Namni kamiiyyu dhukkuba sukkaaraatiif saaxlamaadha	1	2	3	4	5
405a	Sigaraa xuxuun dhukkuba sukkaaraa gosa lammaffaatiif nama saaxila	1	2	3	4	5
406a	Jajjabenya qaamaa/ sosocha'u dhiisuun dhukkuba sukkaaraa gosa lammaffaa fiida / saaxlisiisa	1	2	3	4	5
407a	Siirrii maala furdaachu/ulfaatiina qama olika'un dhukkuba sukkaaraa gosa lammaffaa fiida / saaxlisiisa	1	2	3	4	5
408a	Dhugaati alkoolii baayisanii fayyadamuun dhukkuba sukkaaraa gosa lammaffaa fiida / saaxlisiisa	1	2	3	4	5
409a	Cooma baayisanii nyaachun dukkuba sukkaara gosa lammaffaa fiida / saaxlisiisa	1	2	3	4	5
410a	Dukkubni sukkaara gosa lammaffaa naqabachu dandaa'a jette ni yaadda	1	2	3	4	5
411a	Dukkuba sukkaara gosa lammaffaa rakkina fayyaa Itiiyoophiyaati	1	2	3	4	5
Rakkina gadifageenyaani hubaachu / Perceived severity						
Maaloo gaaffiilee aramaan gadii yoon dubbisu na dhaggeeffadhaatii deebii keessaan : Sirritti morma, Nan morma , hin beekku, walii gale ykn Sirrittin walii gala jechuun naaf deebisaa 1. Sirrittin morma 2. nan morma 3. hin beekku 4. Walii nan gala 5. Sirrittin walii gala						

412a	Yoo dukkuba sukkaara qabaadhee , nan dhiphaa fi mukka'a	1	2	3	4	5
413a	Yoo dukkuba sukkaara qabaadhee, qo'oorcha dukkuba sukkaara koot nafudhaadha	1	2	3	4	5
414a	Dukkuba sukkaara gosa lammaffaan yoo ittisamuu baate dhukkuba ulfaatadha	1	2	3	4	5
415a	Dukkubni sukkaaraa gosa lammaffaan du'a tasaa fiida	1	2	3	4	5
416a	Dukkuba sukkaara gosa lammaffaa wajjin dhukkubootni walqabatan lubbuuf ulfaatoodha	1	2	3	4	5
417a	Dukkuba sukkaara gosa lammaffaan kan fayyu miti	1	2	3	4	5
418a	Dukkuba sukkaara gosa lammaffaan dukkuboota biroo caalaa ulfaatadha	1	2	3	4	5
419a	Dukkubni sukkaara gosa lammaffaan namoota ummiriidhaan guddaa ta'an irratti cima/ baayyata	1	2	3	4	5
420a	Dukkuba sukkaara gosa lammaffaan namoota furdaa ta'ani irratti cima/ baayyata	1	2	3	4	5
421a	Dukkuba sukkaara gosa lammaffaan namoota siigaraa xuuxan irrat ciima/ baayyata	1	2	3	4	5
422a	Dukkuba sukkaara gosa lammaffaan namoota dhugaati alkooli baayinaan fayyadaman irratti cima/ baayyata	1	2	3	4	5
423a	Dukkuba sukkaara gosa lammaffaan namoota sukkaara baayinaan fayyadaman irratti cima/ baayyata	1	2	3	4	5
424a	Dukkuba sukkaara gosa lammaffaan namoota cooma baayyisanii nyaatan irratti cima/ baayyata	1	2	3	4	5
425a	Dukkuba sukkaara gosa lammaffaan namoota baay'ee dhiphatan irratti cima/ baayyata	1	2	3	4	5

Dukkuba sukkaara gosa lammaffaan ittisuf tooftaale fayyadaman hubachuu /Perceived benefits

Maaloo gaaffiilee armaan gaditti jiran dhaggeffadhaa/dubbisaatii deebii keessan: Sirritti morma, Nan morma , hin beeku, walii nan gala ykn Sirrittin walii gala jechuun deebisaa

1. Sirrittin morma
2. nan morma
3. hin beeku
4. walii nan gala
5. Sirrittin walii gala

426a	Dukkuba sukkaara gosa lammaffaan akka salphaati fayyiisun ni dandaa'ama	1	2	3	4	5
427a	Walitti dhaassudha mana yaalaa deemun dukkuba sukkaaraa yoo qabamee fi lubbuu koo baraaruf ni gargaara	1	2	3	4	5
428a	Nyaaata sukkaara qabu nyaachuun fi cooma hiirrisun dukkuba sukkaaraa gosa lammaffaatiin akka hin saaxilamnee ni taasiisa	1	2	3	4	5
429a	Ulfaatina qamaa hir'suuf sosochiin qaamaa hojjatamu dhukkuba sukkaaraa ittisuuf ni gargaara	1	2	3	4	5
430a	Haala jireenyaa fayyaa qabeessa jiraachun dukkuba sukkaara gosa lammaffaatiif akka hin saaxilamnee ni taasiisa	1	2	3	4	5

431a	Sigaaraa xuuxuu/ arsuu dhiisuun / dhaabun dukkuba sukkaaraa gosa lammaffaa tiin akka hin qabamne ittisuf ni gargaara	1	2	3	4	5
432a	Dhugaati alkooli hiirrisuun dukkuba sukkaara gosa lammaffaatiin akka hin saaxilamnee ni taasiisa	1	2	3	4	5
433a	Sogidda soodiiyamii qabu nyaata kessaa hirrisun dukkuba sukkaara gosa lammaffaatiif akka hin saaxilamnee ni taasiisa	1	2	3	4	5
434a	Fudraa, kudraa nyaachuun fi cooma hiirrisun dukkuba sukkaaraa gosa lammaffaatiin akka hin saaxilamnee ni taasiisa	1	2	3	4	5
Dhukkuba sukkaaraa isa lammaffaa akka hin hir'isne wantoota sababa ta'an hubachuu / Perceived barriers						
Maaloo gaaffilee armaan gadii eega dhaggeeffattanii/dhageessanii booda deebii keessan: Sirritti morma, Nan morma , hin beeku, walii nan gala ykn Sirrittin walii gala jechuun filannoo keessan guutaa. 1. Sirritti nan morma 2. nan morma 3. hin beeku 4. walii nan gala 5. Sirrittin walii nan gala						
435a	Walitti dhaassudha mana yaalaa deeme offi ilaalichissun yeroo heddu fudhaata	1	2	3	4	5
436a	Wal'aansa ykn qorichi dukkuba sukkaaraa gosa lammaffaa fayyiisu bu'a qabeesaa ta'e hin jiru	1	2	3	4	5
437a	Dukkuba sukkaaraa gosa lammaffaa caalaa dhibeelee biraa na yaadessan heddutu jira	1	2	3	4	5
438a	Waa'ee maaloota dhukkuba sukkaara gosa lammaffaa ittin ittisan irrati beekumsa gahaa ta'e hin qabu	1	2	3	4	5
439a	Dhaabbileen fayyaa dhiiga yeroo yerootti safarachuuf/ laallamuuf mijaahoo miti	1	2	3	4	5
440a	Hanga fayyaa ta'etti waa'ee dhukkuba kamiyyuu osoo yaadu baadhee nan filaadha	1	2	3	4	5
441a	Hojii heddu waan qabuf waa'ee dhibee yaadaa yeroo koo qiisaaseesu hin barbaadu	1	2	3	4	5
442a	Maatii kootis ta'e namootiin nati dhihaatan dukkuba sukkaaraa gosa lammaffaa akka ittisu na hin hubachiisan	1	2	3	4	5
443a	Dukkuba sukkaara gosa lammaffaa ofirraa ittissuf maalllaqa gahaa, beekumsaa fi iddo ni barbaachiisa	1	2	3	4	5
444a	Mana yaalaa deemu laalamun nama qaanessa	1	2	3	4	5

Hojiira oolchudhaaf mallattolee hubachuu/ Cues to action			
Lakk.	Gafffi	Deebii	Yaadaa
445a	Waa'ee dukkuba sukkaara gosa lammaffaa ittissuf miidiyaarraa oddeffannoo gahaa ta'e ergaadhee jira hojiirra olchuudhaafyaalaan jira	1. Gonkumaa/tasumaa 2. Yeroo muraasa 3. Yeroo tokko tokko 4. Yeroo hundaa	

446a	Hojjetootni eksiteeshiini fayyaa waa'ee ittisa dukkuba sukkaara gosa lammaffaa barumsa gahaa ta'e naaf kennu	1. Gonkumaa/tasumaa 2. Yeroo muraasa 3. Yeroo tokko tokko 4. Yeroo hundaa	
447a	Maatii fi hiriyyootni koo goorsi naaf laatan dukkuba sukkaaraa gosa lammaffaa ittisuuf na jajjabeessa	1. Gonkumaa/tasumaa 2. Yeroo muraasa 3. Yeroo tokko tokko 4. Yeroo hundaa	
448a	Dukkubni sukkaaraa gosa lammaffaa dhukkuba umirii guutu ta'u isaa yoon yaadu ittissa isaa irrati akka xiiyyeffadhu na taasiisa	1. Gonkumaa/tasumaa 2. Yeroo muraasa 3. Yeroo tokko tokko 4. Yeroo hundaa	
449a	Namootni ani beekuufi nati dhiiyaataniif dukkuba sukkaara gosa lammaffaatin dhukkubisatanii arguun koo ittisa irrati akka xiiyyeffadhu na taasiisa	1. Gonkumaa/tasumaa 2. Yeroo muraasa 3. Yeroo tokko tokko 4. Yeroo hundaa	

Amanataa/ilaalcha dhuunfaa (Self-efficacy)

Lakk.	Gafffi	Deebii	Yaadaa
450a	Dukkuba sukkaara gosa lammaffaa ofirraa ittisuuf hojiileen hojjedhu haala salphaati naaf miilkaa'a	1. Sirritti nan morma 2. Nan morma 3. Hin beeku 4. Walii nan gala 5. Sirrittin walii nan gala	
451a	Dukkuba sukkaara gosa lammaffaa ofirraa ittisuuf hojiileen haala jireenyaa fayyaa qabeessa ta'e nan hojjedha	1. Sirritti nan morma 2. Nan morma	

		3. Hin beeku 4. Walii nan gala 5. Sirrittin walii nan gala	
452a	Dukkuba sukkaara gosa lammaffaa ofirraa ittisuuf Fayyaa qorachiissun argamu barbaachissaadha	1. Sirritti nan morma 2. Nan morma 3. Hin beeku 4. Walii nan gala 5. Sirrittin walii nan gala	
453a	Dukkuba sukkaara gosa lammaffaa akkamit ofirraa ittisuuf oddeeffannoo qaba	1. Sirritti nan morma 2. Nan morma 3. Hin beeku 4. Walii nan gala 5. Sirrittin walii nan gala	

