

**THE CONTRIBUTION OF COWPEAS TO DIETARY DIVERSITY AND FOOD  
ACCESS IN PERI-URBAN GABORONE, BOTSWANA**

by

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### Declaration by candidate

I declare that **THE CONTRIBUTION OF COWPEAS TO DIETARY DIVERSITY AND FOOD ACCESS IN PERI-URBAN GABORONE, BOTSWANA** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references.

O.B. OLESITSE

20/08/2010

SIGNATURE  
(MISS)

DATE

## **Dedication**

I dedicate this thesis to my mother Florence G. Moilwa, whose unfailing love has been my support, protection, pillar of strength and was my first encounter with excellence and prayer. To my siblings Lillian, Priscilla, Thabo and Maleboame, whose presence and company has always been angelic in my life.

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## **Abstract**

The study aimed at determining the contribution of cowpeas to dietary diversity and food access, among women living in a peri-urban area of Gaborone called Gabane village in Botswana. Consuming a variety of food groups ensures adequate intake of nutrients for health. Diet diversity measures diet quality, food access and an indication of nutritious diets. Cowpeas are a nutritious vegetable which can contribute to diet diversity, diet quality and food access of many poor rural households who cannot afford to purchase a wide variety of nutritious food (ARC, 2006).

Data was collected through administering a Cowpea consumption survey questionnaire which indicated that most of the households consume cowpeas which are essential to improve household food access, diet diversity and diet quality. A socio-demographic questionnaire was also used and it indicated an average number of household members of 6 people. The respondents were mainly the elderly people of 56 years and above with primary school education as the most achieved level of education. A Household Dietary Diversity Score (HDDS) questionnaire was contextualised for local foods consumed in Botswana. Focus group discussions were conducted to collect more data from women regarding their attitude, opinions and perceptions of consuming a variety of foods, cultivating and consuming cowpeas to ensure good health.

The focus group results indicated that cowpeas were consumed by most families and 100% of adults and children consume cowpeas as leaves and seeds. Cereals were predominantly consumed by 95% of households, vitamin A rich fruits and vegetables by 52.5%, meat, poultry and fish by 42.5%. Vitamin A rich foods such as vegetables, fruits and organ meat were poorly consumed except green leafy vegetables which included cowpea leaves consumed by 52.5%. Meat, poultry and fish were consumed by 42.5%. Legumes, nuts, seeds and organ meat were also poorly consumed.

Cowpeas grow well in Botswana, are Botswana's cultural food, can improve nutritional intake and livelihoods through sold surplus profit. A diet diversity score of 2.9, well below the advised cut-off point of 4 was documented, indicating poor household dietary diversity and poor diet quality and food access.

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## **Chapter 1**

### **Introduction**

The consumption of a diversified diet is important to human life. A diversified diet provides an excellent supply of adequate macro and micro-nutrients which assist in improving the nutritional status, health and ensure proper growth as well as preventing nutritional diseases.

On average, if households consume six or more different foods from several food groups per day, this will indicate that they have access to both macro and micro-nutrients. Consuming a higher number of different foods is preferable when compared to households that consume four kinds of foods from one food group, such as the cereal group (FAO, 2005).

According to Hoddinott & Yohannes (2002), household food access is an important determinant of the well-being of families, since the availability of a variety of foods in households makes a significant contribution to both macro and micro-nutrient intake. The accessibility and the availability of both exotic and indigenous foods can make a major contribution to diversity and improve the quality of household diets. Cowpeas, as an indigenous legume vegetable, can significantly contribute to food access, resulting in a diverse quality diet.

Household vegetable gardens are important since they can contribute significantly to food access, availability and a healthy diverse diet needed by families (Eberhard, 1998). According to Gobotswang, (1998), the long drought of 1980s caused the government of Botswana to annual conduct the drought assessment by an Inter-Ministerial Drought Committee (IMDC). Given that the country is susceptible to droughts the IMDC team also assesses the extent of food insecurity. The nutritional surveillance data are used in combination with other indicators such as rainfall, crop forecast and grazing conditions to decide whether a particular year warrants government intervention (Gobotswang, 1998).

This study can make a contribution to knowledge related to diet diversity, diet quality and household food access to supplement research data existing in Botswana. The relevant governmental ministries in Botswana will be able to benefit from the results and improve in areas of concern related to this study. Assistance and knowledge regarding cultivation and

consumption of cowpeas hold out hope for communities to improve their nutritional intake and food access.

## **1.1 Purpose of the study**

The aim of the study was to investigate the contribution of cowpeas to dietary diversity, diet quality and household food access. The study was conducted in Gabane village, which is a peri-urban area of Gaborone. Women from a sample of forty households were interviewed, since they are responsible for preparing meals in households (Ruel, 2006).

### **The specific objectives for the study were:**

1.1.1 to determine the socio-economic characteristics of the community such as household size, age, marital status, income sources and education of respondents.

1.1.2 to determine the diversity of the diet by recording food consumed over a given period

1.1.3 to document food access of households

1.1.4 to quantify the contribution of cowpeas to diet diversity, diet quality and food access.

## **1.2 Research design**

Both quantitative and qualitative methods were applied to achieve the aim and objectives of the study. Three questionnaires and focus group discussions were used to collect the data, namely: a socio-demographic questionnaire, a household dietary diversity score (HDDS) questionnaire and a cowpea consumption questionnaire. All these measuring instruments were piloted to preclude possible misunderstandings and other problems which could arise during the interviews.

### **1.3 Measuring tools for data collection**

#### **1.3.1. Socio-demographic questionnaire (Appendix 2)**

A socio-demographic questionnaire was developed to record the social status, marital status, education level, household size and income sources for each household.

#### **1.3.2 Household dietary diversity score questionnaire (HDDS) (Appendix 3)**

The international standardised household dietary diversity score questionnaire was developed by FAO, (2008) and was used as the data collection tool in this study to indicate the diversity and quality of food consumption. The HDDS questionnaire was contextualised to include foods consumed in Botswana and to incorporate the specific foods per food group that would be commonly consumed in the designated community. Data from the HDDS were analysed to determine an average score for food intake, which would be an indicator of diet diversity and nutritional quality. The diet diversity score also provided a proxy measurement of the accessibility and availability of foods.

#### **1.3.3 Cowpea consumption survey questionnaire (Appendix 2)**

The cowpea consumption survey questionnaire was developed to determine the level of knowledge regarding cowpeas, the consumption of cowpeas, the preparation of cowpeas for human consumption and the methods of preparing dishes from cowpeas. The questionnaire was focused on the cultivation and processing of cowpeas.

#### **1.3.4 Focus group discussions**

Three focus group discussions with women of different age categories were conducted after the interviews, with the purpose of obtaining more information on issues regarding their knowledge of, attitudes to and opinions on diet diversity and the consumption of cowpeas.

## **1.4 Ethical considerations**

Ethical considerations before sampling and during interviewing were strictly adhered to. All participants were informed on the objectives of the study and if they agreed to participate, they were asked to sign an Ethics Letter of informed Consent (Appendix 1).

## **1.5 Summary of results**

### **1.5.1 Household diet diversity**

The results indicated a poor household dietary diversity intake with a score of 2.9, well below the score of 4 which is suggested to be the cut-off point for adequate diet diversity and diet quality.

### **1.5.2 Food access**

The study data from the diet diversity questionnaire indicated poor food access because the community did not consume food from all food groups, resulting in a poor intake of both macro and micro-nutrients.

### **1.5.3 Cowpeas**

Members from all forty households that were interviewed indicated that both adults and children consumed cowpeas as a dark green leafy vegetable and as raw or dried beans. Cowpea leaves are used as an accompaniment to any of the commonly consumed starch-based products such as maize-meal porridge, sorghum porridge and rice.

## **1.6 Organisation of the dissertation**

### **Chapter 1: Introduction**

This chapter provides the background to and motivation for the study, as well as purpose, study design and the aims and objectives.

## **Chapter 2: Literature review**

Chapter two presents a literature review regarding food access, household food security and diet diversity. The review also includes published information on cowpeas as an indigenous food, and its nutritional contribution in providing essential micro-nutrients such as vitamin A and iron.

## **Chapter 3: Methods and materials**

The methodology chapter focuses on the research design, as well as sampling and development of all measuring instruments to achieve the aims and objectives. A profile of Botswana, the study area and the study population in Gabane is provided.

## **Chapter 4: Results and discussion**

Chapter four presents the results and discussion of the data obtained during the data collection. The results from the socio demographic questionnaire, the Household Dietary Diversity Score (HDDS) questionnaire, the cowpeas consumption survey and the focus group discussions are discussed in the light of published research information.

## **Chapter 5: Conclusions and Recommendations.**

Chapter five informs the reader of the conclusions reached and recommendations for further action and study.

## Chapter 2

### Literature Review

#### 2.1 Introduction

Africa and specifically Botswana have numerous food security challenges which can impact negatively on a community. It could contribute to poverty, malnutrition diseases such as kwashiorkor and marasmus, and to a lesser extent, diet-related non-communicable diseases, such as diabetes and heart-related diseases. Therefore it is essential for diet-related diseases in Africa and specifically Botswana to be addressed. This study seeks to contribute to solutions to some of these issues particularly with reference to the Millennium Development Goals (MDGs), where the first goal is to eradicate extreme hunger and poverty by 2015 (United Nations Development Program, 2000).

#### 2. 2 Food access and household food security

The aim of this study was to investigate the dietary diversity and diet quality of foods consumed by households in the peri-urban Gabane village and the contribution of cowpeas to improving food access and thus household food security. Food security and specifically food access, refer to a situation “when all members of a household, community, region or nation have physical and economic access to food at all times, either through buying, producing, obtaining or consuming sufficient, safe and nutritious food to meet their dietary needs and food preferences for a healthy and active life” (IFRC & RCS, 2006).

According to FAO, (2008), food security has three different dimensions, namely:

- **Food availability** is achieved when sufficient quantities of food are consistently available for people to consume,
- **Food access** relates to adequate resources and entitlement as well as the ability to grow, be given or work for food,
- **Food utilization** is the biological use of food by the body.

These three elements are inextricably linked in order to achieve strong food security and to maintain stability in the face of a variety of natural, economic, social and policy shocks and stresses (Faber *et al.*, 2008).

It is important to address issues of food insecurity, because, once the community is food secured, hunger, starvation, malnutrition and poverty will be minimized and the risk of an outbreak diseases will be reduced. Epidemic proportions of disease such as HIV/AIDS or malnutrition in Botswana, including Gabane, have a critical influence on people's vulnerability to the effects of food insecurity, hunger and malnutrition and ultimately death (Mugabe *et al.* 1998).