Kutaa V : Amaloota fi araada garagaraa ilaalchisee

Sigaraa fayyadamuu			
Lakk	Gaaffii	Deebii	Yaada
501a	Sigaraa xuuxxanii beektanii?	1. Eeyye 2. Lakkii	
502a	Yeroo amma sigaraa ni xuxxuu ?	1. Eeyye 2. Hin xuxxu	
503a	Gaffii lakk. 202 debiin keessan eeyye yoo ta'ee yeroo meeqa arsitaa/xuuxxa?	1. Guyyaa guyyaadhan 2. Toorbanitti kessatti guyyaa 5-6 3. Toorbanitti kessatti guyyaa 3-4 4. Toorbanitti kessatti guyyaa 1-2	
504a	Gidduu galeesan guyyati sigaaraa meeqa arsitaa/xuuxxaa?	lakkofsaan_____	
505a	Sigaaraa arsuu/xuuxxuu yeroo erga egaltee wagga meeqa tahe?	waggaadhan-------	
Dhufgaati alkoolii fayyadamuu			
506a	Dhuugaatii alkoolii qaban dhugdee beektaa	1. Eeyye 2. Lakkii	
507a	Yeroo ammaa alkoolii ni dhugdaa	1. Eeyye 2. Hin dhugu	
508a	Gaffii lakk. 207 debiin kee eeyye yoo ta'ee torbanitti alkooli si'aa meqa fudhattu?	1. Guyyaa guyyaadhan 2. Toorbanitti kessatti guyyaa 5-6 3. Toorbanitti kessatti guyyaa 3-4	

		4. Toorbanitti kessatti guyyaa 1-2	
509a	Yeroo tokkoti qaruurra/ Birchiqoodhan (300ml biraadhaf fi siinii shaayi dhugaati adaatiif)	lakkofsaan_____	
510a	Alkoolii waggaa meeqaaf dhugdan	waggaadhan _____	
Caatii qama'uu			
511a	Caatii qamaatani ni bektanii	1. Eeyye 2. Lakkii	
512a	Yeroo ammaa caatii ni qamaatuu	1. Eeyye 2. Hin qama'u	
513a	Gaffii lakk. 212 debiin kee eeyye yoo ta'ee torbanitti si'aa meqa qamaatu ?	1. Guyyaa guyyaadhan 2. Toorbanitti kessatti guyyaa 5-6 3. Toorbanitti kessatti guyyaa 3-4 4. Toorbanitti kessatti guyyaa 1-2	
514a	Caati waggaa meeqaaf qamaate?	Waggaadhaan_____	
Buna fayyadamuu			
515a	Buna ni dhugdani	1. Nan dhuga 2. Hin dhugu	
516a	Gaffii lakk. 215 debiin kee eeyye yoo ta'ee torbanitti buna si'aa meqa fudhaatta?	1. guyyaa guyyadhan 2. 5-6 guyyaaa toorbee kessatii 3. 3-4 guyyaaa toorbee kessatii 4. 1-2 guyyaaa toorbee kessatii	
517a	Siinii meqa dhugdu	Lakkofsaan sinii_____	
518a	Bunatti maal dabalitani dhugdu?	1. soogidda 2. Sukkaaraa 3. buna duwwaa	
Haala nyaataa ykn soorataa			

519a	Yeroo soorata kamirratti baayyistanii nyaattu?	1. Sa'aati ciree 2. Sa'aati laaqanaa 3. sa'aati irbaataa 4. Sa'aati Olchaa(maksasii)	
520a	Fuduraalee/firaafiree/ ni nyaatta?	1 eyyeen 2 hin Nyaadhu	
521a	Kuduraalee/ashaakiltii/ ni nyaattaa?	1 eyyeen 2 hin Nyaadhu	
522a	Gaffii lakk. 220 debiin kee eeyye yoo ta'ee torbanitti Fuduraale si'aa meqa nyaatta ?	1. guyyaa guyyadhan 2. 5-6 guyyaaa toorbee kessatii 3. 3-4 guyyaaa toorbee kessatii 4. 1-2 guyyaaa toorbee kessatii	
523a	Gaffii lakk. 221 debiin kee eeyye yoo ta'ee torbanitti Kuduraale si'aa meeqa nyaatta?	1. guyyaa guyyadhan 2. 5-6 guyyaaa toorbee kessatii 3. 3-4 guyyaaa toorbee kessatii 4. 1-2 guyyaaa toorbee kessatii	
524a	Nyaata dhadhaa fi cooma ittii baayyate ni nyaattaa?	1 . Eyyeen 2 . Hin Nyaadhu	
Haala fayyadama Soogiddaa			
526a	Hanga nyaata kessatti dabalamee olitti soogidda dabalitani ni nyaattuu? Soogidda	1. Eeyyen 2. Hin nyaadhu	
Haala ga'umsaa qama			
527a	Guyyaa guyyaadhan hojiin hijjettan yoo xiqqate daqiqaa kudhanif (10) sosochii qaamaa ykn humna ni gaafataa?	1. Eeyye 2. Lakkii	
528a	Torbanitti yeroo meeqa hojii humnaa hojjatu?	1. guyyaa guyyadhan 2. 5-6 guyyaaa toorbee kessatii 3. 3-4 guyyaaa toorbee kessatii 4. 1-2 guyyaaa toorbee kessatii	
iddoo tokko gara iddoo biraatti socho'uu			
529a	Yoo xinnatee daqiqaa kudhaniif(10) iddoo tokko gara iddoo biraatti ni sochootuu	1. Eeyyen 2. Hin socho'uu	
530a	Torban tokko kessaati yoo xinnatee daqiqaa kudhaanif(10) guyyoota meqa deemtu/sochootu?	1. guyyaa guyyadhan 2. 5-6 guyyaaa toorbee kessatii 3. 3-4 guyyaaa toorbee kessatiI 4. 1-2 guyyaaa toorbee kessatii	

531a	Geejjibaaf(imaala) maalitti fayyadamta?	1. Miila 2. Biskileetta 3. Konkolaata 4. Kan biro----------	
Sochii bashannanaa			
532a	Human kan gaafatu kan (jajjiabeenya qaamaa) hojjachuun bashannantuu?	1. Eeyyen 2. Hin hojjadhu	
533a	Torban kessati sosochii jajjbeenya qaamaa si'a meqa hojjattu ykn bashannantu(ispoorti)?	1. guyyaa guyyadhan 2. 5-6 guyyaaa toorbee kessatii 3. 3-4 guyyaaa toorbee kessatii 4. 1-2 guyyaaa toorbee kessatii	
Kutaa VI : Waa'ee olii kaa'insaa shukkaarii dhiigaa keessa fi dhibee dabalataa			
Lakk	Gaffiilee	Deebii	
601a	Doktaara ykn Oogeesii fayyaa shukkaarii dhiigaa kee keessa jiruu akka inni oli kaa'ee sitti himee beekuu?	1. Eeyyeen 2. Lakkii 3. Hin beekuu	
602b	Oogeesii fayya dhiibbaa dhiigaa kee keessa jiruu akka inni alkaa'ee sitti himee beekuu?	1. Eeyyeen 2. Lakkii 3. Hin beekuu	
603a	Yeroo amman kana qoriichaa,wal'aansa/gorsa dukkuba sukkaara gosa lammaffaatif kan Doktaara ykn Oogeesii fayyaa siif ajajamee fudhataani jirtu ?	1. Eeyyeen 2. Lakkii 3. Hin beekuu	
603a	Maatii kee keessaa dukkuba sukkaara gosa lammaffaa kan qabuu jiruu? Abba/hadhaobbolessa/oboleettii	1. Eeyyeen 2. Lakkii 3. Hin beekuu	
605a	Wanta siin cinquu/dhiiphiissuu jira?	1. Eeyyeen 2. Lakkii 3. Hin beekuu	

Kutaa torbaffaa(VII) : Safara qaamaa- ulfaatinaa fi dheerina/hojjaa			
lakk	Gaaffii	Deebii	
701a	Dheerina	_____cm	
702a	Naannawa mudhii	_____cm	
703a	Naannawa luqqeetti/tafa	_____cm	
704a	Ulfaatinna qamaa	_____k.g	
Dhiibbaa dhiigaa daqiiqaa 15 gidduutti			
705a	Dubbisa 1	_____siistoolikii _____diyaastoolikii	
706a	Dubbisa 2	_____siistoolikii _____diyaastoolikii	
707a	Dubbisa 3	_____siistoolikii _____diyaastoolikii	
Safartuu guluukoosii dhiigaa			
708a	Yoo xiqqaate sa'aatii 8 (saddeet) erga soomanii booda sadarkaa guluukoosii dhiigaa	----------mg/dl FBS irratti kan argamu	

Hirmaannaa keessaniif galatoomaa!!!

ANNEXURE Q: INFORMED CONSENT FORM IN AFAAN OROMO LANGUAGE(PHASE II)

BARREEFFAMA ODEEFFANNOO MAAMILEE : Hospital base- unmatched case-control -based crossectional study(Phase II) Marsaa 2ffaa keessatti

Ibsa Hayyamamaa ta'uu fi Qabxilee barbbachisoo.

Maqaa Projectii: qorannoo waa,ee *Tooftaalee Ittisa Dhukkuba Sukkaaraa Gosa lammaffaa Ga'eessota akka goodina Goodina Baaleetii , Kibba Baha Itoophiyaa irratti hundaa'e*

Gaaffii kutaa 2: Tooftaalee Ittisa Dhukkuba Sukkaaraa Gosa lammaffaa namoota Ga'eessota akka goodina Goodina Baaleetii , Kibba Baha Itoophiyaa

Kabajamoo hirmaataa/hirmaattuu

Ani maqaan koo_____kan jedhamu qorannoo obbo Tasfaayee Asaffaatiin hogganamu barataa PHD (digrii 3ffaa) yuniversiistii Afrikaa kibbaa (UNISA) kan ta'e, kan hogganamu irratti odeeffannoo sassaabaa ta'een hojjachaa jira. Aniis ragaalee **Tooftaalee Ittisa Dhukkuba Sukkaaraa Gosa lammaffaa namoota Ga'eessota akka goodina Goodina Baaleetii , Kibba Baha Itoophiyaa** irrattti xiyyeffate akka goodina baaleetti, kibba baha Itiyoophiyaatti kanan funaanudha. Qorannoon kun sababoota dhukkuba sukkaara isa lammaffaaf nama saaxilan adda baasuuf akka galteetti ni gargaaramaloota dhukkuba sukkaaraa ittiiin offirraa ittisan irrattii odeeffannoo ni sassaabna. Gaaffiileen dhihaatan kutaa sadii qabu isaaniis: gaaffiilee fulduraan gaafataman (gafiif deebii, safara dhiibbaa dhiigaa, safara nannawa mudhii fi luqqeettuu, safara ulfaatinaa fi dheerinaa kan qabatu ta'a. Gaaffiilee sasalphoo tokko tokko isin gaafanna. Maqaa fi wantootni adda baafannoo garagaraa asirrattii hin barraahu, akkasumas deebii deebisuuf hin dirqissifamtan. Yeroo barbaadanitti deebii deebisuu dhaabuu ni dandeessu, haa ta'u malee deebiin isin nuuf kennitan sababoota dhukkuba sukkaaraaf nama saaxilan adda basuu keessatti fi dhukkuba kana ittisuu irratti gahee olaanaaa qaba. Wantootni siniif hin mijoofne yoo jiraate yeroo kamuu adda kutuu ni dandeessu. Gaaffilee kana xumuruuf hanga daqiiqaa 20 ykn 35 fixachuu danda'a. Yaadni isin nuuf laattan kallattidhaan kan isin fayyaduu ta'uu baateyyuu, qophaa'ina tarsiimoo fi sagantaa dhukkuba sukkaraa hir'suu irratti ga'ee guddaa qaba. Biiroon Fayya Oromiyaa qoranno kana hayyamee jira.

Gaafiiwwan armaa gaditti ka’ame hirmanan koo barbachisa ta’u isaatti fi Iciitin koo egamaa, akkasumas qo’annoo kanaaf qofa kan olluu ta’u isaa hubadheen jira. Qoranno kana irratii hirmachuu kessanif midhaan qamaas ta’e xiin-sammuu isirra gahuu gonkuma hin jiru.

KAAYYOO QORANNOO

Kaayyoon qorannoo kanaa tooftaalee ittisa dhukkuba sukkaaraa gosa 2ffaa ga’eessota Goodina Baalee , Kibba Bahaa Itoophiyaa keessatti argaman qopheessuudha.

GAAFFII QORANNOO

Dhukkuba Sukkaaraa Gosa 2ffaa akka dhukkuba daddarboo hin taaneetti ittisuuf maaltu godhamuu danda’a?

RAGAA NAAMUSAA

Pirootokooliin qorannichaa Kolleejjii Saayinsii Namaa keessatti Koreewwan Digirii Olaanoo Kutaa Qo’annoo Fayyaa Unisaatti dhiyaateera. Koreewwan kunneen naamusa qorannichaaf hayyama barreeffamaa kennaniiru.

SIN IRRAA EEGGAMA

Qorannicha irratti hirmaachuuf yoo walii galte, yeroo kee keessaa sa’aatii tokko nama odeeffannoo walitti qabuuf kennuu qabda. Kutaa kana keessatti waa’ee odeeffannoo dhuunfaa fi akkaataa jireenya keessanii gaaffii fi deebii ni taasifama. Dabalataanis safartuuwwan akka dhiibbaa dhiigaa, ulfaatina qaamaa fi dheerina qaamaa ni fudhatamu. Ulfaatinaafi olka’iinsa sirritti safaruuf uffata ulfaataa fi kophee akka baastan isin gaafatamuu hubadhaa. Akkasumas waa’ee ilaalcha bocaafi fakkii qaamaa, dhiphina sammuu fi nyaata dhabuu si gaafatamuu danda’a.

MIRGA KEE AKKA HIRMAATA QORANNOO KANA KEESSATTI

Qo’annoo kana irratti hirmaachuun keessan guutummaatti fedhii keessaniiti. Hirmaannaa hirmaachuu dhiisuu yoo filatte hirmaannaa diduudhaaf mirga qabda. Jalqaba irratti hirmaachuuf yoo murteessite boodarra garuu yaada kee yoo jijjiirte, bu’aa badaa tokko malee osoo hin mudatin qorannicha keessaa ba’uuf bilisa taate. Yeroo kamiyyuu odeeffannoo murtaa’e kennuu yoo hin barbaanne, diduudhaaf mirga qabda.

RAKKOO HOJII QORANNOO IRRATTI ARGAMU

Qorannoon kun fi hojimaanni isaa miira qaamaa ykn sammuu irraa eegamu kamiyyuu kan of keessaa qabu miti. Haa ta'u malee, yeroo qorannichaa miira namaa kan hin tolle yoo si mudate, qorattootaaf hatattamaan beeksisuun barbaachisaadha. Rakkoo isin mudachuu danda'u kamiyyuu furuuf deeggarsa fi gorsa barbaachisaa ta'e kennuudhaaf qophii guutuu qabna.

BALAA QORANNOO KANA KEESSATTI ARGAMAN

Qorannoon kun balaa mul'atu ykn tilmaamamuu danda'u siif ykn maatii keetiif hin dhiyeessu.

ICCITII

Odeeffannoon qorannoo kana keessatti walitti qabame hundi akka iccitii cimaatti kan ilaalamu fi haala nageenya qabuun kan kuufamu ta'a. Joornaalota saayinsii qorannoo kana gabaasan kamiyyuu keessatti eenyummaan kee hin ibsamu. Daataan kun bakka nageenya qabutti kan kaa'amu yoo ta'u, hayyama ifa ta'e keessan malee namoota hayyama hin qabne kamiifuu hin qoodamu. Qorannoon kun erga maxxanfamee waggaa shan booda ragaan ni barbadaa'a.

Kaayyoon qorannichaa hubattee? Eeyyee ( ) Lakki ( ). Qo'annaa kanarratti hirmaachuuf fedhii qabdaa? Eeyyee ( ) Lakki ( ).

Mallattoo hirmaataa----------

Qorannicha ykn gaaffilee ilaalchisee gaaffii ykn yaaddoo yoo qabaattan Obbo Tasfaayee Assaffaa Taaddasaa

Bilbila : 091134995, obbo Tasfaayee Asaffaa

Email: tessssfu@gmail.com

Supparvayizriin qorannoo Digrii sadafaa(PHD) kanaa Dr Zodwa Manyisaa jedhamu

Q001b. Koodii gaaffilee---------- .

Maqaa walitti qabatoota deetaa ----------mallattoo----------guyyaa----------

Kutaa 1b: Dhimma hawaasummaa fi dinagdee ilaalchisee (Hospital base-unmatched case-control -based crossectional study(Phase II) Marsaa 2ffaa

Lak.	Gaaffii	Deebii	Yaada
101b	Iddoo jireenyaa Dhabbataa	1. Magaalaa 2. Baadiyaa	
102b	Saala	1. Dhiraa **2.** Dubaratii	
103b	Umuriin kee meeqa?	---------- waggaadhan	
104b	Halaa gaa'eelaa	1. Kan hin fuune/hin heerumne 2. Kan fuudhe/heerumte 3. Kan hike/hikte 4. Kan jalaa du'e/duute	
105b	Sadarkaa Barumsa /Yeroo darbee kessati wagga Sadarkaa Barumsa Xumurtee/	1) Dubbisuu fi barreessuu kan hin dandenye 2) Dubbisuuf fi barreessuu kan danda'u/chu 3) Sadarkaa 1ffaa(1-8) 4) Sadarkaa Lammaffaa(9-12) 5) Dippiloomaa fi Sanaa ol	
106b	Amaantaa kee maali	1) Oritoodoksii 2) Musilimaa 3) Proteesitaanti 4) Kaatooliikii 5) Kan biroo ibsi_____	
107b	Qoomoo/sabni kee maali	1) Oromoo 2) Amahara 3) Tigree	

		4) Gaammoo 5) Kan biroo ,haa ibsamu_____	
108b	Haala Hojji/ maal hojjataa jiraatta/	1) Qaxaramee kan hojjatu/ motumma ykn dhuunfaa/ 2) Hojii humnaa 3) Daldala 4) Qotee bulaa 5) Hadhaa manaa 6) Kan soorama bahee 7) Kan biroo haa ibsamu_____	
109b	Baayina maatii lakkofsaan	_____	
110b	Gosa maatii	1) Kan qofaa jiraatu/ttu 2) Hadhaa, abbaa fi ijoollee 3) Haadha, abbaa, ijoollee fi fira dabalatee	
111b	Giddu galeessaan Ji'atti qarshii/mallaqa hangam argattu/ akka maatiitti/?	Giddu galeessaan _____qarshii	
112b	Manni kessa jiraattan abbumma isaa.	1) Kan dhunfaa 2) kan kiireefatame	
113b	Ittii aansuudha waantoota ibsaman kessaa kan mana keessan kessatti argaamu "Eyyeen" kan hin jirre immo "Lakki" jechuudha deebisaa		
A	Ibsaa /sararra ibsaa/elektiriikii/	1) Eeyye 2) Lakkii	
B	Reediiyoonii	1. Eeyye **2.** Lakkii	
C	Teeleviizyiinii	1. Eeyye **2.** Lakkii	
D	Firijii	1. Eeyye 2. Lakkii	
E	Bilbiila /moobaayilaa ynk biliblaa manaa/	1. Eeyye	

		2. Lakkii	
F	Biisikileetii	1. Eeyye 2. Lakkii	
G	Doodoqee/bayskilii mootoraa/	1. Eeyye 2. Lakkii	
H	Konkoolata/ makinaa	1. Eeyye 2. Lakkii	
I	Minjaala	1. Eeyye 2. Lakkii	
G	Tessoo/ barcummaa	3. Eeyye 4. Lakkii	
K	Siree firaashii wajjin	3. Eeyye 4. Lakkii	
L	Eelee elatiriikaan hojjatu	1. Eeyye 2. Lakkii	
M	Butaa gaazii / meeshaa elatiriikaan nyaata bilcheessan/	1. Eeyye 2. Lakkii	
N	Dabtara baankii	1. Eeyye 2. Lakkii	

Kutaa II b :Amaloota fi araada garagaraa ilaalchisee

Sigaraa fayyadamuu			
Lakk	Gaaffii	Deebii	Yaada
201b	Sigaraa xuuxxanii beektanii?	1. Eeyye 2. Lakkii	
202b	Yeroo amma sigaraa ni xuxxuu ?	1. Eeyye 2. Hin xuxxu	
203b	Gaffii lakk. 202 debiin keessan eeyye yoo ta'ee yeroo meeqa arsitaa/xuuxxa?	1. Guyyaa guyyaadhan 2. Toorbanitti kessatti guyyaa 5-6 3. Toorbanitti kessatti guyyaa 3-4 4. Toorbanitti kessatti guyyaa **1-2**	
204b	Gidduu galeesan guyyati sigaaraa meeqa arsitaa/xuuxxaa?	lakkofsaan_____	
205b	Sigaaraa arsuu/xuuxxuu yeroo erga egaltee wagga meeqa tahe?	waggaadhan-------	
Dhufgaati alkoolii fayyadamuu			
206b	Dhuugaatii alkoolii qaban dhugdee beektaa	1. Eeyye 2. Lakkii	
207b	Yeroo ammaa alkoolii ni dhugdaa	1. Eeyye 2. Hin dhugu	
208b	Gaffii lakk. 207 debiin kee eeyye yoo ta'ee torbanitti alkooli si'aa meqa fudhattu?	1. Guyyaa guyyaadhan 2. Toorbanitti kessatti guyyaa 5-6 3. Toorbanitti kessatti guyyaa 3-4 4. Toorbanitti kessatti guyyaa 1-2	
209b	Yeroo tokkoti qaruurra/ Birchiqoodhan (300ml biraadhaf fi siinii shaayi dhugaati adaatiif)	lakkofsaan_____	
210b	Alkoolii waggaa meeqaaf dhugdan	waggaadhan _____	