The Central Statistics Office (CSO, 2002) of Botswana has recognised that food insecurity can cause malnutrition and inflict lasting physical damage on individuals, future generations and the environment. Moepeng (2002) indicated that the agricultural Gross Domestic Products sector contributed 2.5% to the Botswana GDP, which is a small percentage of food for the nation, especially when considering the poverty rate of 36% and the HIV/AIDS prevalence of 36% in Botswana. According to Buchanan-Smith (1998), the poorest households in Botswana tend to depend on rain-fed arable crop production. Crops such as cereals are most susceptible to drought therefore food security cannot be guaranteed.

Based on Kapunda, (2006), sharing food in rural areas is more common than in urban areas since the former has a lower income than the latter. Despite the existence of food security at national level, there is a high incidence of household food insecurity, especially in rural areas where households allocate about 88% of their disposable income to food and only 12% to non-food items (Kapunda, 2006). The availability of food also depends on the household's access to different types of foods and a sufficient intake thereof.

Mugabe *et al.*, (1998), indicated that households in Botswana use different strategies to access food for their daily requirements. Financial availability ensures food security and improves the livelihoods of the community (O'Donnell, 2004). Food security can be acquired through food production or food procurement, such as purchasing food, using earned income, working on government programmes such as "cash-for-work projects", receiving cash from national drought relief programmes ("*namola-leuba*"), remittances from members of the household engaged in wage employment, and obtaining food from families and neighbours, which is still common practice in traditional communities in Botswana (Mugabe *et al.* 1998).

Achieving food security remains a challenge in many households in Botswana (Ngwenya & Mosepele, (2007). Food access is linked to dietary diversity because the availability and accessibility of sufficient food will assist one to vary the diet, thereby improving the nutritional status (FAO, 2005). Studies have shown that changing from a monotonous diet to a more varied or diversified diet contributes to an increased intake of macro-nutrients such as energy and quality protein, as well as an enhanced intake of essential micro-nutrients such as vitamin A and iron (Steyn *et al.*, 2005).

According to Kantor, (2001) food access also requires community participation in dealing with the underlying social, economic, and institutional factors within a community which can affect the quantity, quality, and affordability of food. A study in Botswana by Asefa, (2007), indicated that Botswana has survived its worst drought for some years without a single death from starvation, through policies implemented by the government to address poverty, improved agricultural production and a diversified rural economy. The National Food Strategies for Botswana provides food security to the most vulnerable segment of the population by supplementary feeding, in the form of monthly food baskets and small monthly cash vouchers to purchase food of their choice (Asefa, 2007). Some of the community members supplement their income provided by the government by participating in community projects known as “*ipelegeng*”. These involve cleaning up in areas or surroundings of the cities and villages (Asefa, 2007).

In Botswana, many peri-urban areas such as Gabane village have facilities such as supermarkets, shops, tuck shops, street vendors and other small businesses initiated by the community to support themselves (Central Statistics Office, 2002). The access and availability of income significantly contribute to household food security and possibly help to alleviate poverty (USDA, 2006).

### **2.3 Indigenous and wild food access**

Indigenous foods are foods which originate or naturally occur in a specific area or environment. Wild foods are those foods which grow in a forest or veld where they can be collected or gathered for household consumption. Indigenous foods are nutritious and provide many of the micro-nutrients essential to good health (ARC, 2006).

The accessibility and the availability of indigenous foods including cowpeas should be considered to diversity for household diet and improve the quality of a diet (Kuhnlein, 2003).



The use and consumption of wild foods can also contribute to a diversified diet as well adding other micronutrients (Kuhnlein, 2003). Using indigenous foods provides economic benefits to families. They can sell the surplus, improve diet diversity and enjoy good health through the intake of micro-nutrients. Traditional parents should also instruct the young people or new generation on the nutritional benefits of indigenous foods. In the process traditional knowledge of indigenous food will be preserved (Chan & Kuhnlein, 2003).

### **2.3.1 Indigenous foods in Botswana**

Most of the foods consumed in Botswana are indigenous foods which have been cultivated and consumed for decades. These foods include all the cereal foods grown in Botswana such as sorghum grains (*mabele*), maize grains (*mmedi*), millet (*lebelebele*), wheat or barley for bread flour, some beans (*dinawa*) including cowpea beans and green-leafy vegetables (*merogo*) such as cowpea leaves and pumpkin leaves.

Cowpeas are used as an indigenous leafy vegetable and for its seeds or beans, and it is valuable in providing nutritious food in hot and dry climates (Van den Heever, 2007). Diet diversity or the consumption of a variety of foods, including indigenous foods is crucial and must be encouraged among individuals and the community who can access them.

### **2.3.2 Wild foods in Botswana**

According to Kuhnlein & Receveur, (2003), the Bushmen or San of the Kalahari desert in Botswana have a way of life and culture that provides a varied and balanced diet, relying on hunting wild animals for meat and gathering wild fruits and vegetables. The diet is typified as “as much meat as they can get and as much vegetable/plant food as they need” (Kuhnlein & Receveur, (2003).

Meat obtained from wild animals is used for consumption, ceremonial purposes, social cohesion and other wildlife products such as handicrafts and clothing from animal skins (Perrett, 1996). However, with hunting opportunities now being restricted in Botswana and with supplies of veldt or wild foods being depleted around the settlements, the Bushmen have become increasingly dependent on government assistance and cash for survival.

## **2.4 Household dietary diversity**

### **2.4.1 Introduction**

Dietary diversity refers to the variety of foods from several food groups consumed over a period of time to provide a quality diet with all the nutrients needed by the body for growth and optimal health. The Household Dietary Diversity Score (HDDS) is defined as the number of food groups consumed over a reference period of 24 or 48 hours or even 7 days preceding the interview.

For decades researchers have been promoting the consumption of a variety of foods to ensure a sufficient intake of essential nutrients to ensure a healthy life. Household dietary diversity can be used as an indicator for assessing food access and nutritional intake of a household (Swindale & Ohri-Vachaspati, 2005). On average, if households consume six or more different foods from several food groups, this will be an indication that they have sufficient access to both macro and micro-nutrients. The dietary diversity indicator is more significant when it is measured in households that consume four or fewer types of foods which in developing countries may consist of cereals only (Swindale, 2007).

Savy *et al.*, (2006), maintains that it is more meaningful to measure the diet diversity score at the end of a food-shortage period, because it will effectively identify the more vulnerable households susceptible to household food insecurity. The HDDS is a user friendly indicator of dietary diversity because a highly varied diet raises dietary diversity score and the intake of micro-nutrients thereby leading to improved family health (Hoddinott & Yohannes, 2002).

### **2.4.2 Dietary diversity in relation to family health**

Family health is related to a daily consumption of a diet comprising a variety of foods that will provide adequate macro and micro-nutrients. The macro and micro-nutrients strengthen the body to develop a strong immune system, to fight infections, to prevent deficiency diseases and to build a healthy body.

A study conducted by Johns, (2001) shows that dietary diversity, especially the intake of fruits and vegetables, has the potential to reduce the probability of developing high-risk

diseases such as diabetes and heart-related diseases. According to Clausen *et al.*, (2005), dietary diversity is inversely associated with age-adjusted mortality rate among HIV/AIDS-infected people. HIV-infected children in Botswana tend to have a lower dietary diversity intake due to challenges such as loss of appetite poor medication administration and low socio-economic status (Mponshane *et al.*, 2008). The lack of dietary diversity and food variety in the diets of poor populations in Botswana and other developing countries reflects a high reliance on starchy staple foods, resulting in diets that often include no animal products and only a few fresh fruits and vegetables, with inadequate micro-nutrients (Clausen *et al.* 2005). Vitamins are essential in diets to prevent vitamin deficiency that can lead to malnutrition and stunting in children.

Ruel (2004) indicates that a micronutrient deficiency continues to be a serious nutritional concern in developing countries, since diets are usually cereal-based diets which provide energy, with little diversity and minimal micro-nutrients. According to Maruapula, (1998), clinic attendance rises considerably during the dry season in Botswana. Households with under-5 children would then be eligible to receive government welfare handouts such as food baskets. The monthly monitoring child welfare clinic attendance decreases during normal years because of better household food security. Drought periods contribute to poor household food security and malnourished children.

Malnutrition presents a challenge to Botswana, where about 470 malnourished children died in 2006 during a diarrhoea outbreak (NRC, 2009). Currently some children are being rehabilitated by the use of ready-to use therapeutic food, freely provided in clinics and hospitals (NRC, 2009).

Based on Maruapula, (1998), malnutrition is the most prevalent public health problem in many developing countries, including Botswana. Moderate malnutrition in children under 5 years of age was 15 percent in Botswana in 1993. This type of malnutrition occurs when the intake of vitamin A needed to improve the child's health and given to all children. Older persons are typically at nutritional risk as a result of a lifetime of poverty, deprivation and poor access to health care. These factors may make them vulnerable to diseases and other medical conditions such as osteoporosis and high blood pressure (Clausen *et al.*, 2005). Johns, (2001) has also shown that dietary diversity has positive effects on longevity and can help to reduce the rates of chronic degenerative diseases such as cardiovascular diseases, diabetes and cancer.

### **2.4.3 Food groups and the Household Diet Diversity Score (HDDS)**

Foods consumed from diverse food groups contribute to an adequate intake of both macro-nutrients and micro-nutrients which are essential for proper body growth and other body processes. FAO, (2008), the HDDS method is defined as a measurement of foods consumed from a number of food groups, and of the types of food within a food group. Despite many studies using the HDDS, there is still no agreement regarding the number of food groups that will provide sufficient clarity on diet quality. However, several numbers of food groups were used in different studies and FAO, (2008) for 16 food groups, 14 food groups, 12 food groups and 9 food groups and 5 food groups (Clausen *et al.*, 2005).

The expanded fourteen food group questionnaire is of particular importance since it identifies specific foods of significance such as vitamin A and iron (Swindale, 2007). In this study the data from the fourteen food groups were collapsed into a nine-food group list, to make the findings of this study comparable to other studies in South Africa. A study by Steyn *et al.*, (2005) in Limpopo, showed that a cut-off point of 4 for a diet diversity score is closely related to diet quality. A score below 4 indicates that the food intake is of a diet quality that cannot sustain health. The nine-food group includes: cereals, roots and tubers, vitamin A-rich fruits and vegetables, other fruits, other vegetables, legumes, nuts and seeds, meat, poultry and fish, dairy products, eggs and oils and fats. (Appendix 4). The HDDS questionnaire was contextualised to include local foods consumed in Botswana (Appendix 5).