Caatii qama'uu			
211b	Caatii qamaatani ni bektanii	1. Eeyye 2. Lakkii	
212b	Yeroo ammaa caatii ni qamaatuu	1. Eeyye 2. Hin qama'u	
213b	Gaffii lakk. 212 debiin kee eeyye yoo ta'ee torbanitti si'aa meqa qamaatu ?	1. Guyyaa guyyaadhan 2. Toorbanitti kessatti guyyaa 5-6 3. Toorbanitti kessatti guyyaa 3-4 4. Toorbanitti kessatti guyyaa **1-2**	
214b	Caati waggaa meeqaaf qamaate?	Waggaadhaan_____	
Buna fayyadamuu			
215b	Buna ni dhugdani	1. Nan dhugaa 2. Hin dhugu	
216b	Gaffii lakk. 215 debiin kee eeyye yoo ta'ee torbanitti buna si'aa meqa fudhaatta?	1. guyyaa guyyadhan 2. 5-6 guyyaaa toorbee kessatii 3. 3-4 guyyaaa toorbee kessatii 4. 1-2 guyyaaa toorbee kessatii	
217b	Siinii meqa dhugdu	Lakkofsaan sinii_____	
218b	Bunatti maal dabalitani dhugdu?	1. soogidda 2. Sukkaaraa 3. buna duwwaa	
Haala nyaataa ykn soorataa			
219b	Yeroo soorata kamirratti baayyistanii nyaattu?	1. Sa'aati ciree 2. Sa'aati laaqanaa 3. sa'aati irbaataa 4. Sa'aati Olchaa(maksasii)	
220b	Fuduraalee/firaafiree/ ni nyaatta?	1 eyyeen 2 hin Nyaadhu	
221b	Kuduraalee/ashaakiltii/ ni nyaattaa?	1 eyyeen 2 hin Nyaadhu	
222b	Gaffii lakk. 220 debiin kee eeyye yoo ta'ee torbanitti Fuduraale si'aa meqa nyaatta ?	5. guyyaa guyyadhan 6. 5-6 guyyaaa toorbee kessatii 7. 3-4 guyyaaa toorbee kessatii 8. 1-2 guyyaaa toorbee kessatii	
223b	Gaffii lakk. 221 debiin kee eeyye yoo ta'ee torbanitti Kuduraale si'aa meeqa nyaatta?	5. guyyaa guyyadhan 6. 5-6 guyyaaa toorbee kessatii 7. 3-4 guyyaaa toorbee kessatii	

		8. 1-2 guyyaaa toorbee kessatii	
224b	Nyaata dhadhaa fi cooma ittii baayyate ni nyaattaa?	1 . Eyyeen 2 . Hin Nyaadhu	
Haala fayyadama Soogiddaa			
226b	Hanga nyaata kessatti dabalamee olitti soogidda dabalitani ni nyaattuu? Soogidda	3. Eeyyen 4. Hin nyaadhu	
Haala ga'umsaa qama			
227b	Guyyaa guyyaadhan hojiin hijjettan yoo xiqqate daqiqaa kudhanif (10) sosochii qaamaa ykn humna ni gaafataa?	3. Eeyye 4. Lakkii	
228b	Torbanitti yeroo meeqa hojii humnaa hojjatu?	1) guyyaa guyyadhan 2) 5-6 guyyaaa toorbee kessatii 3) 3-4 guyyaaa toorbee kessatii 4) 1-2 guyyaaa toorbee kessatii	
iddoo tokko gara iddoo biraatti socho'uu			
229b	Yoo xinnatee daqiqaa kudhaniif(10) iddoo tokko gara iddoo biraatti ni sochootuu	1) Eeyyen 2) Hin socho'uu	
230b	Torban tokko kessaati yoo xinnatee daqiqaa kudhaanif(10) guyyoota meqa deemtu/sochootu?	1) guyyaa guyyadhan 2) 5-6 guyyaaa toorbee kessatii 3) 3-4 guyyaaa toorbee kessatiI 4) 1-2 guyyaaa toorbee kessatii	
231b	Geejjibaaf(imaala) maalitti fayyadamta?	1) Miila 2) Biskileetta 3) Konkolaata 4) Kan biro----------	
Sochii bashannanaa			
232b	Human kan gaafatu kan (jajjiabeenya qaamaa) hojjachuun bashannantuu?	1) Eeyyen 2) Hin hojjadhu	
233b	Torban kessati sosochii jajjbeenya qaamaa si'a meqa hojjattu ykn bashannantu(ispoorti)?	1) guyyaa guyyadhan 2) 5-6 guyyaaa toorbee kessatii 3) 3-4 guyyaaa toorbee kessatii 4) 1-2 guyyaaa toorbee kessatii	

Kutaa III b: Waa'ee olii kaa'insaa shukkaarii dhiigaa keessa fi dhibee dabalataa			
Lakk	Gaffiilee	Deebii	
301b	Doktaara ykn Oogeesii fayyaa shukkaarii dhiigaa kee keessa jiruu akka inni oli kaa'ee sitti himee beekuu?	1) Eeyyeen 2) Lakkii 3) Hin beekuu	
302b	Oogeesii fayya dhiibbaa dhiigaa kee keessa jiruu akka inni alkaa'ee sitti himee beekuu?	1) Eeyyeen 2) Lakkii 3) Hin beekuu	
303b	Yeroo amman kana qoriichaa,wal'aansa/gorsa dukkuba sukkaara gosa lammaffaatif kan Doktaara ykn Oogeesii fayyaa siif ajajamee fudhataani jirtu ?	1) Eeyyeen 2) Lakkii 3) Hin beekuu	
304b	Maatii kee keessaa dukkuba sukkaara gosa lammaffaa kan qabuu jiruu? Abba/hadhaobbolessa/oboleettii	1) Eeyyeen 2) Lakkii 3) Hin beekuu	
305b	Wanta siin cinquu/dhiiphiissuu jira?	1) Eeyyeen 2) Lakkii 3) Hin beekuu	
306b	Gaffii lakk. 305b debiin kee Eeyye yoo ta'ee digdamii(24 sa;aati), sa'aatii meeqa rafiitu?	Sa'aatii:daqiiqaa_____	
307b	Gaffii lakk. 306b debiin kee Eeyye yoo ta'ee mallatoo kan akka gadda, cinqii kaka'umsa dhabu ni qanbduu?	1. Eeyyeen 2. Lakkii 3. Hin beekuu	
308b	Gaffii lakk. 306b debiin kee Eeyye yoo ta'ee mallatoo kan akka qorichaa addaa ykn dhugaati alkoolii fayyadamuu,tamboo fayyadamuu, garmale nyaachu, xiqqoo nyaachu, walti dhufeenyaa hawaasaa wajjin qabdan dhiisuu ynk adda kutuu?	1. Eeyyeen 2. Lakkii 3. Hin beekuu	
309b	Mana yaala deemte akka dhiibbaa dhiigaa qabduu kan atii beektee wagga meeqa ta'aa?	_____waggaadha	
310b	Ammamtaa mana yaalaati hordooffi gootu	1. Ji'aan 2. Ji'a lama lamaan 3. Ji'a sadii sadiin	
311b	Dhibee bira ni qabda ?	1. Dhibee shukkaarii 2. Dhibee onnee 3. Dhibee kalee walan 4. Kan biro	

312ab	Maatii kee keessaa dhiibaa dhigaa/ shukkarii dhiigaa kan qabuu eenyuu? Abba/hadha/obbolessa/oboleettii	1. Eeyyeen 2. Lakkii 3. Hin beekuu	
313b	Dhiiga suukaara kee hamaam ta'a?	**1.** <130mg/dl FBS **2.** >130mg/dl FBS	

Kutaa IVb: Safara qaamaa- ulfaatinaa fi dheerina/hojjaa			
lakk	Gaaffii	Deebii	
401b	Dheerina	_____cm	
402b	Naannawa mudhii		
403b	Naannawa luqqeetti/tafa		
404b	Ulfaatinna qamaa	_____k.g	
Dhiibbaa dhiigaa daqiiqaa 15 gidduutti			
405b	Dubbisa 1	____siistoolikii __diyaastoolikii	
406b	Dubbisa 2	____ siistoolikii __ diyaastoolikii	
407b	Dubbisa 3	____ siistoolikii __ diyaastoolikii	

Kutaa Vb: Haala fi Guddinaa qaamaa irratti ilaalcha gaafatamtootaa			
Lakk	Gaaffii	Deeebii	Yaada
501b	Siirri maale ulfaachuun ykn furdachuun mallattoo fayyummaati	1. Eeyyee 2. lakki 3. hinbeeku	
502b	Namni tokko ulfaatiina qaamaa guddaa yoo qabaate yookan baayyee furdaa tahe sooressa tahuu danda'a.	1. eeyyee 2. lakki 3. hinbeeku	
503b	Siirri maale ulfaatiina dabaluun ykn fuurdachuun mallatoo coomuuti	1. eeyyee 2. lakki 3. hinbeeku	
504b	Gaffii lakk. 3 debiin kee lakkii yoo ta'ee sabaabiin kee maal?	1. badaa/badduu tahuu 2. saalfii 3. aarii 4.kan biro (ibsi_____)	
505b	Qallaa ta'uun/ huuqqata ta'un mallattoo fayyaa dhabuuti	1. eeyyee 2. lakki 3. hinbeeku	
506b	Haati manaa/abbaan warraa haam mi qaama isaa/ishee akkam yoo ta'e jaalattu	1. sirrii malee furdaa/doo 2. sirrii malee ulfaataa/ttuu 3. giddugaleessa 4. ulfaatina xiqqaa 5. ani hin beeku	
507b	Yeroo ammaa haala qaama keetii akkamitti ibsita?	1. sirrii malee furdaa/doo 2. sirrii malee ulfaataa/ttuu 3. giddugaleessa 4. ulfaatina xiqqaa 5. ani hin beeku	

508b	Haala qaaama amma qabdan irratti maaltu isinitti dhagahama?	1. jaaladheera 2. hin jaalanne 3. hin beeku	
509b	Namootni biro waa'ee haala qaamaa fi guddina qaama keetii irratti ilaalcha siif kennanii beekuu?	1. eeyyee 2. lakki 3. hin beeku	
510b	Deebii gaaffii 9 irratti deebiin kee eeyyen yoo ta'e ilaalchi isaanii maal ture?	1. sirrii malee furdaa/doo 2. sirrii malee ulfaataa/ttuu 3. giddugaleessa 4. ulfaatina xiqqaa 5. ani hin beeku	
511b	Sirrii malee furdaa yookan ulfaatina guddaa qabdu jedhamee ilaalchi yoo siif kenname maal goota?	1. isa tursiisuun yaala 2. gorsa ykn yaala argachuuf ogeessa fayyaan dhubbisa 3. sosochii qaamaan jalqaba 4. haala nyaata koon sirreessa 5. kan biroo(_____)	
512b	Sirrii malee ulfaachuun yookan furdachuun rakkoo fidu qabaa?	1. eyyee 2. lakki 3. hin beeku	
513b	Deebiin kee eeyyeen yoo ta'ee muraasa ibsi	<u>Eeyyee</u> <u>Lakkii</u> 1. dhukkuba sukkaaraa 2. dhukkuba dhiibbaa dhiiigaa 3. dhukkuboota onnee 4. kaansarii/daranyoo 5. kan biro_____)	
514b	Fooni dheedhii fi bu'aa beeyladootaa yeroo baayyee nyaachuun guddinaa fi haaala qaama keenyaaf baayyee barcbaachisaadha.	1. Eeyyee 2. Lakki 3. Hinbeeku	

515b	Gosoota nyaataa akka fuduraa, kuduraa fi baala magariisa yeroo baayyee nyaachuun guddinaa fi ijaarsaa qaamaa irratti dhiibbaa fida	1. Eeyyee 2. lakki 3. hinbeeku	

Gaffanna:

Kutaa VIb : Gaaffilee nyaataan of danda'uu maatii illaallatan (Household food security)

Gaffanna: Gaaffii gaafatamaniif yoo walii galte "eyyee darbee darbee, eyyee yeroo tokko tokko, eyyee yeroo baayyee", jechuun deebisaa. walii hin galle ykn mamii qabaattan "lakki" jechuun deebisaa

Lakk	Gaaffii	Deeebii	Yaada
601b	Hanga nyataa guutachuu dadhabuudhaan cinqamtee/dhiphattee beektaa?	0. Lakki 1. Eyyee darbee darbee (yeroo 1-2) 2. Eyyee yeroo tokko tokko(yeroo 2-10) 3. Eyyee yeroo baayyee(yeroo 10 oli)	
602b	Nyaata gosa barbaadde nyaachuu/bitachuu dadhabdee rakkattee beektaa	0. Lakki 1. Eyyee darbee darbee (yeroo 1-2) 2. Eyyee yeroo tokko tokko(yeroo 2-10) 3. Eyyee yeroo baayyee(yeroo 10 oli)	
603b	Nyaata gosa barbaaddu nyaachuu/bitachuu hir'istee beeektaa	0. Lakki 1. Eyyee darbee darbee (yeroo 1-2) 2. Eyyee yeroo tokko tokko(yeroo 2-10) 3. Eyyee yeroo baayyee(yeroo 10 oli)	
604b	Nyaata baayyee barbaachisoo dhiistee nyaata rakasha yookan baayyee hin barbaachifne nyaaachuuf dirqamtee turtee?	0. Lakki 1. Eyyee darbee darbee (yeroo 1-2)	

		2. Eyyee yeroo tokko tokko(yeroo 2-10) 3. Eyyee yeroo baayyee(yeroo 10 oli)	
605b	Hanga nyaata hir'isteeraa?	0. Lakki 1. Eyyee darbee darbee (yeroo 1-2) 2. Eyyee yeroo tokko tokko(yeroo 2-10) 3. Eyyee yeroo baayyee(yeroo 10 oli)	
606b	Yeroo nyaataa barame osoo hin nyaatin darbuuf dirqamtee beektaa	0. Lakki 1. Eyyee darbee darbee (yeroo 1-2) 2. Eyyee yeroo tokko tokko(yeroo 2-10) 3. Eyyee yeroo baayyee(yeroo 10 oli	
607b	Nyaata kamiyyuu osoo hin nyaatin yeroon itti dabarsitan jiraa	0. Lakki 1. Eyyee darbee darbee (yeroo 1-2) 2. Eyyee yeroo tokko tokko(yeroo 2-10) 3. Eyyee yeroo baayyee(yeroo 10 oli	
608b	Guyyaa fi galgala osoo hin nyaatin dabarsitanii beektuu?	1. Lakki 2. Eyyee darbee darbee (yeroo 1-2) 3. Eyyee yeroo tokko tokko(yeroo 2-10) 4. Eyyee yeroo baayyee(yeroo 10 oli	
609b	Torban 4 (guyyoota 30) darban keessa ati ykn miseensi manaa kamiyyuu nyaanni gahaan waan hin	0. Lakki 1. Eyyee darbee darbee (yeroo 1-2) 2. Eyyee yeroo tokko tokko(yeroo 2-10) 3. Eyyee yeroo baayyee(yeroo 10 oli	

Kutaa VIIb: Dhiphina Sammuu (wantoota saaxileessan) dhukkuba sukkaaraa gosa 2ffaa meeshaa SRQ20 fayyadamuun (Mental stress)

lakk	Gaaffii	Deebii		
		1.Eeyyen	2.Lakki	Yaadaa
701b	Yeroo baayyee Mataa Dhukkubbii ni qabaa?			
702b	Fedhiin nyaataa kee gadheedhaa?			
703b	Hirriba hamaa ni raftaa?			
704b	Salphaatti ni sodaattaa?			
705b	Harki kee ni raafama?			
706b	Naasuun, dhiphinni ykn yaaddoon sitti dhagahama?			
707b	Bullaa'insa nyaataa kee gaarii mitii?			
708b	Sirritti yaaduu ni rakkataa?			
709b	Gammachuun sitti dhagahama?			
710b	Yeroo biraa caalaa ni boossi?			
711b	Sochii guyyaa guyyaa gootutti gammaduun sitti ulfaataa?			
712b	Murtoo gochuun sitti ulfaataa?			
713b	Hojiin kee guyyaa guyyaa rakkachaa jiraa?			
714b	Jireenya keessatti gahee faayidaa qabu taphachuu hin dandeessu?			
715b	Fedhii wantootaa dhabdee?			
716b	Nama gatii hin qabne akka taate sitti dhagahamaa?			
717b	Yaadni jireenya kee xumuruu sammuu kee keessa jiraa?			
718b	Yeroo hunda dadhabbiin sitti dhagahama?			
719b	Garaa kee keessatti miira mijataa hin taane qabdaa?			
720b	Salphaatti ni dadhabaa?			

Hirmaannaa keessaniif galatoomaa!!!

ANNEXURE R: CONSENT LETTER FOR PARTICIPANTS AMHARIC VERSION

የምርምር ጥናት ተሳታፊዎች ስምምነት መግለጫ

ርዕስ፡ ምስራቅ ኢትዮጵያ በባሌ ዞን በአዋቂዎች ላይ ሁለተኛ ዓይነት የስኪር በሽታ ለመከላከል የሚረዱ ስትራቴጂዎች/ዘዴዎች ፡፡(የማህበረሰብ አቀፍ ጥናት (ክፍል 1)

በጥናቱ ለመሳተፍ ፈቃደኛ ነኝ፡፡

የጥናቱም ዓላማ በሚገባ ተብራርቶልኛል ፡፡

በጥናቱ መስማማት ማለት የሚከተሉትን እንደሚጠቀልል ተረድቻለሁ፡

ሀ. በደቡብ አፍሪካ ዩኒቨርስቲ ተማሪ መጠይቅ መሳተፍ

ለ. መጠይቁም እንዲቀዳ መስማማት

ሐ. ለተጨማሪ መጠይቅ መገኘት እናም የተቀዳውን ድምጽ አጥኚው/ጠያቂው እንዲጠቀም መፍቀድ

መ. የጥናቱንም ውጤት ማወቅ

ሰ. የጥናቱም አላማ በጤና ሳይንስ የዶክትሬት ዲግሪ ለሚሟላት መሆኑን ማወቅ

ረ. የምሰጠውም መረጃ ሚስጥራዊነቱ የተጠበቀ ይሆናል

- ተሳትፎዬም በፈቃደኝነት ነው
- በመጠይቁ በከፊልም ሆነ በሙሉ አለመሳተፍ
- በማንኛውም ሰዓት ማቋረጥ

የተሳታፊው/ዋ ስም፡ ----------

ፊርማ፡ ----------

ቀን፡ ----------

የአጥኚው ስም፡ ----------

የተማሪ ቁጥሩ፡ ----------

ፊርማ፡ ----------

ቀን፡ ----------

ANNEXURE S: INFORMATION SHEET AMHARIC VERSION

የተሳታፊ መረጃ ማቅረቢያ ቅፅ

ርዕስ፡ **በደቡብ ምስራቅ ኢትዮጵያ በባሌ ዞን በአዋቂዎች ላይ ሁለተኛ ዓይነት የስኪር በሽታ ለመከላከል የሚረዱ ስትራቴጂዎች/ዘዴዎች ፡፡(የማህበረሰብ አቀፍ ጥናት (ክፍል 1)፡፡**

የምርምር ጥናት ተሳታፊዎች ስምምነት መግለጫ

ርዕስ፡ በደቡብ ምስራቅ ኢትዮጵያ በባሌ ዞን በአዋቂዎች ላይ ሁለተኛ ዓይነት የስኪር በሽታ ለመከላከል የሚረዱ ስትራቴጂዎች/ዘዴዎች ፡፡(የማህበረሰብ አቀፍ ጥናት (ክፍል 1)

ውድ የወደፊት ተሳታፊዎች

ሰላምታ. የኔ ስም _____. ለመገምገም የምርምር ጥናት እየተካሄደ ነው።

በባሌ ዞን በደቡብ ምስራቅ ኢትዮጵያ_____ስትሬጅ ፎር ፕረቨንሽን 2 የስኪር በሽታ መከላከል በአዋቂዎች ላይ በባሌ ዞን፣ በደቡብ ምሥራቅ ኢትዮጵያ›› እንዲሳተፉ ተጋብዘዋል።

የኔ ስም _____. እኔ የምወክለው በደቡብ አፍሪካ ዩኒቨርሲቲ የዶክትሬት ተማሪ በሆነው በአቶ ተስፋዬ አሰፋ አሰፋ አስተባባሪነት እና የሚመራው የምርምር ቡድን ነው። በባሌ ዞን ደቡብ ምስራቅ ኢትዮጵያ የአዋቂዎች ሁለተኛ ዓይነት የስኪር በሽታ መከላከል ስትራቴጂዎች በሚል ርዕስ በጥናቱ ላይ መረጃ እየሰበሰብኩ ነው። የአዋቂዎች የእውቀት ግንዛቤ እና አደገኛ ባህሪ ከሁለተኛ ዓይነት የስኪር በሽታ እና መከላከል ላይ ይገመገማል። ለመጠይቁ ሶስት ክፍሎች አሉ፡- የፊት ለፊት ቃለመጠይቆች እና አካላዊ መለኪያዎች እንደ የደም ግፊት፣ የወገብ ዙሪያ፣ የዳሌ ዙሪያ፣ ክብደት እና ቁመት። የደም ግሉኮስን ለመመርመር ጣትዎን በቀስታ በመወጋት ትንሽ የደም ናሙና ከጣትዎ ጫፍ ይወሰዳል።

በዚህ ጥናት ውስጥ ያለዎት ተሳትፎ ከላይ በተጠቀሱት ጉዳዮች ላይ መረጃ ለማግኘት በጣም ጠቃሚ ይሆናል።

ስለዚህ በጥናቱ ውስጥ በተጠቀሱት ችግሮች ላይ መረጃ ለመሰብሰብ የእርስዎን ተሳትፎ ማድረግ በጣም ጠቃሚ ይሆናል ።

ስለዚህ፣ በዚህ ጥናት ውስጥ መሳተፍዎ ከላይ የተጠቀሰውን ችግር ለመፍታት መረጃ በማመንጨት ረገድ ከፍተኛ ጠቀሜታ ይኖረዋል።

ለደም መሰብሰብ ጣትዎን መወጋቱ ብቸኛ ሊሆኑ የሚችሉ አደጋዎች ከትንሽ ህመም እና የደም መፍሰስ ጋር እዚያ ኢንፌክሽን የመፍጠር እድሉ በጣም ሩቅ ነው።

መግቢያ

እንደ ተመራማሪው ስለ የምርምር ፕሮቶኮሉ እና አሰራሮቹ በሚመች እና በሚስጥር ሁኔታ ለመረዳት በሚያስችል ቋንቋ በመጠቀም በቂ መረጃ አቀርባለሁ። በዚህ ጥናት ውስጥ የምርምር ፕሮቶኮሉን እና አካሄዶቹን ለተሳታፊዎች ምቹ በሆነ ሁኔታ እገልጻለሁ. ከ18 ዓመት በላይ የሆናችሁ ጎልማሳ ቋሚ ነዋሪ እንደመሆኖ፣ በባሌ ሮቤ እና በጎባ ከተማ አስተዳደር በሚካሄደው በዚህ የምርምር ፕሮጀክት በፈቃደኝነት እንዲሳተፉ በዘፈቀደ ተመርጠዋል።

የዚህ በራሪ ወረቀት አላማ ለመሳተፍ ፈቃደኛ መሆንን በተመለከተ በመረጃ ላይ የተመሰረተ ውሳኔ እንዲያደርጉ መርዳት ነው። ከመወሰንዎ በፊት፣ በተሳትፎ ጊዜዎ በጥናቱ ውስጥ ምን እንደሚካተት በግልፅ መረዳትዎ በጣም አስፈላጊ ነው። የሚከተሉት አንቀጾች በጣም አስፈላጊ የሆኑትን ነጥቦች ያብራራሉ. በዚህ በራሪ ወረቀት ላይ የጎደለ፣ በቂ ያልሆነ ወይም ግልጽ ያልሆነ መረጃ ካለ፣ እባክዎን መርማሪውን ከመጠየቅ ወደኋላ አይበሉ። ተጨማሪ ጥያቄ ካሎት ወይም ተጨማሪ መረጃ ከፈለጉ ተስፋዬ አሰፋ ታደሰ በ +251911034995 ሊያገኙኝ ይችላሉ። እባክዎን ለመሳተፍ ይስማሙ በሁሉም ሂደቶች ሙሉ በሙሉ ካረኩ ብቻ ነው።

ጥናቱ ዓላማ

የዚህ ጥናት ዓላማ በደቡብ ምስራቅ ኢትዮጵያ በባሌ ዞን በአዋቂዎች ላይ ዓይነት 2 የስኳር በሽታን ለመከላከል የሚያስችሉ ስልቶችን ማዘጋጀት ነው።

የጥናት ጥያቄ

ሁለተኛ ዓይነት የስኳር በሽታ እንደ ተላላፊ ያልሆነ በሽታ ለመከላከል ምን መደረግ አለበት?