### **2.4.4 Diet diversity Scores**

According to Swindale and Bilinsky (2006), the fourteen food-group questionnaire can be used successfully to determine a household dietary diversity score since it classifies foods according to the main nutrients they contain, such as vitamin A-rich foods and iron-rich foods. These fourteen food groups are used as a measuring tool to determine dietary diversity, since it provides a wider range of food choices with a good supply of macro and micro-nutrients needed by the body (FAO, 2008).

Dietary diversity is an indicator of the supply of adequate micronutrients to assist in calculating the dietary diversity score and cut-off point (Kennedy *et al.*, 2007). According to the FAO, (2008) the fourteen food groups include cereals, white tubers, vitamin A-rich

vegetables and tubers, vitamin A-rich fruits, other fruits, dark green leafy vegetables, other vegetables, organ meat (iron rich), flesh meat, eggs, fish, legumes, nuts and seeds, milk and milk products and oils and fats. A cut-off point is a measurement which helps to determine the household dietary diversity score. According to FAO, (2008), cut-off points for dietary diversity scores are determined by calculating the average value of food groups consumed per households as documented in the HDDS measurement. Cut-off points may differ based on the number of food groups used in a study.

Steyn *et al.*, (2005) found that a cut-off point below 4 indicates a diet of poor dietary quality. A high food variety score is associated with urbanization, higher education and a higher number of meals, since urban households have better access to income with a higher access to a variety of foods (Clausen *et al.*, 2005). There appears to be no consensus as yet on HDDS scores and cut-off points, because food groups vary from one country to the other (Steyn *et al.*, 2005). Diet quality and the consumption of a variety of foods have a greater influence on dietary diversity scores when compared to monotonous diets of poor quality, often prevalent in developing countries.

According to Steyn *et al.*, (2005), for a household to be considered as food secure, an HDDS score above 4 is required for adequate nutrition. A score below it would indicate a diet of poor quality and household insecurity. According to Faber *et al.*, (2008) in a study conducted in South Africa, the average household dietary diversity score for adults was 4.6 which was slightly higher than the average dietary diversity score of 3.6 observed for 1-8 year-old South African children conducted by Steyn *et al.*, (2005). Clausen *et al.* (2005), in their study among the elderly in Botswana, documented an HDDS score of 3.5, indicating that the elderly are more vulnerable to food insecurity.

#### **2.4.5 Diet diversity and Diet Quality**

Diet quality refers to the availability of nutrients in the diet to provide the body with all the nutrients required to build the body and strengthen its immune system (FAO, 2008). Consumption of a variety of foods is a significant requirement of adequate nutritional intake and household food access.

Studies conducted in Mali, Kenya, Ghana, Malawi, Guatemala and Niger confirmed that dietary diversity scores are linked to nutrient adequacy (Arimond & Ruel, 2004). Similarly, in

Kenya increased dietary diversity improved nutrient adequacy among children aged 4-8 years. Steyn *et al.*, (2005) found that the nutritional status of children in Limpopo improved due to increased dietary diversity, as did Clausen *et al.*, (2006) in a study of elderly people in Botswana.

According to Swindale and Bilinsky, (2006), the number of daily eating occasions is a good indicator for gauging the adequacy of household micro nutrients such as iron, vitamin A and macro-nutrients, such as carbohydrates and protein. Dietary diversity enhances the supply of all macronutrients and micronutrients, the recommended values of which vary according to gender, body needs, type of work and the age group one belongs to (Winichagoon, 2008). The higher the number of meals consumed, the greater the probability of achieving a diet with sufficient nutrients needed for healthy living.

#### **2.4.6 Dietary diversity and micro-nutrients: vitamins and trace elements**

Micro-nutrients refer to the nutrients which the body needs in small quantities for growth, development and maintenance. These include vitamin A, iron and folate, which are often deficient in developing countries (FAO, 2008). According to Clausen *et al.*, (2006), micro-nutrient malnutrition remains one of the largest nutritional problems worldwide, affecting people in both developed and developing countries.

Micro-nutrients are essential in the diet of young children to prevent nutrient deficiency diseases and malnutrition (IYCFC, 2006). The nutrients contained in the diet of young children are often inadequate to meet their nutritional needs, resulting in micro-nutrient deficiencies. Increasing the intake of a variety of food groups can prevent this, especially if the child's diet contains meat, poultry, fish and vegetables (FAO/ILSI, 1997). Studies support the importance of increasing diet diversity and food fortification to raise micronutrient levels in children's diets (NRC, 2008).

##### **2.4.6.1 Vitamin A**

Macro-nutrients such as proteins and carbohydrates, and micro-nutrients such as iron and vitamin A-rich foods have to be consumed daily in adequate amounts to improve the immune system and maintain a healthy body. It is advisable to eat a variety of food containing the fat soluble vitamin A daily to sustain the body's vitamin A supply, because vitamin A mainly promotes good vision, improves child development and growth, helps to strengthen the

immune system, assist in the regulation of cell development, supports bone growth and teeth and promotes healthy skin (Whitney, 2002). Not surprisingly then that vitamin A is described as a “combatant vitamin”.

Globally, children with a mild vitamin A deficiency tend to be at increased risk of respiratory diseases, diarrhoea and increased mortality rates from infectious diseases. A study conducted in South Africa shows that 50% of the diets of young children are deficient in vitamins A, C, and B3 (Steyn *et al.* 2005). If vitamin A supplements are given to children with diarrhoea, the survival rate is 30 percent and similarly, a 50 percent survival rate for those with measles (Gaoswediwe, 2009).

About 500,000 children globally lose their sight as a result of vitamin A deficiency and the majority of these children die within one year (NRC, 2009). In Botswana, about 4 percent of malnutrition among children less than five years of age is the result of vitamin A deficiency (Gaoswediwe, 2009). A micro-nutrient study in Botswana revealed that 35% of children have a marginal vitamin A status, with 38% being diagnosed with iron-deficiency anaemia (Ministry of Health, 1996). To address the issues of vitamin A deficiency in Botswana, particularly among infants and young children under 5 years of age, the government have put in place a programme including vitamin A campaigns in which children are given vitamin A supplements free of charge at clinics (Gaoswediwe, 2009). Cowpeas, rich in vitamin A and commonly cultivated and consumed in Botswana, can make a significant contribution to improving the diet quality in food insecure households.

- **Food sources of vitamin A**

Animal sources of vitamin A include liver, kidneys, eggs and fish whereas plant sources of vitamin A include green and yellow fruits and yellow vegetables rich in beta-carotene. Vitamin A is also present in some oils and fats such as fish oil which contains anti-oxidants and beta carotene, as well. Vitamin A is a fat soluble vitamin which can easily be absorbed through oil consumption.

#### **2.4.6.2. Iron**

Iron is an essential micro-nutrient, vital for many cell activities and if deficient, can lead to anaemia (Whitney, 2002). Iron is required for the formation of red blood cells and haemoglobin in the body to transport oxygen throughout the body for the production

enzymes, collagen, hormones and neurotransmitters as well as for the repair of body tissue (Whitney, 2002). A lack of iron in the body can result in anaemia which is evidenced by pale skin, pale palms, low blood pressure and dizziness, all of which can be dangerous to health and may even lead to death.

A study conducted in 1993 in Botswana indicated that 38% of preschool children had anaemia in Botswana. Attention to the iron content and planning of a child's daily food intake is critical (NRC, 2008).

Iron present in cowpeas can make a difference to the nutrient intake of the people of Botswana when compared that of foods low or without iron content such as cabbage, cucumber, eggplant, lettuce, onion and lentils (ARC, 2006). In comparison with cabbage, cowpeas contain 3.9 mg iron versus 0.7mg iron in cabbage (ARC, 2006). The use of cowpeas can therefore be of significant benefit to increase the intake of iron to many households.

- **Iron absorption and Inhibitors**

The iron absorption can be enhanced by consuming foods rich in vitamin C such as oranges, mangoes, and other vitamin C rich vegetables. Meat can also enhance the bioavailability of iron in meals containing dark green leafy vegetables (Nestel, & Nalubola, 2003). The absorption of iron can be inhibited by food containing high amounts of phytic acid and polyphenols (Nestel & Nalubola, 2003).

#### **2.4.7 Dietary diversity and macro-nutrients**

Macro-nutrients such as carbohydrates, proteins, and fats and oils are referred to as those nutrients which the body requires in large amounts for the formation of body tissues and to regulate all body processes (NRC, 2008).

##### **2.4.7.1 Carbohydrates**

A balanced diet should provide least 55% of carbohydrates (NRC, 2008). The major sources of energy are carbohydrates which are essential to provide sufficient energy and to help prevent malnutrition. An excess carbohydrate is usually converted to glycogen and fat and



stored in the body for further utilization (Whitney, 2002). In developing countries, most of the carbohydrates come from starch-based foods (Ruel, 2006).

Consuming carbohydrates is essential for physical activity, for maintenance of body temperature and for internal physiological processes (Arimond & Ruel, 2004). Good sources of carbohydrates are mainly foods of plant origin, such as cereals, legumes, rice, bread, sorghum, millet, maize, oats, beans, peas, potatoes, pumpkins, bananas, oranges and mangoes (FAO, 2008). Most animal foods, such as liver and milk, contain minimal amounts of carbohydrates (NRC, 2008).

#### **2.4.7.2 Protein**

Proteins are the major component of most body cells and contribute to formation of skin, muscles, blood and blood clotting factors, hair, enzymes, vision, cell growth and antibodies (Wardlaw, 1996). Dietary diversity relates primarily to the intake of protein from animal sources, which are considered to be of high quality, compared to plant protein which lacks some of the essential amino acids (Swindale and Bilinsky, 2006).

Protein intake is one of the key elements in preventing protein energy malnutrition (PEM) which is caused by a lack of both proteins and carbohydrates. Animal food sources contain all of the eight essential amino acids whereas plant protein sources do not (Wardlaw, 1996). High-quality animal protein is sourced from foods such as meat and meat products, chicken, fish, eggs, milk and dairy products (Wardlaw, 1996). Plant protein sources are beans, cowpea beans, peas, peanuts and soya which all contribute to the health of the body (Wardlaw, 1996).