የስነምግባር ማረጋገጫ

የጥናት ፕሮቶኮሉ ለዩኒሳ ጤና ጥናት ዲፓርትመንት የከፍተኛ ዲግሪ ኮሚቴዎች በሰው ሳይንስ ኮሌጅ ቀርቧል። ኮሚቴዎቹ ለጥናቱ ሥነ ምግባራዊነት በጽሁፍ ፈቃድ ሰጥተዋል።

ከእርስዎ የሚጠበቁ ነገሮች

በጥናቱ ለመሳተፍ ከተስማሙ፣ ጊዜያችሁን አንድ ሰአት ለዳታ ሰብሳቢው መስጠት ይጠበቅባችኋል። በዚህ ክፍለ ጊዜ፣ ስለግል መረጃዎ እና የአኗኗር ዘይቤዎ ቃለ መጠይቅ ይደረግልዎታል። በተጨማሪም እንደ የደም ግፊት፣ ክብደት እና ቁመት ያሉ መለኪያዎች ይወሰዳሉ። ለትክክለኛ ክብደት እና ቁመት መለኪያዎች ከባድ ልብሶችን እና ጫማዎችን እንዲያነሱ እንደሚጠየቁ እባክዎ ልብ ይበሉ። እንዲሁም ስለ የሰውነት ቅርጽ እና ምስል, የአእምሮ ጭንቀት እና የምግብ ዋስትና ማጣት ያለዎትን ግንዛቤ ሊጠየቁ ይችላሉ.

በዚህ ጥናት ውስጥ እንደ ተሳታፊ የእርስዎ መብቶች

በዚህ ጥናት ውስጥ ያለዎት ተሳትፎ ሙሉ በሙሉ በፈቃደኝነት ነው። ላለመሳተፍ ከመረጡ ተሳትፎን ላለመቀበል መብት አልዎት። መጀመሪያ ላይ ለመሳተፍ ከወሰኑ በኋላ ግን ሃሳብዎን ከቀየሩ ምንም አይነት አሉታዊ ውጤት ሳያጋጥሙ ከጥናቱ ለመውጣት ነፃ ነዎት። በማንኛውም ጊዜ የተወሰነ መረጃ መስጠት ካልፈለጉ እምቢ የማለት መብት አልዎት።

በጥናት ሂደቶች ምክንያት የሚከሰት ምቾት ማጣት

ጥናቱ እና ሂደቶቹ ምንም ዓይነት የሚጠበቀው የአካል ወይም የስነ-ልቦና ምቾት ችግርን አያካትቱም. ይሁን እንጂ በጥናቱ ወቅት ምንም አይነት ምቾት ካጋጠመዎት ለተመራማሪዎቹ ወዲያውኑ ማሳወቅ አስፈላጊ ነው. ሊያጋጥሙህ የሚችሉ ችግሮችን ለመፍታት አስፈላጊውን ድጋፍ እና ምክር ለመስጠት ሙሉ በሙሉ ተዘጋጅተናል።

በዚህ ጥናት ውስጥ የተካተቱ አደጋዎች

ይህ ጥናት ለእርስዎ ወይም ለቤተሰብዎ ምንም የሚታዩ ወይም ሊገመቱ የሚችሉ አደጋዎችን አያቀርብም።

ሚስጥራዊነት

በዚህ ጥናት ወቅት የሚሰበሰቡት መረጃዎች ሁሉ እንደ ጥብቅ ሚስጥራዊ እና ደህንነቱ በተጠበቀ መልኩ ተከማችተዋል። ጥናቱን በሚዘግቡ ሳይንሳዊ መጽሔቶች ላይ ማንነትዎ አይገለጽም። ውሂቡ ደህንነቱ በተጠበቀ ቦታ ውስጥ ይቀመጣል እና ያለእርስዎ ግልጽ ፍቃድ ለማንኛውም ያልተፈቀዱ ግለሰቦች አይጋራም። ይህ ጥናት ከወጣ ከአምስት ዓመታት በኋላ መረጃው ይጠፋል።

በጥናቱ ለመሳተፍ ፈቃደኛ ነኝ።

የጥናቱም ዓላማ በሚገባ ተብራርቶልኛል ።

በጥናቱ መስማማት ማለት የሚከተሉትን እንደሚጠቀልል ተረድቻለሁ፡

ሀ. በደቡብ አፍሪካ ዩኒቨርስቲ ተማሪ መጠይቅ መሳተፍ

ለ. መጠይቁም እንዲቀዳ መስማማት

ሐ. ለተጨማሪ መጠይቅ መገኘት እናም የተቀዳውን ድምጽ አጥኚው/ጠያቂው እንዲጠቀም መፍቀድ

መ. የጥናቱንም ውጤት ማወቅ

ሰ. የጥናቱም አላማ በጤና ሳይንስ የዶክትሬት ዲግሪ ለሚሟላት መሆኑን ማወቅ

ረ. የምሰጠውም መረጃ ሚስጥራዊነቱ የተጠበቀ ይሆናል

- ተሳትፎዬም በፈቃደኝነት ነው
- በመጠይቁ በከፊልም ሆነ በሙሉ አለመሳተፍ
- በማንኛውም ሰዓት ማቋረጥ

የአጥኚው ስም፡ ----------

የተማሪ ቁጥሩ፡ ----------

ፊርማ፡ ----------

ቀን፡ ----------ከላይ የተገለፀዉን ማብራሪያ ተረድቻለዉ

በጥናቱ ለመሳተፍ መስማማቴን በፊርማ አረጋግጣለሁ .....

ነገር ግን በጥናቱ ለመሳተፍ አልስማማም .....

የቀበሌው ስም.....

የመጠይቁ መለያ ቁጥር_____

ምዕራፍ አንድ፡ ኢኮኖሚያዊና ማህበራዊ መረጃዎ

ቁጥር	ጥያቄዎች	ምላሽ	ምርመራ
101a	ቋሚ የመኖሪያ ቦታ	1. ከተማ 2. ገጠር	
102a	ጸታ	1. ወንድ 2. ሴት	
103a	እድሜ	_____ዓመት	
104a	የትዳር ሁኔታ	1. ያላገባ/ያላገባች 2. ያገባ/ያገባች 3. ፍች የፈጸመ/የፈጸመች 4. ባል/ሚስት በህይወት የሌለ	
105a	የትምህርት ደረጃ /ባለፈዉ አመት ያጠናቀቁት የትምህርት ደረጃ/	1. መጻፍና ማንበብ የማይችል/የማትችል/ 2. መጻፍና ማንበብ ብቻ የሚችል/የምትችል/ 3. አንደኛ ደረጃ (1-8) 4. ሁለተኛ ደረጃ (9-12) 5. ዲፕሎማ እና ከዚያ በላይ	
106a	እምነት	1. ኦርቶዶክስ 2. እስላም 3. ፕሮቴስታንት 4. የካቶሊክ 5. ሌላ(ይግለጹ).....	
107a	ብሔር	1. ኦሮሞ 2. አማራ 3. ትገሬ 4. ጋሞ 5. ሌላ(ይግለጹ)_____	
10a	የስራ ሁኔታ	1.ተቀጥሮ የሚሰራ (በመንግስት/በግል) 2.የቀን ሰራተኛ 3. ነጋዴ 4. የቤት እመቤት 5. ጡረተኛ 6. ሌላ(ይግለጹ)	
109a	የቤተሰብ ብዛት በቁጥር		
110a	ወርሃዊ የቤተሰብ ገቢ በአማካይ በብር	በአማካይ_____ብር	

111a	የሚኖሩበት ቤት ባለቤትነት	1 የግል 2 የኪራይ	
112a	ቀጥሎ ከሚጠቀሱት ውስጥ በቤትዎ የሚገኙት አለ የማይገኙትን የለም በማለት ይመልሱ	1. አለ 2. የለም	
A	ኤልክትሪክ/መብራት መስመር	3. አለ 4. የለም	
B	ሬዲዮ	3. አለ 4. የለም	
C	ቴሌቪዥን	1. አለ 2. የለም	
D	ፍሪጅ	1. አለ 2. የለም	
E	ስልክ /ሞባይል ወይም መደበኛ/	1. አለ 2. የለም	
F	ብስክሌት	1. አለ 2. የለም	
G	ሞተር ሳይክል	1. አለ 2. የለም	
H	መኪና	1. አለ 2. የለም	
I	ጠረጴዛ	1. አለ 2. የለም	
J	ወንበር	1. አለ 2. የለም	
K	አልጋ ከፍራሽ ጋር	1. አለ 2. የለም	
L	የኤልክትሪክ ምጣድ	3. አለ 4. የለም	
M	ቡታ ጋዝ /የኤሌክትሪክ ምግብ ማብሰያ	1. አለ 2. የለም	