#### **2.4.7.3 Fats and oils**

A balanced diet indicates that fats should contribute at most 20% of energy intake per day, and should be consumed in small amounts since they are a concentrated source of energy (NRC, 2008). One gram of fat provides nine kilocalories compared to one gram of carbohydrates with four kilocalories (NRC, 2008). Sources of fats and oils can be of plant origin such as sunflower oil, peanut oil and olive oil and those of animal origin fish oil, lard, dripping and fats in meat (Whitney, 2002).

Carbohydrates, fats and oils and protein work interchangeably to provide the body with energy and maintain other body processes.

## **2.5 Dietary diversity and food access**

According to Hoddinott & Yohannes, (2002), household food access is an important measure of well-being for families since the availability of varied diets in households makes a significant contribution to diet quality. Dietary diversity is a proxy measure for household food access which also helps to improve nutritional intake (Hoddinott & Yohannes, 2002).

Food access relates to the underlying social, economic and institutional factors within a community that affect the quantity, quality and affordability of food (Kantor, 2001). Food security and nutrition security are the results of healthy diets. A quality diet with a variety of foods is a basic daily need for people to be able to survive and live healthily. According to Belbase, (1998), the availability and utilization of diversified diets and access to foods such as dark green leafy vegetables, including cowpeas, mangoes and nutritious wild fruits, are the solution to proper nutrition in poor households or those with a poor intake of micro-nutrients due to religious or cultural believes.

The accessibility and the availability of foods such as indigenous food as well as cowpeas can diversify and improve the quality of household diets and ultimately ensure household food security. The use of cowpeas can add diversity, improve food quality and significantly contribute to food access.

## **2.6 Dietary diversity and household Income**

Household income refers to any amount of money available to the household for expenses, such as purchasing food. Consumption of food rich in macro- and micro-nutrients is primarily influenced by the household income, which determines which food varieties that can be purchased. With an increased income and more money for food, the quantity and quality of the household food intake will be enhanced.

According to Arimond & Ruel, (2004), families with higher incomes tend to have diverse diets and improved access to health care. Other studies have shown that households with a diet

diversity score below the critical value of 4, had fewer assets, experienced more food shortages and had a higher household food insecurity score (Faber *et al.*, 2009). Faber *et al.*, (2009) also indicates that household income makes a significant contribution to household dietary diversity and consequent improved caloric intake.

The availability of money plays an important role in securing and maintaining adequate and quality foods within the household (Winichagoon, 2008). According to Clausen *et al.*, (2005), high income or financial stability contributes to a high intake of both macro-nutrient and micro-nutrients, since these households can purchase a variety of food. In the study among the elderly in Botswana, a highly varied diet can be associated with urbanization and employment (Clausen *et al.*, 2005).

Rural dwellers are likely to have no paid employment, as there are fewer highly skilled jobs and less work competition among workers (USDA, 2006). Higher paid employment opportunities are also strongly associated with education. It has been observed that low-income households, particularly in rural areas and poor central cities, have less access to reasonably priced, high-quality food than other households due to lack of supermarkets in the area. There are many other foods available such as expensive canned foods, highly refined foods and preserved foods, which should be consumed only in moderate amounts (Kantor, 2001).

Some families that own cattle can sell livestock to generate household income. One of the minority groups in Botswana called the Basarwa, also known as Bushmen, who used to live by hunting and gathering, has become increasingly dependent on the government's assistance including cash for their survival. The hunting restrictions in Botswana have had a negative impact on their income (Perrett, 1996). Low household income limits the ability of households to purchase fruit and vegetables (Amissah, 2000). To address limited household food access, diseases and nutritional challenges to family health, a household must have sufficient income to access food that is affordable, available and nutritious.

## **2.7 Indigenous foods and nutritional contribution to dietary diversity**

According to Kuhnlein, (2003), indigenous foods are good sources of micro-nutrients which add value to household dietary diversity. The wealth of micro-nutrients contained in

indigenous food can improve the nutritional intake and status of communities if appropriately utilized (Kuhnlein, 2003). Indigenous food also can improve the diet diversity of many families if utilized well, especially by people dwelling in rural areas who can easily access such foods from the forest, veld and within their surroundings that have favourable conditions to grow these crops.

Although indigenous people are often the most marginalised and disadvantaged subgroups of people, their traditional knowledge and diverse food resources can add dietary diversity to their diets. This addition will improve their micronutrient intake thus preventing malnutrition and deficiencies (Kuhnlein & Receveur, 2003).

## **2.8 Factors that Influence Food Choices**

The availability of sufficient food can help households to achieve food access, food security, food quality and adequate intake of nutrients. People's food choices can be influenced by lifestyle, habits and attitudes thus making the nutritional intake poor (Bigler-Doughten & Jenkins, 1987).

- **Unemployment**

Many households require money to purchase nutritious food which can help sustain their health as well as being free from hunger and poverty. If no one is earning any income in the family, there will be no or less food to consume resulting in nutrient deficiencies (Central Statistics Office, 2003).

- **Cultural practices**

There are certain cultural practices which can be a hindrance for households to achieve adequate intake of nutrients, for example, some cultures do not allow pregnant women to consume eggs and offal since they believe that the child will be born with certain abnormalities (Asiamah, 2004). There are also certain cuts of meat men and women are not allowed to consume as it is believed that they can get sick.

- **Religious believes**

Some religious believes do not allow households to consume certain foods although they are nutritious. For example, some Christians believe that pork is an unclean animal and that it should not be consumed it, others do not consumed beef and as a result they can become anaemic.

- **Individual's behaviour**

Some people may not have an adequate intake of nutrients due to their negative attitude and behaviour towards food intake (Clausen *et al.*, 2005).

## **2.9 Cowpeas and its contribution to diet diversity and food access**

### **2.9.1 Introduction**

Cowpeas are legumes that can make a major nutritional contribution to the promotion of diet diversity and diet quality. Nutritionally, cowpeas are important food to include in household diet, given the legume rich in many nutrients such as vitamin A, calcium, iron and plant protein (Lost Crops of Africa, 2006). Cowpeas are able to contribute inexpensive protein, vitamin A and other micro-nutrients to many predominantly starch-based diets, thus providing diet diversity and improving nutritional status (Lost Crops of Africa, 2006).

According to Barrette (1990), cowpeas (*Vigna unguiculata* L.) are a legume species of green- leafy vegetables with edible seeds. Cowpeas are also known as southern peas, black eyed peas, crowder peas, lubia, coupe or frijole (Davis *et al.* 2003). Literature has shown that cowpeas have their origin in Africa and are widely grown in most of the African countries including Botswana, as well as other non-African countries such as Latin America, Southern Asia and the Southern United States (Lost Crops of Africa, 2006). Cowpeas are also grown widely in savannah regions of the tropics and sub-tropics, especially in western and central African countries. Cowpeas are known as black-eyed peas in India, Brazil, the Caribbean and the United States as well as Senegal, Sudan, Somalia, southern of Zimbabwe and Botswana (Lost Crops of Africa, 2006).

Cowpeas are considered to be one of Africa's most vital indigenous vegetables and the legume has the ability to boost the nutrition of the greatest number of needy (Lost Crops of Africa, 2006). About 200 million people around the world consume cowpeas beans daily, because of its availability and nutritional quality since it is a legume rich in plant protein, digestible carbohydrate, riboflavin, niacin, thiamine and fibre. The rising awareness of the nutritional quality of cowpeas and other legumes in both infant and adult diets can enhance access and availability of cowpeas that are combined with other foods (CRSP, 2006). Cowpeas provide quality protein and other essential nutrients to complement the unbalanced diets of poorer households with no or limited food choices to consume (Lost Crops of Africa, 2006).

Cowpeas are considered as one of the plant protein sources that could help to feed Africa's millions of malnourished people. For all these reasons, this legume has a promising future in enhancing diet diversity and effectively balancing diets (Lost Crops of Africa, 2006).

### **2.9.2 Cowpeas and food access**

Household food access is a key element to achieving good nutrition needed for optimal growth and health and access should be an integral part of adequate maternal and childcare, basic health services and a healthy environment for adequate living. The utilization of cowpeas for household consumption can contribute to food access, nutrition security and diet diversity, since cowpeas provide protein, vitamin A and iron which can improve the diet quality of many households (Aphane, *et al.* 2002).

### **2.9.3 Human consumption of cowpeas**

Cowpeas are a vital food because they contain some of the essential nutrients to ensure growth, a strengthened immune system and other body functions. In Zimbabwe both the leaves and seeds are consumed in equal quantities, whilst in the more humid parts of East Africa, cowpeas are grown mainly for their leaves (Barrett, 1990). In West Africa, Ghana and Nigeria cowpea seeds are fried or cooked in palm oil then combined with fried ripe plantain, a dish commonly known as "red red" (Asiamah, 2004).

One of the advantages of growing cowpeas for consumption is that they can be consumed at different stages in its development, as fresh green leaves, dried leaves, green pods, green beans or dried beans. In Africa, including Botswana, the most popular and common way of

preparing cowpeas is to boil the dry cowpea beans, immature seed pods or cowpea leaves which will then be consumed as a vegetable (Lost Crops of Africa, 2006).

Traditionally cowpea beans in West African countries are prepared and incorporated into various dishes. In West Africa, most cowpeas are cooked with vegetables, spices and palm oil to produce a thick soup that accompanies basic staple foods, notably cassava, yam or plantain. In some of the African dishes, seeds are decorticated, ground into a flour, then mixed with chopped vegetables (mainly onions) and spices and pressed into cakes that are either deep-fried (*akara balls*) or steamed (*moin-moin*). In Nigeria, some of the cowpea seeds are ground or crushed to be used in buns, fritters and sauces for different meals (Luse, 2007). Boiled and pounded cowpeas can be served with puddings, porridges and soups for more palatable meals. Cowpea seeds or beans can also be boiled with maize corn as samp, eaten as porridge, or even boiled in their pods then peeled. Alternatively, they may be steamed or fried to make a paste or sauce that is often eaten with *ugali* or other thick starchy staple foods of Africa. Cowpeas are commonly available and prepared and preserved as canned foods for future use in Zimbabwe (Lost Crops of Africa, 2006).

#### **2.9.4 Nutritional Quality of Cowpeas**

The cowpea is a legume species that can make a major nutritional contribution to diet diversity and diet quality. Nutritionally, cowpeas are an important food to include in the diet, given that they are able to provide what the body needs for healthy living. This is particularly true for vitamin A, calcium, iron and plant protein that are all vital to ensure health (Lost Crops of Africa, 2006).