P	ባንክ /ማይክሮ ሲስተምስ አካውንት	1. አለ 2. የለም	

ምዕራፍ ሁለት ፡የተሳታፊዎች በሁለተኛ ዓይነት የስኪር በሽታ ተጋላጭነትን መከላከል ላይ ያለእዉቀት እና አመለካከት

ቁጥር	ጥያቄ	ምላሽ	ምርመራ
201a	ስለ የሁለተኛ ዓይነት የስኪር በሽታ ሰምተው ያውቃሉ?	1 አዎ 2 አላውቅም	
202a	ስለ ሁለተኛ ዓይነት የስኪር በሽታ ከጤና ባለሙያ ትምህርት/መረጃ አግኝተው ያውቃሉ	1 አዎ 2 አላውቅም	
203a	የሁለተኛ ዓይነት የስኪር በሽታ ተላላፊ በሽታ ነው ?	1 አዎ 2 አላውቅም	
204a	የሁለተኛ ዓይነት የስኪር በሽታ መከላከል ይቻላል ?	1 አዎ 2 አላውቅም	
205a	የሁለተኛ ዓይነት የስኪር በሽታ መጠን ልኬት አገልግሎት የት እንደሚሰጥ ያውቃሉ?	1 አዎ 2 አላውቅም	
206a	ለጥያቄ ቁጥር 205 መልስ አዎ ከሆነ የት ነው የሚሰጠው? (ከአንድ በላይ ምላሽ መመለስ ይቻላል)	1.ጤና ኬላ 2.ጤና ጣቢያ/ክሊኒክ 3 ሆስፒታል 4.በቤት ውስጥ 5.ሌላ	
207a	የሁለተኛ ዓይነት የስኪር በሽታ በዘር የሚተላለፍ ነዉ	1 አዎ 2 አላውቅም	
208a	የሁለተኛ ዓይነት የስኪር በሽታ የእድሜ ልክ ነሽት ነዉ	1 አዎ 2 አላውቅም	
209a	የሁለተኛ ዓይነት የስኪር በሽታ ድንገት ገዳይ ነዉ	1 አዎ 2 አላውቅም	
210a	የተስተካከለ የደም ውስጥ የስኪር መጠን ስንት እንደሆነ ያውቃሉ? (መልሱ 70-100 ግራም/ዲሲ መሆኑ ይረጋገጥ)	1 አዎ 2 አላውቅም	

211a	ለ የሁለተኛ ዓይነት የስኪር በሽታ እንድንጋለጥ የሚያደርጉ ባህሪያትን ያውቃሉ	1 አዎ 2 አላውቅም	
212a	ለተራ ቁጥር 208 መልስዎ አዎ ከሆነ ምን ምን ባህሪያት የደም ግፊት በሽታ ያጋልጣሉ(ከአንድ በላይ ምላሽ መመለስ ይቻላል)	1. ሲጋራ ማጨስ 2. የአካል ብቃት እንቅስቃሴ ጉድለት 3. ከመጠን ያለፈ አልኮል መጠቀም 4. ጨማ የበዛበትን ምግብ ብዙ ጊዜ መመገብ 5. ጨው አብዝቶ መጠቀም 6. የተጨናነቀ ኑሮ	
ምዕራፍ ሦስት ከ የሁለተኛ ዓይነት የስኪር በሽታ ጋር የተያያዘ ታሪክ እና ተዛማጁ በሽታዎች			
ቁጥር	**ጥያቄ**	**ምላሽ**	**ምርመራ**
301a	የሁለተኛ ዓይነት የስኪር በሽታ ዎን በሀኪም ወይም በሌላ የጤና ባለሙያ ተለክተው ያውቃሉ?	1 አዎ 2 አላውቅም	
302a	የሁለተኛ ዓይነት የስኪር በሽታ መጨመር አለቦት ተብለው ተነግሮዎታል?	1 አዎ 2 አላውቅም	
303a	በአሁኑ ጊዜ በሀኪም ወይም በሌላ የጤና ባለሙያ የታዘዘልዎት ለደም ግፊት መጨመር መቆጣጠሪያ የሚወስዱት መድሀኒት ወይም ምክርና ህክምና አለ?	1 አዎ 2 አልጠቀምም	
304a	በቤተሰብዎ መካከል የሁለተኛ ዓይነት የስኪር በሽታ መጨመር ያለበት ሰው አለ?	1 አዎ 2 አላውቅም	
305a	የስኪር በሽታ አለብዎት ተብሎ በሀኪም ወይም በሌላ የጤና ባለሙያ ተነግሮት ያውቃል	1 አዎ 2 አላውቅም	

ምዕራፍ አራት በጤና ላይ ያለ የግንዛቤ ጥያቄዎች

ተጋላጭነትን መገንዘብ						
እባኮትን ቀጥሎ ያለውን አረፍተ ነገር ሳነብ ልብ ብለዉ ያድምጡ እና መስማማት አለመስማማቶን በነዚህ ቃላት ይግለፁ፡በጣም ዐልሥማማም፤ ዐልሥማማም፤ አስተያየት አልሰጥም፤ እስማማለሁኝ ወይም በጣም እስማማለሁኝ 1. በጣም ዐልሥማማም 2. ዐልሥማማም 3. አስተያየት አልሰጥም 4. እስማማለሁኝ 5. በጣም እስማማለሁኝ						
401a	ሁሉም ሰው ለሁለተኛ ዓይነት የስኪር በሽታ የተጋለጠ ነው?	1	2	3	4	5
402a	ሲጋራ ማጨስ ለሁለተኛ ዓይነት የስኪር በሽታ ያጋልጣል	1	2	3	4	5
403	የሰውነት እንቅስቃሴ አለማድረግ ለሁለተኛ ዓይነት የስኪር በሽታ ይዳርጋል/ያጋልጣል	1	2	3	4	5
404	አልኮል በብዛት መጠቀም ለሁለተኛ ዓይነት የስኪር በሽታ ይዳርጋል/ያጋልጣል	1	2	3	4	5
405	ጨማን አብዝቶ መመገብ ለሁለተኛ ዓይነት የስኪር በሽታ ይዳርጋል በሚለው ይስማማሉ	1	2	3	4	5
406	ጨው የበዛበት ምግብ አዘዉትሮ መመገብ ለደም ግፊት በሽታ ይዳርጋል/ያጋልጣል	1	2	3	4	5
407	የሁለተኛ ዓይነት የስኪር በሽታ ሊይዘኝ ይችላል የሚል ስጋት አለብኝ	1	2	3	4	5
408	የሁለተኛ ዓይነት የስኪር በሽታ የኢትዮጵያ የጤና ችግር ነው	1	2	3	4	5
የችግሩ ጥልቀት መገንዘብ						
እባኮትን ቀጥሎ ያለውን አረፍተ ነገር ሳነብ ልብ ብለዉ ያድምጡ እና መስማማት አለመስማማቶን በነዚህ ቃላት ይግለፁ፡በጣም ዐልሥማማም፤ ዐልሥማማም፤ አስተያየት አልሰጥም፤ እስማማለሁኝ ወይም በጣም እስማማለሁኝ 1. በጣም ዐልሥማማም 2. ዐልሥማማም 3. አስተያየት አልሰጥም 4. እስማማለሁኝ 5. በጣም እስማማለሁኝ						
409	የሁለተኛ ዓይነት የስኪር በሽታ ለድንገተኛ ሞት ይዳርጋል	1	2	3	4	5
410	ከሁለተኛ ዓይነት የስኪር በሽታ ጋር የተገናኙ ህመሞች ለህይወት አደጋና ከባድ ናቸው	1	2	3	4	5
411	የደም ግፊት በሽታ የማይድን በሽታ ነው	1	2	3	4	5
412	የሁለተኛ ዓይነት የስኪር በሽታ ከሌላ በሽታ በላይ ከባድ ነው	1	2	3	4	5
413a	የሁለተኛ ዓይነት የስኪር በሽታ እድሜያቸው በገፉ ሰዎች ላይ ይብሳል	1	2	3	4	5
414	የሁለተኛ ዓይነት የስኪር በሽታ በወፍራም ሰዎች ላይ ይብሳል	1	2	3	4	5
415	የሁለተኛ ዓይነት የስኪር በሽታ ሲጋራ በሚያጨሱ ሰዎች ላይ ይብሳል	1	2	3	4	5

416	የሁለተኛ ዓይነት የስኪር በሽታ አልኮል በብዛት የሚወስዱ ሰዎች ላይ ይብሳል	1	2	3	4	5
417	የሁለተኛ ዓይነት የስኪር በሽታ ጨዉ አብዝተዉ የሚጠቀሙ ሰዎች ላይ ይብሳል	1	2	3	4	5
418	የሁለተኛ ዓይነት የስኪር በሽታ ብዙ ጭማ አብዝተዉ በሚመገቡ ሰዎች ላይ ይብሳል	1	2	3	4	5
419	የሁለተኛ ዓይነት የስኪር በሽታ በሚጨናነቁ ሰዎች ላይ ይብሳል	1	2	3	4	5

ግፊትን መከላከያ ዘዴዎች ስለ መተግበር ጥቅም መገንዘብ

እባኮትን ቀጥሎ ያለውን አረፍተ ነገር ሳነብ ልብ ብለዉ ያድምጡ እና መስማማት አለመስማማቶን በነዚህ ቃላት ይግለፁ፡በጣም ዐልሥማማም፤ ዐልሥማማም፤ አስተያየት አልሰጥም፤ እስማማለሁኝ ወይም በጣም እስማማለሁኝ

1. በጣም ዐልሥማማም
2. ዐልሥማማም
3. አስተያየት አልሰጥም
4. እስማማለሁኝ
5. በጣም እስማማለሁኝ

420 a	ክብደት ለመቀነስ የሚደረጉ የአካል ብቃት እንቅስቃሴዎች የደም ግፊት በሽታን ለመከላከል ይረዳሉ	1	2	3	4	5
421	ሲጋራ ማጨስን ማቆም የሁለተኛ ዓይነት የስኪር በሽታ እንዳይዘን ለመከላከል ይረዳል	1	2	3	4	5
422	አልኮል አጠቃቀምን መቀነስ ለ የሁለተኛ ዓይነት የስኪር በሽታ እንዳንጋለጥ ሊታደግ ይችላል	1	2	3	4	5
423	ሶዲየም ያለበት ጨዉ በምግብ ውስጥ መውሰድን መቀነስ ለ የሁለተኛ ዓይነት የስኪር በሽታ ን እንዳንጋለጥ ይረዳናል	1	2	3	4	5
424	አትክልትና ፍራፍሬ መመገብ እና ጭማ መቀነስ ለ የሁለተኛ ዓይነት የስኪር በሽታ እንዳንጋለጥ ይረዳናል	1	2	3	4	5

የሁለተኛ ዓይነት የስኪር በሽታ ን እንዳንከላከል የሚያደርጉ ተግዳሮቶችን መገንዘብ

እባኮትን ቀጥሎ ያለውን አረፍተ ነገር ሳነብ ልብ ብለዉ ያድምጡ እና መስማማት አለመስማማቶን በነዚህ ቃላት ይግለፁ፡በጣም ዐልሥማማም፤ ዐልሥማማም፤ አስተያየት አልሰጥም፤ እስማማለሁኝ ወይም በጣም እስማማለሁኝ

1.በጣም ዐልሥማማም
2.ዐልሥማማም
3.አስተያየት አልሰጥም
4.እስማማለሁኝ
5.በጣም እስማማለሁኝ

425 a	ከሁለተኛ ዓይነት የስኪር በሽታ በላይ የሚያሳስበኝ ሌሎች ብዙ በሽታዎን አሉ	1	2	3	4	5
426	ስለ ሁለተኛ ዓይነት የስኪር በሽታ መከላከያ ዘዴዎችን በቂ እውቀት የለኝም	1	2	3	4	5
427	የጤና ተቋማት ደም ቶሎ ቶሎ ለመለካት አመቺ አልሆኑኝም	1	2	3	4	5
428 a	ጤናማ እስከሆንኩ ድረስ ስለ ምንም በሽታ ባላስብ እመርጣለሁ	1	2	3	4	5
429a	ብዙ ስራዎች ስላሉብኝ ስለ በሽታ እያሰብኩ ጊዜ አላባክንም	1	2	3	4	5
430 a	ቤተሰብም ሆነ የቅርብ ሰዎቼ የደም ግፊት በሽታ እንድከላከል አያሳስቡኝም	1	2	3	4	5
431	የሁለተኛ ዓይነት የስኪር በሽታ ለመከላከል ደህና ገንዘብ፤እዉቀት፤ጊዜ እና ቦታ ያስፈልጋል	1	2	3	4	5