Cowpeas as a green leafy vegetable are generally good sources of calcium, magnesium, carotene, iron, some vitamin C and vitamin A in high amounts. Cowpeas, both as seeds and as a green leafy vegetable, contain vitamin A, about 25% protein, and minimal amounts of fat. The essential amino acids in cowpeas complement those found in cereal grains (ARC, 2007). The bean is made up of nearly two-thirds complex carbohydrate, some oil (up to as much as two percent), and various minerals.

Table 2.1 illustrates the nutritional value of 100g of edible cowpea leaves compared to the same amount of cabbage and pumpkin leaves. In the table, vitamin A, iron, protein and folic acid are printed in italics to indicate the major nutrients contributed by cowpeas. The table shows that cowpeas are good sources of vitamin A, iron and folic acid, all vital to

improve the health of the community. The intake of these nutrients can however present a challenge to households with poor food security thus the cultivation and utilization of cowpeas can significantly help to improve household food and nutrition security.

**Table 2.1 Nutrient composition per 100g of edible portion cowpeas compared to cabbage and pumpkin.**

Nutrients	Cowpea leaves	Cabbage	Pumpkin
<b>Iron (mg)</b>	<b>3.9</b>	<b>0.7</b>	<b>15.9</b>
<b>Protein (g)</b>	<b>4.1</b>	<b>1.7</b>	<b>4.2</b>
Moisture (%)	87.6	91.4	87.3
Energy in Calories	-	26	-
Carbohydrate (g)	6.8	6.0	5.0
Vitamin C (mg)	-	54	-
Calcium (mg)	221.1	47	382.9
Phosphorus (mg)	80.1	40	119.2
<b>Vitamin A (mg)</b>	<b>2 249.35</b>	<b>100</b>	<b>1 694.55</b>
Thiamine	0.05	0.04	0.12
Riboflavin	-	01	-
<b>Folic Acid (mg/100g)</b>	<b>107</b>	<b>-</b>	<b>-</b>

**(Agricultural Research Council, 2006)**

Promoting consumption of cowpeas produced in household food gardens and small fields can contribute to the household diet quality especially to households that cannot afford to purchase nutritious foods.



## **2.9.5 Cultivation, harvesting and storing of cowpeas**

### **2.9.5.1 Cultivation of cowpeas**

Depending on the different cultivars of cowpeas, some plant types can be often described as erect, semi-erect, prostrate (trailing) or climbing (Akinci *et al.*, 2007). Currently Nigeria is the world's largest cowpea producer and accounts for about 22% of the total production, followed by Brazil, which produces around 10% of global production (ARC, 2007).

Cowpeas are a multi-purpose type of legume crop that can be cultivated and harvested within 30 days or more, depending on the type of seed planted and conditions under which the crop was grown. The leaves are harvested gradually to be cooked as an accompaniment to starch based dishes such as sorghum, millet and maize-meal stiff porridge (Barrett, 1990). In many African communities the harvested cowpeas are used not only for household consumption, but also for selling surplus to generate income (ARC, 2007).

Cowpeas are known as a warm-season annual herbaceous legume plant which thrives well in extremely dry areas (Nkouannessi, 2005). Botswana is a semi-arid country with unreliable rainfall, usually heavy in summer and low in winter, with an average rainfall of approximately 43.8mm subject to changes since fluctuation during rainy seasons are often unreliable and unpredictable (Countries of the World, 2001). One of the advantages of cowpeas is that some cultivars mature with as little as 30mm of rain. In Botswana, cowpeas can be cultivated with success, since most of the world's cowpea production occurs in dry regions where droughts are prevalent (Nkouannessi, 2005).

Cowpeas are often intercropped with sorghum, millet or maize, in order to strengthen root growth and to ensure that the leaf growth is supported as the plant climbs through the stems of sorghum, millet and maize (Lost Crops of Africa, 2006). As one of the best land care food crops, the cowpea plant has deep roots that help to stabilise the soil, as well as dense foliage that shades and covers the soil surface thereby conserving moisture (Lost Crops of Africa, 2006).

The plate 2.1 below shows the growth of cowpeas intercropped with other plants in a large field (*masimo*).



**Plate 2.1 Growing cowpeas intercropped with other plants.**

The plate 2.2 below shows cowpeas growing in a field.





**Plate 2.2 Cowpeas growing in a field.**

#### **2.9.5.2 Harvesting and storing of cowpeas for human consumption**

According to Lost Crops of Africa (2006), depending on the cultivar and climate, cowpeas may take as few as 60 days or as many as 240 days or 2-3 months before it is ready to harvest. When harvesting cowpeas leaves, pods with seeds are separated from the stem and branches. Harvesting and pruning are done by hand and the produce is stored in safe-to-store durable containers such as kerosene tins, jute bags, plastic bags, bottles, calabashes, clay pots, racks-atop-fire place, metal drums and/or any other containers that will sustain the freshness or shelf life of cowpeas (Asiamah, 2004). Harvesting can sometimes however be complicated by prolonged and uneven ripening of cowpea seeds and therefore it is advisable to harvest the pods as soon as they mature to avoid the seeds from

scattering. Furthermore, if seeds get damp from rain or excessive humidity before being harvested, they will start sprouting inside the pods while still on the plants.

The plate 2.3 below shows a picture of a woman harvesting cowpeas in a field.



**Plate 2.3 Woman harvesting cowpeas in a field.**

Plate 2.4 below illustrates dry cowpea beans.





**Plate 2.4 Dry cowpea beans.**

#### **2.9.5.3 Other uses for cowpeas**

In Botswana and other African countries, cowpeas are cultivated as a source of seeds, forage and leaf vegetable produce for livestock fodder (Barrett, 1990). In many other parts of the world cowpea leaves are used as high-quality protein hay fodder for livestock feed (Nkouannessi, 2005). Cowpeas, a nitrogen-fixing crop, can provide high protein pasturage, as well as nutritious hay and silage for animals (ARC, 2007).

According to Nkouannessi (2005), the Hausa and Yoruba tribes from Nigeria use cowpeas for sacred purposes in rituals and traditional sacrifices. The same tribes use cowpea seeds as a traditional medicine, for example two cowpea seeds are ground and then mixed with soil or oil to give to a child with gastro-intestinal problems. Cowpeas can also be roasted, ground, and served as a coffee substitute (Nkouannessi, 2005).

## **2.10 Summary of literature review**

The literature review in this chapter focused mainly on household food access, dietary diversity, cowpeas and indigenous foods. It is important to consider food access, dietary diversity and the role of cowpeas because this legume can contribute to stable household food security with improved nutritional intake.

### **2.10.1 Food access**

Food access means that people have an adequate intake of food for daily living. The cultivation, availability and accessibility of food from all food groups in a community are greatly influenced by factors such as ploughing seasons determined by the weather, harvesting and rainfall. A household with a poor food intake is more vulnerable to contracting deficiency diseases and suffer from malnutrition. It is therefore important to cultivate and utilize available food such as cowpeas which can also supply micro-nutrients and protein.

The availability of money to purchase nutritious food is a key factor in many households. Cultural and religious beliefs may affect the intake of nutritious food. Drought may prevent food crops from growing which may result in poor food access.

### **2.10.2 Diet diversity**

A high dietary diversity score is a good indicator of household food access and household food security. For a household to be nutritionally secure, a variety of foods must be consumed. This may be influenced by factors such as a lack of money to purchase nutritious food, as well as unemployment, poor soil for food cultivation, limited rainfall and a lack of shops and supermarkets to purchase food. Indigenous foods can significantly add diversity to household food and nutritional intake.

### **2.10.3 Cowpeas**

Cowpeas are a nutritious vegetable which can contribute to household food access, diet diversity and diet quality. Cowpeas can easily be cultivated in the semi-arid conditions and poor soil of Botswana. The micro-nutrients contained in cowpeas such as vitamin A and iron from cowpea leaves, and protein from cowpea beans, can significantly contribute to improved nutrition in many households, especially those of poor socio-economic status that

cannot afford to purchase nutritious food. All households must be encouraged to have household gardens and small fields to ensure sustainable food security.

## Chapter 3

### Research Methodology

#### 3. Introduction

This chapter includes a brief description of the research study area and the sample population in Gabane village, Botswana. The research designs, as well as data collection techniques are presented. Ethical considerations are discussed and finally, constraints affecting the research.

#### 3.1 Research study area

Gabane is a village situated in the peri-urban areas of Gaborone, the capital city of Botswana. The village is surrounded by other small villages that make up the *Kweneng* district. Gabane village is under the leadership of chief Sello Pule.

The people residing in Gabane village belong to the *Balete tribe*, which moved from South Africa during the Bantu wars. Due to the accessibility and proximity of Gabane village to Gaborone, the village accommodates many people from other tribes and nationalities who find it convenient to reside in Gabane than in Gaborone.

Gabane residents find the village to be convenient to reside at while working Gaborone. Utilities such as electricity, water and housing are more affordable in Gabane village than in Gaborone city where costs of living are high. Plate 3.2 below partially indicates the map of Botswana with Gabane village within the South Eastern Region.

##### 3.1.1 Profile of Botswana

Botswana is a landlocked country that borders on South Africa, Namibia and Zimbabwe. The country size of Botswana is 582,000 square kilometres. The economy of the country is based mainly on mineral resources, such as diamonds. Agriculture contributes \$11.9 billion or 1.7% to the GDP (Republic of Botswana, 2008). The capital city of Botswana is Gaborone



with a population of 1, 76 million, with 79% being Batswana and the rest minority groups, including people from foreign countries.

### **3.1.2 Profile of peri-urban Gabane village**

The study was conducted in the peri-urban Gabane village within the South Eastern region of Botswana. Gabane is classified according to the National Settlement Policy (1998) as a secondary centre, and is administered by the Kweneng District Council (Report of Survey, 2003). Gabane is a peri-urban area, 15km southwest of the capital city Gaborone. The village of Gabane covers an area size of 202, 8 square meters (Report of Survey, 2003). In 2001, Gabane had a total of 10399 residents (4707 men and 5695 women) (Central Statistics Office, 2002). The majority of Batswana residing in Gabane village belong to the *Balete* tribe. A small proportion of the population belong to different tribes in Botswana such as *Bangwato*, *Bakgatla*, *Bakalaka*, *Bakena*, and others including foreigners mainly from Zimbabwe.

The village is headed by a Chief who is assisted by village elders. The Chief reports to the House of Chiefs, which is a legislative branch forming part of the Government in Botswana (Republic of Botswana, 2008). The map below as plate 3.1 indicates Botswana and its neighbouring countries such as South Africa, Namibia, Angola Zambia and Zimbabwe.



**Plate 3.1 Map of Botswana.**

The map below as plate 3.2 gives a clear indication of where Gabane village is situated in Botswana, as part of the *Kweneng* district.

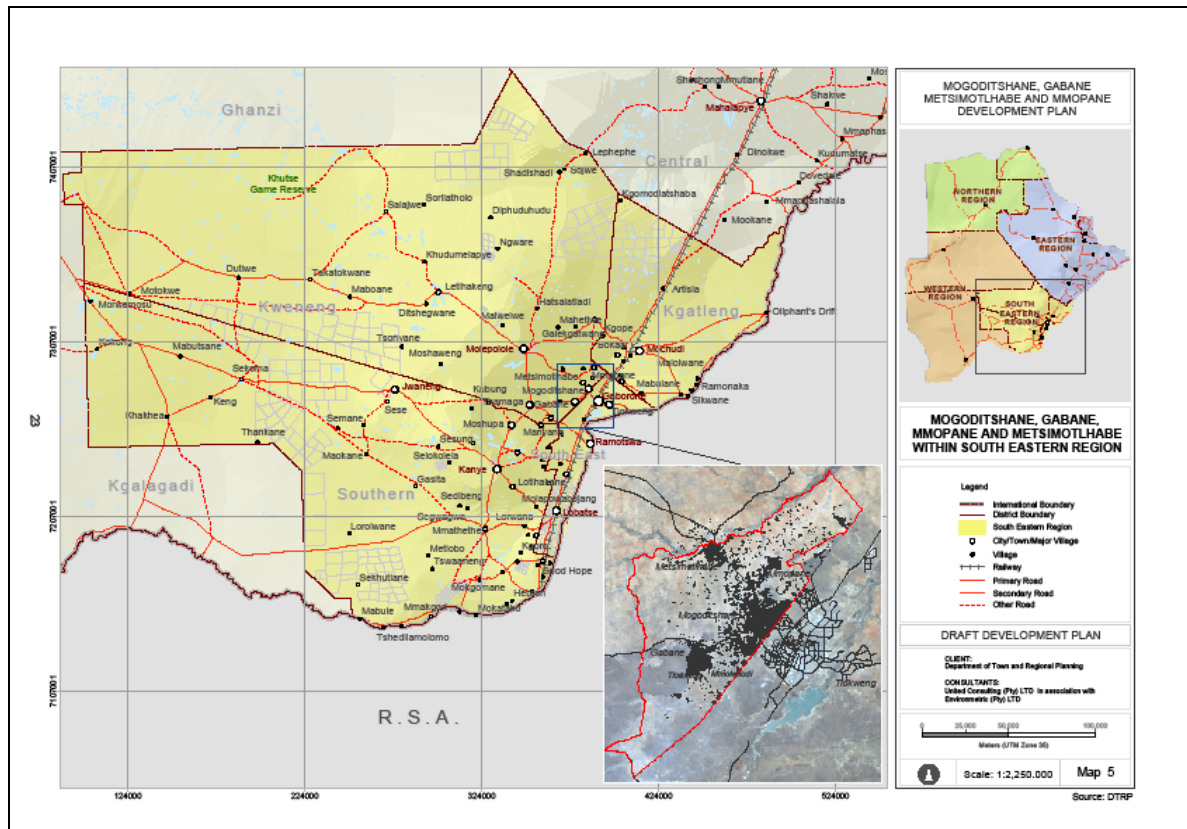
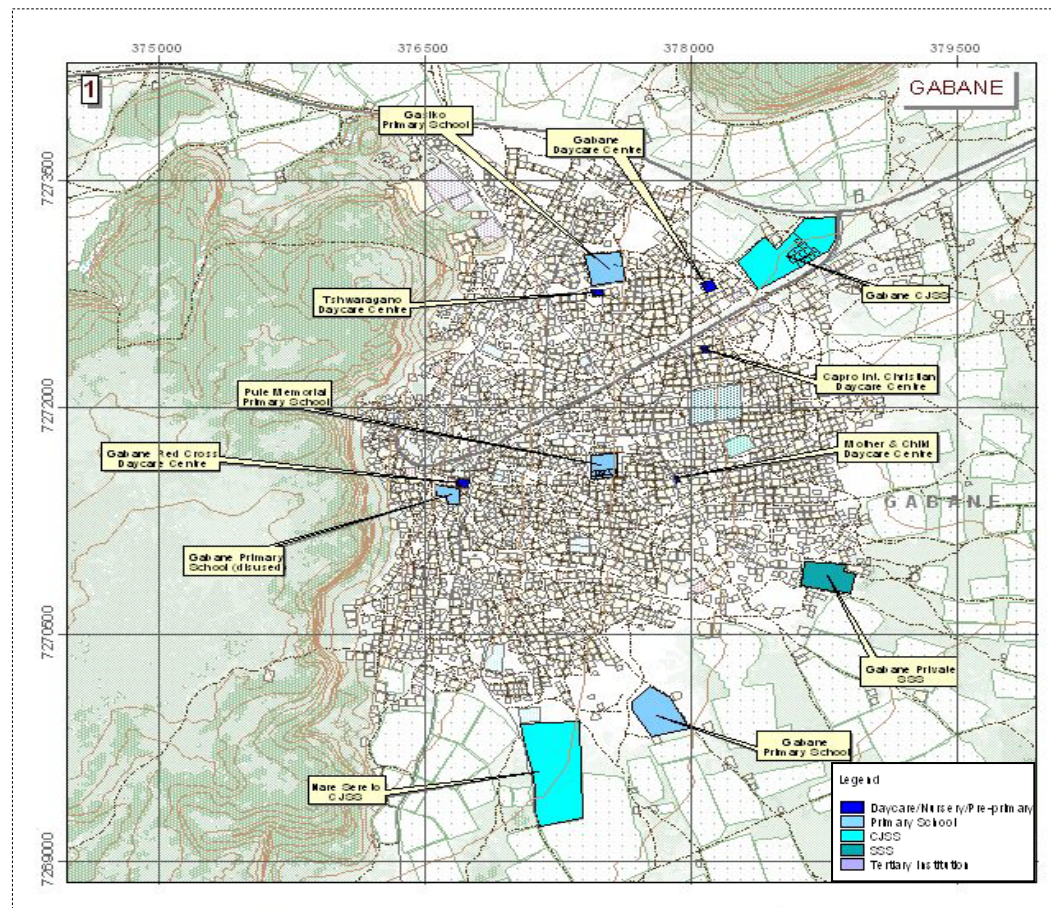


Plate 3.2 Map of Botswana with Gabane Village within the South Eastern Region.

Gabane village is also reflected in Plate 3.3 below showing educational facilities available.



**Plate 3.3 Gabane Village educational facilities.**

### 3.1.3 Agriculture and climate in Gabane

Gabane is classified as a dry subtropical semi-arid area and is designated as a desert subtype 5d. This climatic condition is characterised by seasonal and highly erratic, unreliable rainfall (Report of Survey, 2003). Ninety percent of the rainfall occurs during the summer months from October to April but the annual distribution varies in terms of occurrence and intensity. Gabane's highest temperatures occur during summer months (November, February and March), with mean temperatures being from 20-30 degrees Celsius (Report of Survey, 2003).

With Botswana being situated in the Kalahari Desert, drought often affect the agricultural activities in Gabane. The unreliable rainfall affects the rate at which the community can cultivate and harvest its produce. Slower growth and harvesting occur during dry season. Sometimes heavy rains can speed disaster when plants have germinated and plant growth is disturbed by water-logged soil.

#### **3.1.4 Education facilities in Gabane**

One of Botswana's long term goals (vision 2016) is education. There are four education policy objectives namely pre-primary and primary school education, secondary school education, vocational training and special education for the disabled. There are five pre-schools in Gabane which are expensive and privately owned, one privately owned senior school and four government primary schools, two government secondary schools and one Brigade/vocational training school owned by the government (Report of Survey, 2003).

#### **3.1.5 Health facilities in Gabane**

The principal goal of the Botswana National Health Policy is to provide adequate health care for all Batswana (Report of Survey, 2003). Gabane village has only one clinic and one health post located in the south western part of the village. Given the limited health services, some of the villagers visit clinics in Gaborone (which is 15km away) to access specific services.

#### **3.1.6 Water availability in Gabane**

Water for the Gabane settlement is supplied by the Water Utilities Corporation that is considered to be a very reliable source. The Kweneng District Council manages the distribution and maintains the water reticulation network as well as purchase of large volumes of water from the Department of Water Affairs via a booster station positioned in Mogoditshane (Report of Survey, 2003).

In Gabane in 2002, there was an increase in private indoor household water connections and household access to piped water outdoors. Dependence on communal stand pipes decreased as the village developed. A steady supply of water improved household living

conditions because some households could build water system toilets to ensure proper sanitation.

### **3.1.7 Electricity supply in Gabane**

Electricity is available from government in Gabane at a reasonable cost. Provision of electricity in Gabane is by a card system which is different from the one-meter system in Gaborone. It has been noted that the energy preference is electricity and candles, while the use of paraffin and wood fuel has decreased substantially (Report of Survey, 2003).

### **3.1.8 Roads and transportation in Gabane**

With Gabane being a peri-urban area, the primary national road network links up with all routes leading to Namibia and South Africa (Report of Survey, 2003). The community is dependent on public transport or minibuses and the cost of a trip to Gaborone is reasonable at P3.00 or R 3.75 (Republic of Botswana, 2008).

### **3.1.9 Economic opportunities in Gabane**

Those who are in full time employment and part-time employment in Gabane are mainly government employees such as teachers, police officers, nurses and other professions. Employment opportunities are very limited in Gabane. Part-time employment can be both professional and non-professional which include housekeeping, child care or baby-sitting and gardening.

In Gabane village, food can be purchased from supermarkets, shops, tuck shops, street vendors and other small businesses initiated by the community to earn a livelihood. The availability of these income generating-activities enables households to purchase nutritious foods to improve household food security and thus adequate nutritional intake.

Plate 3.4 below shows a street vendor stall with fruits, vegetables and candies sold for income to support household living.