ለመተግበር ምልክቶችን መገንዘብ

ቁጥር	ጥያቄ	ምላሽ	ምርመራ

432 a	ስለ ሁለተኛ ዓይነት የስኪር በሽታ መከላከያ ከሚዲያ በቂ መረጃ አግኝቻለሁ ለመተግበር እየሞከርኩ ነዉ	1 በጭራሽ 2 ጥቂት ጊዜ 3 አንዳንዴ 4 ሁልጊዜ	
433 a	የጤና ኤክስቴሽን ሰራተኞች ስለ ሁለተኛ ዓይነት የስኪር በሽታ መከላከያ በቂ እውቀት ይሰጡኛል	1 በጭራሽ 2 ጥቂት ጊዜ 3 አንዳንዴ 4 ሁልጊዜ	
434a	ከቤተሰብና ከጓደኞች የሚሰጡኝ ምክሮች የሁለተኛ ዓይነት የስኪር በሽታ ለመከላከያ ያበረታታኛል	1 በጭራሽ 2 ጥቂት ጊዜ 3 አንዳንዴ 4 ሁልጊዜ	
435a	የሁለተኛ ዓይነት የስኪር በሽታ የእድሜ ልክ በሽታ መሆኑን ሳስበው መከላከሉ ላይ እንዳተኩር ያደርገኛል	1 በጭራሽ 2 ጥቂት ጊዜ 3 አንዳንዴ 4 ሁልጊዜ	
436a	የማውቃቸውና የምቀርባቸው ሰዎች በየሁለተኛ ዓይነት የስኪር በሽታ ሲታመሙ ማየቴ በመከላከሉ እንዳተኩር ያደርገኛል	1 በጭራሽ 2 ጥቂት ጊዜ 3 አንዳንዴ 4 ሁልጊዜ	
የግል እምነት			
ቁጥር	ጥያቄ	ምላሽ	ምርመራ
437a	የሁለተኛ ዓይነት የስኪር በሽታ መከላከያ ተግባራት ማከናወን በቀላሉ ይሳካልኛል	1. በጣም ዐልሥማማም 2. ዐልሥማማም 3. አስተያየት አልሰጥም 4. እስማማለሁኝ 5. በጣም እስማማለሁኝ	

ምዕራፍ 5 የባህሪይ መመዘኛዎች

ሲጋራ አጠቃቀም			
ቁጥር	ጥያቄ	ምላሽ	ምርመራ
501a	ሲጋራ አጭሰው ያውቃሉ?	1. አዎ 2. አላውቅም	
502a	በአሁኑ ጊዜ ሲጋራ ያጨሳሉ?	1. አዎ 2. አላጨስም	
503a	ለጥያቄ 402 ምላሽዎ አዎ ከሆነ በምን ያህል ጊዜ ውስጥያጨሳሉ?	1. በየቀኑ 2. በሳምንት ከ5-6 ቀናት 3. በሳምንት ከ3-4 ቀናት 4. በሳምንት ከ1-2ቀናት	
504a	በአማካይ በቀን ምን ያህል ሲጋር	_____በቁጥር	
505a	ያጨሳሉ ለምን ያህል ጊዜ አጭሰዋል?	_____ በአመት	
አልኮል አጠቃቀም			
506a	አልኮል ነክ መጠጦችን ጠጥተው ያውቃሉ?	1አዎ 2 አላውቅም	
507a	በአሁኑ ጊዜ አልኮል ይጠጣሉ?	1አዎ 2 አልጠጣም	
508a	ለጥያቄ 707 ምላሽዎ አዎ ከሆነ በምን ያህል ጊዜ ውስጥ ነዉ አልኮል መጠጥ የሚወስዱት?	1. በየቀኑ 2. በሳምንት ከ5-6 ቀናት 3. በሳምንት ከ3-4 ቀናት 4. በሳምንት ከ1-2ቀናት	
509a	በአንድ ጊዜ ምን ያህል ጠርሙስ/ብርጭቆ ይጠጣሉ (300ሚሊ ለቢራ እና የሻይ ሲኒ ለባህላዊ መጠጥ)	_____ በቁጥር	
510a	ለምን ያህል ጊዜ ነዉ የጠጡት?	_____በአመት	
ጫት መቃም			
511a	ጫት ቅመው ያውቃሉ	1አዎ 2 አላውቅም	

512a	በአሁኑ ጊዜ ጫት ይቅማሉ	1አዎ 2 አልቅምም	
513a	ለጥያቄ 212a ምላሽዎ አዎ ከሆነ በምን ያህል ጊዜ ውስጥ ነዉ ጫት የሚቅሙት	1. በየቀኑ 2. በሳምንት ከ5-6 ቀናት 3. በሳምንት ከ3-4 ቀናት 4. በሳምንት ከ1-2ቀናት	
514a	ለምን ያህል ጊዜ ጫት ቅመዋል?	_____በአመታት	
ቡና አጠቃቀም			
515a	ቡና ይጠጣሉ	1. እጠጣለዉ 2. አልጠጣም	
516a	ለጥያቄ 415 ምላሽዎ አዎ ከሆነ በምን ያህል ጊዜ ውስጥ ነዉ የሚጠጡት	4. በየቀኑ 5. በሳምንት ከ5-6 ቀናት 6. በሳምንት ከ3-4 ቀናት 7. በሳምንት ከ1-2ቀናት	
517a	ምን ያህል ሲኒ	_____ሲኒ በቁጥር	
518a	ቡና የሚጠጡት ምን ጨምሮ ነው?	1. ጨው 2. ስካር 3. ባዶ	
አመጋገብ			
519a	በየትኛው የምግብ ሰአት ነው በአንጻሩ በብዛት የሚመገብት?	1. በቁርስ ሰዓት 2. በምሳ ሰዓት 3. በእራት ሰዓት 4. በመክሰስ ሰዓት	
520a	ፍራፍሬዎችን ይመገባሉ?	1.አዎ 2. አልመገብም	
521a	አትክልት ይመገባሉ	1. አዎ 2. አልመገብም	
522a	ለጥያቄ 220 ምላሽዎ አዎ ከሆነ በምን ያህል ጊዜ ውስጥ ነዉ ፍራፍሬዎችን የሚመገብት	1. አዎ 2. አልመገብም	
523a	ለጥያቄ 422 ምላሽዎ አዎ ከሆነ በምን ያህል ጊዜ ውስጥ ነዉ አትክልት የሚመገብት	1. በየቀኑ 2. በሳምንት ከ5-6 ቀናት 3. በሳምንት ከ3-4 ቀናት 4. 4. በሳምንት ከ1-2ቀናት	
524a	ቅቤና ጮማ የበዛበት ምግቦችን ይመገባሉ	1 አዎ 2 አልመገብም	

525a	ለጥያቄ 224 ምላሽዎ አዎ ከሆነ በምን ያህል ጊዜ ውስጥ ነዉ አትክልት የሚመገብት	1. በየቀኑ 2. በሳምንት ከ5-6 ቀናት 3. በሳምንት ከ3-4 ቀናት 4. 4. በሳምንት ከ1-2ቀናት	
የጨው አጠቃቀም			
526a	በምግብ ውስጥ ከተጨመረው በላይ ሌላ ጨው ጨምረው ያበላሉ	1 አዎ 2 አልመገብም	
የሰውነት እንቅስቃሴ ሁኔታ			
527a	በየዕለቱ የሚሰሩት ስራ ቢያንስ ለ10 ደቂቃ እንቅስቃሴ እና ጉልበት የሚጠይቅ ነው?	1 አዎ 2 አይደለም	
528a	በሳምንት ለምን ያህል ጊዜ የጉልበት ስራ ይሰራሉ?	1. በየቀኑ 2. በሳምንት ከ5-6 ቀናት 3. በሳምንት ከ3-4 ቀናት 4. በሳምንት ከ1-2ቀናት	
ከቦታ ቦታ መንቀሳቀስ			
529a	በቀን ቢያንስ ለ10 ደቂቃ ከቦታ ቦታ ይንቀሳቀሳሉ	1 አዎ 2 አልንቀሳቀስም	
530a	በአንድ ሳምንት ውስጥ ቢያንስ ለ10 ደቂቃ ያህል ምን ያህል ቀናት ይራመዳሉ?	1. በየቀኑ 2. በሳምንት ከ5-6 ቀናት 3. በሳምንት ከ3-4 ቀናት 4. በሳምንት ከ1-2ቀናት	
531a	የሚጠቀሙት ትራንስፖርት አይነት	1.በእግር 2.ቢስክሌት 3.ተሽከርካሪ	
የመዝናኛ እንቅስቃሴ			
532a	ጉልበት የሚጠይቅ የአካል ብቃት እንቅስቃሴ(ስፖርት)በማድረግ ነው ሚዝናኑት?	1 አዎ 2 አልሰራም	
533a	በሳምንት ውስጥ ምን ያህል ጊዜ የአካል ብቃት እንቅስቃሴ ያደርጋሉ ወይስይዝናናሉ(በስፖርት)	1. በየቀኑ 2. በሳምንት ከ5-6 ቀናት 3. በሳምንት ከ3-4 ቀናት 4. በሳምንት ከ1-2ቀናት	

ምዕራፍ ስድስት የሰውነት ልኬት ቁመት እና ክብደት			
ቁጥር	ጥያቄ	ምላሽ	ምርመራ
601a	ቁመት	_____ሳሜ	
602 a	ክብደት	_____ኪ.ግ	
የደም ግፊት ልኬት በ15 ደቂቃ ልዩነት			
603a	ንባብ 1	____ሲስቶሊክ __ዳያስቶሊክ	
603a	ንባብ 2	____ሲስቶሊክ __ዳያስቶሊክ	
603a	ንባብ 3	____ሲስቶሊክ __ዳያስቶሊክ	
የግሉኮስ ልኬት			
608 a			

ANNEXURE T: TURNITIN SIMILARITY REPORT

STRATEGIES FOR PREVENTION OF TYPE 2 DIABETES MELLITUS AMONG THE ADULTS OF BALE ZONE, SOUTHEAST ETHIOPIA

ORIGINALITY REPORT

20%	14%	10%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	uir.unisa.ac.za Internet Source	5%
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6	Nebiyu Dereje, Alemu Earsido, Layla Temam, Ashenafi Abebe. "Prevalence and Associated	1%

ANNEXURE U: LANGUAGE AND TECHNICAL DECLARATION

Supplier Database No: MAAA0450241
PostNet Suite #40
Private Bag X04
Menlo Park 0102
Mobile: 060 530 1165
Email: noteworthy@myconnection.co.za /
honey@myconnection.co.za

30 October 2023

TO WHOM IT MAY CONCERN

This serves to confirm that the PhD thesis entitled: *Strategies for Prevention of Type 2 Diabetes Mellitus among Adults in Bale Zone, Southeast Ethiopia.*

By: **TESFAYE ASSEFA TADESSE**, Department of Health Studies, UNISA.

has been professionally edited by one of our accredited English mother-tongue language editors. The accuracy of the content of the final work remains the authors' responsibility.

Dr MC Steyn

Scribing, Proof-reading and Editing Services