**Plate 3.4 Street vendor stall with fruits, vegetables and candies for selling.**

Plate 3.5 below also shows the local general dealer shop along a street of Gabane, where the villagers purchase some of their foods.



**Plate 3.5 Local general dealer shop in Gabane.**

### **3.1.10 Communication in Gabane**

The Botswana Telecommunication Corporation (BTC) is responsible for the telecommunication network in Gabane. The system comprises external, aerial and underground cable reticulation that is supplemented by a Wireless Local Loop system (Report of Survey, 2003). The use of cellular phones has greatly improved communication especially when the BTC has insufficient capacity and breakdown (Republic of Botswana, 2008). Two privately owned mobile phones also provide services (mascom and orange cellular networks).

### **3.2 Research design**

The study was both qualitative and quantitative. Questionnaires were used and some tables provided facts and figures with figures given.

The objectives of the study were:



1. to document the access to food in these households, which contribute to dietary diversity and diet quality.
2. to determine the socio- economic characteristics of the community which contribute to food access and dietary diversity
3. to determine the diversity of the diet through foods consumed from different food groups, including the consumption and utilization of cowpeas in households (Lost Crops of Africa, 2006).

### **3.3 Development of the measuring instruments**

#### **3.3.1 Questionnaires**

Two questionnaires were developed for data collection, namely the Household Dietary Diversity Score (HDDS) questionnaire and a cowpea consumption survey (CCS) questionnaire. The socio-demographic questionnaire was developed as section one of the cowpea consumption survey. All questionnaires were piloted to test for validity and reliability. All the individual interviews were conducted by the researcher.

- **Socio-demographic questionnaire**

The socio-demographic questionnaire was developed to indicate the social status of all participants, household size, age, education level and marital status (Appendix 2).

- **The Household Dietary Diversity Score (HDDS) questionnaire**

The Household Dietary Diversity Score (HDDS) questionnaire is a standardised, international measuring instrument used for determining dietary diversity and diet quality, and by proxy, household food access. The HDDS questionnaire was contextualised to incorporate local foods consumed in the research community (Appendix 5).

- **Cowpeas consumption survey questionnaire**

The Cowpeas consumption survey questionnaire was developed by the researcher to collect data on aspects such as the cultivation, utilization, accessibility, preparation and consumption of cowpeas (Appendix 2).

- **Focus group guideline**

A focus group guideline for in-depth group discussions was developed to guide the researcher. Six women participated in each of the focus group discussions.

The eighteen women who participated in the focus group discussion were randomly selected from different wards in Gabane area. Random sampling was effective because women were able to provide information on how they perceived certain things in their wards. Women from each ward were given an opportunity to present their ideas.

The focus group discussions also had women from three different age groups in the category of 17-57 years of age who had not been part of the study before. The first group comprised young people (17-35 years), followed by the middle age of people (36-45 years) and the elderly people of (46 and 56+ years). The purpose of using three age groups was to triangulate data and gather more data on cowpeas. The discussions were conducted after the individual interviews had been conducted to provide additional information.

### **3.4 Sampling Procedures**

Forty households from five wards in the village were identified using the snowball sampling method. The snowball sampling method was used for the study because women in the community were able to identify households with home gardens and small fields. The selected households had to be actively involved in the cultivation of various foods including cowpeas. The sampling age of 17-56 years was due to the fact that women are primarily engaged with the cultivation of food in the fields or gardens and they are responsible for household meal preparations (Ruel, 2006).

### **3.5 Data Collection procedures**

The individual interviews were structured interviews. All the questionnaires were administered within the homes of the respondents. Data collection took place in the months of May and June which are the last months of harvesting cowpeas, although some had finished harvesting in March and April.

Focus group discussions took place at the Gabane brigade/vocational training school of the government of Botswana (Report of Survey, 2003). A total of 18 women divided in three groups according to their ages participated in the discussion. The researcher could assemble only this number of women, because during the day women were at work and even after working hours women were not prepared to participate since they were tired and their families needed them. Few of the women who were available were older women who were sick and could not participate. All protocol and ethical procedures were followed and maintained by the researcher to establish a good rapport which ensured appropriate responses.

### **3.6 Ethical Considerations**

- **Permission from the Ministry of Local Government and the Village Chief**

The researcher applied for a research permit from the Ministry of Local Government in Gaborone. The necessary documents such as certified copies of the national identity card of the researcher, UNISA student card and the research proposal were attached to the application forms sent to the Ministry of Local Government.

After the research permit letter (Appendix 6) was obtained from the Ministry of Local Government the researcher visited Gabane village. A copy of the research permit letter was submitted to the village chief. The chief's permission was granted orally and no permit letter was offered from the chief's office. There was no presentation conducted for the Ministry of Local Government before the research permit letter could be offered. The purpose of the study was presented to the chief, community leaders and other villagers who had come for the traditional court (*kgotla*) meeting. The chief agreed to the study to be conducted in the village and assigned one of the community leaders to accompany the researcher during a walk through the village, to familiarise the researcher with the village and to identify the village wards and population sample.

- **Permission from participants**

Using snowball sampling the researcher went to the identified participants' households for discussions. The researcher explained the purpose of the study to the participants and assured them of the importance of their participation in the study.

An Ethics letter of informed consent from UNISA was provided by the researcher for the participant to read and sign (Appendix 1). The ethics letter of consent included an explanation to the respondent of the research purpose and its nature, the primary investigator's name and contact details, as well as that of the supervisor and the UNISA department. The participants were told that they were not compelled to participate in the study. The respondents were also assured of confidentiality and anonymity when taking part in the study. Community members were assured that after completion of the study, the researcher would provide feedback to the community with the results and explanations.

### **3.7 Data analysis**

The socio-demographic data were analysed for both frequency and percentages and presented in graphs generated from an excel spread sheet. The cowpea consumption survey data was processed, analysed and interpreted by graphs, tables and figures. The HDDS data analysis was based on the FANTA guidelines provided in the questionnaire. The focus group data was analysed by identifying major themes that corresponded from the group discussions and data was triangulated and validated.

### **3.8 Constraints**

Major constraints the researcher encountered were limited time, less finances for travelling to the field and harsh rainy winter and summer seasons which altered the researcher's data collection schedule.

### **3.9 Summary**

This chapter presented and discussed the research design, sampling procedures, study area, data collection and ethical considerations. Chapter Four presents and discusses the research results regarding the household dietary diversity which indicated the daily dietary intakes, food access and diet quality.

The cowpea consumption survey provided information on the consumption of cowpeas, the cultivation, processing, preparation and storage. The socio-demographic data included details on the average number of household members, marital status of women and the educational level reached by participants.

## **Chapter 4**

### **Results and Discussion**

#### **4. Introduction**

This chapter presents the results and discussion of the study for both the cowpea consumption survey and the Household Dietary Diversity Score (HDDS). The Household Dietary Diversity Score reports on the selection of foods consumed from different food groups and how this relates to diet quality and food access. The cowpeas consumption survey questionnaire reports on knowledge of cowpeas, cowpea consumption habits as well as the cultivation and processing of cowpeas.

#### **4.1 Socio-demographic data**

Socio-demographic data were collected on household size, age, marital status and education levels of the 40 participants, each of whom had a small field and a home garden for cultivation of food.

##### **4.1.1 Household size**

The total number of adults and children from the 40 sampled households were 161 and 77 respectively. The frequency distribution and average household size of the interviewed households in Gabane village are shown in Table 4.1. These households include extended family members that comprise the critical need for stable household food security.

**Table 4.1 Frequency distribution and average household size.**

<b>Household members (40 households)</b>	<b>Number of household members</b>	<b>Average number of household members</b>
Male Adults	70	1.8
Female Adults	91	2.3
Total children	77	1.9
<b>Total number Of household members</b>	<b>238</b>	<b>6</b>

Larger families are more vulnerable to an increased risk of household food insecurity due to added demands for food. In most of the Southern African countries, including Botswana, households with more than seven members are more vulnerable to food insecurity than those with fewer members (ZUA, 2004).

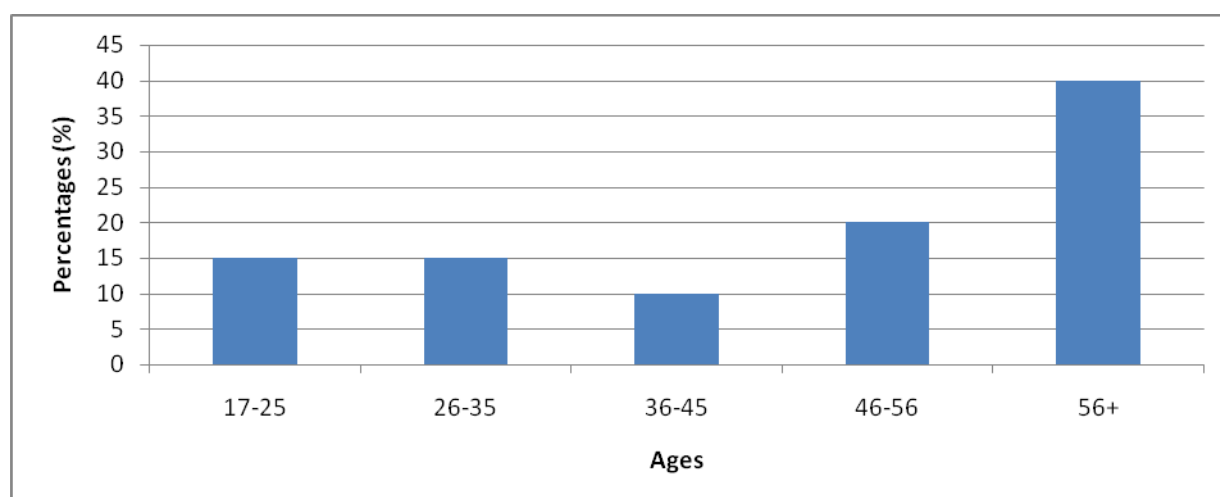
According to Sebolaaphuti, (2008), HIV/AIDS has a huge impact on household livelihoods, since infected household members are usually the ones who previously were employed and provided food for the family. The loss of such income-earning members, can lead to food insecurity for remaining family members. The Botswana National Strategic Framework for HIV/AIDS, (2009) indicated that the HIV/AIDS epidemic continues to worsen contrary to previous projections that HIV prevalence rates would plateau at around 25%. Increased household size and HIV/AIDS infected household members seriously impacted household food security, resulting in some households in other parts of Botswana seeking for other food alternatives (Ngwenya & Mosepele, 2007).

During food shortages, some households resort to coping strategies such as cutting down on the number of meals per day, reducing meal portions, looking for paid work, gathering wild fruit, asking for food from relatives, selling livestock and applying for social assistance . These serious impacts of food insecurity also include sale of family assets, depletion of savings and switching to or abandoning fishing activities (Ngwenya & Mosepele, 2007).

### 4.1.2 Age group of participants

Figure 4.1 shows the age distribution of the participants in Gabane village. The highest age distribution of the participants was in the older group above 56 years of age and the two young age group distributions were both 15%. Older women are the ones mainly involved in food cultivation, because they have time, opportunity and are more knowledgeable about vegetable cultivation, including cowpeas (Alene *et al.*, 2008).

According to Hendricks *et al.*, (2006), younger women display less interest in cultivating indigenous vegetables. Hoddinott, (2002) concludes that a household with a large number of adults may be more likely to include individuals with a wider range of tastes and preference which may vary depending on age and education.



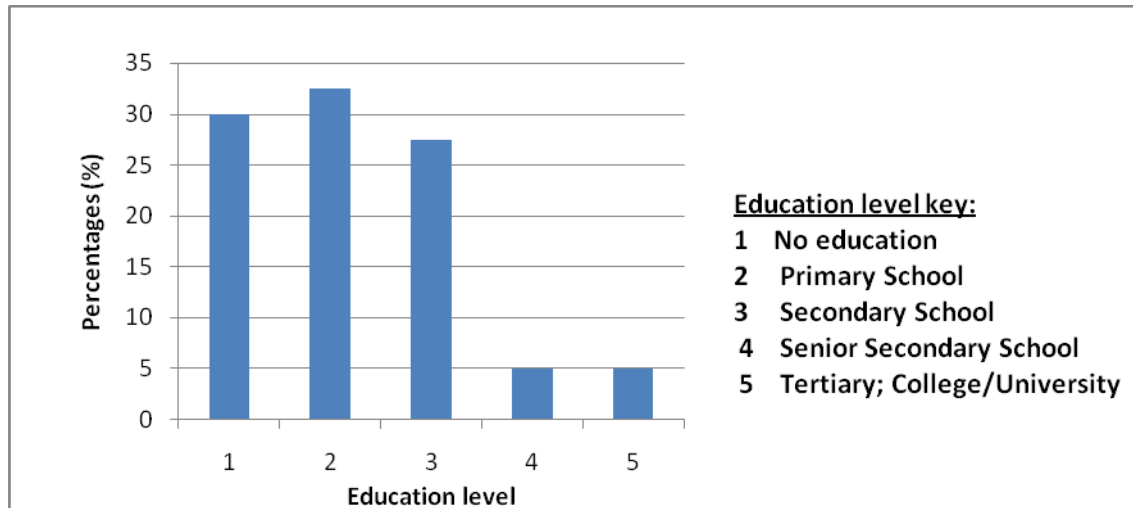
**Figure 4.1 Age groups of participants in Gabane Village.**

### 4.1.3 Education

Figure 4.2 indicates the education levels of participants. The largest group of 32.5% had primary school education only, with 30% of the older group of 56 years of age and above having had no education. The results of this study support the work done by Alene *et al.*, (2008) which indicated that older and less educated females were mostly the ones involved in the purchase, planting, utilization and preparation of meals. Therefore, it could be that



younger women from 17- 35 years of age, who were able to attend school from primary level to tertiary level, had no interest in food cultivation and information on food.



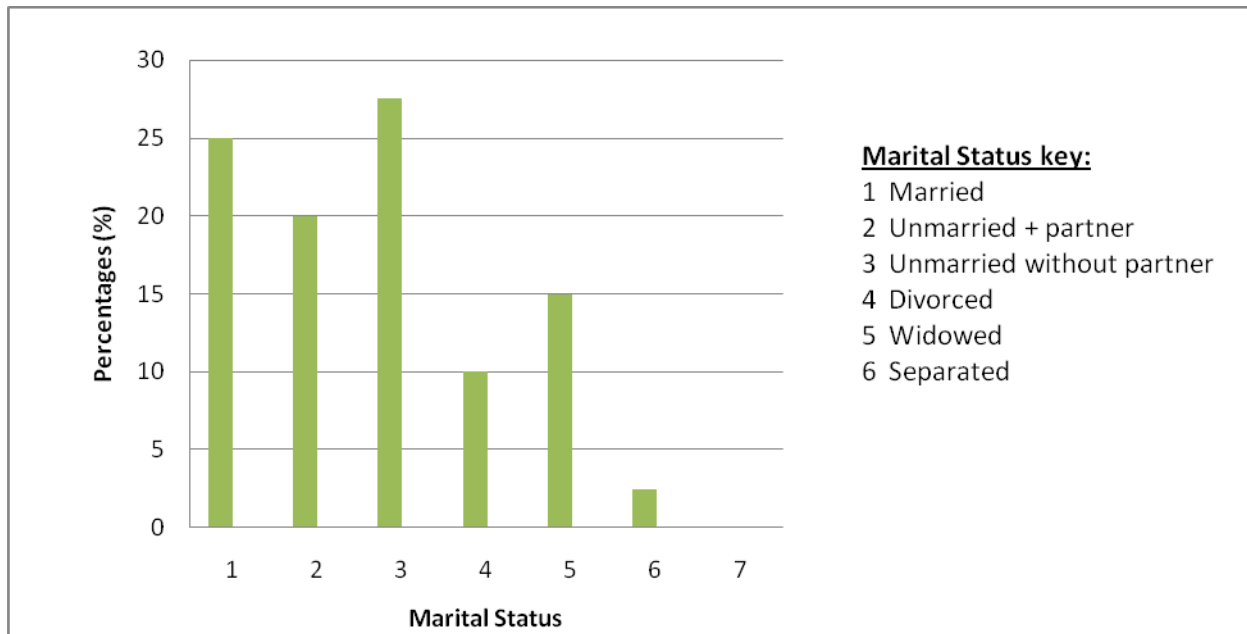
**Figure 4.2 Education levels of participants in Gabane village.**

It is interesting to note that 50% of women from the focus group discussions indicated that age had no bearing to education, because one could learn at any age of life, as is obvious in the Setswana saying (*“thuto ga e golelwe”*). The other women in the focus group discussions were of the opinion that younger age groups usually attended school to all levels and could obtain better employment.

#### **4.1.4 Marital status**

Participants were grouped into six categories based on marital status, namely, a married couple with a man legally married to one wife; living with a partner but not married, also known as cohabitation and unmarried without a partner which means being single, divorced, widowed or separated.

The above mentioned marital categories are commonly found in Botswana (Mokomane, 2006). Figure 4.3 indicates that the largest group of 27.5% were unmarried women living without a partner and less than 20% were unmarried women cohabiting with a partner.



**Figure 4.3 Marital status of participants in Gabane village.**

#### **4.1.5 Sources of income**

All women from the interviewed households indicated that they were neither in full-time nor in part-time employment that would provide them with an income. Most of them indicated that they obtained money from their relatives who worked, parents who received a pensioner's allowance, selling surplus of cultivated food and from piece jobs whenever these were available (Gobotswang, 1998).

An international study revealed that household diet diversity level was strongly correlated with household income per capita and access to a livelihood, suggesting that diet diversity could be a practical indicator of food access, affordability and utilization of available sources to improve household food security (FAO, 2005).

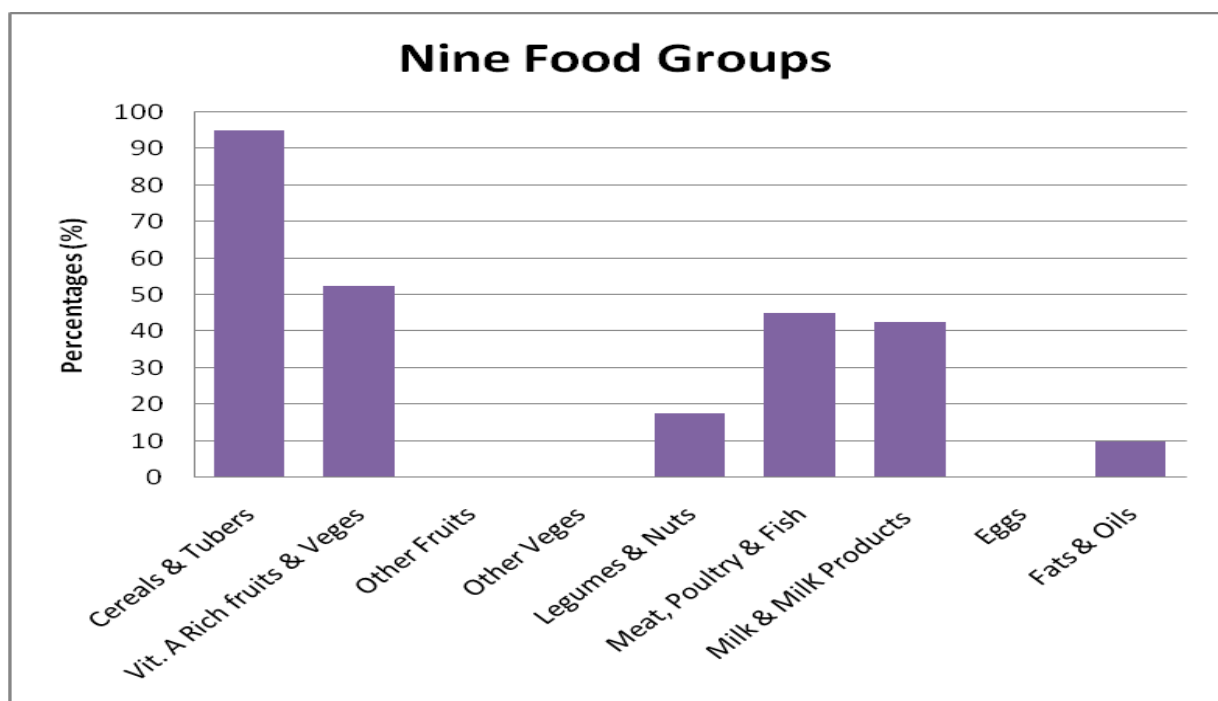
#### **4.2 Household Dietary Diversity Score (HDDS)**

The purpose of the HDDS is to provide data on the foods from specific food groups consumed over a specific period of time. The HDDS reflects an intake of a variety of foods and the diet quality. The HDDS is also a proxy measurement for food access, since a low diversity score of the diet will indicate inadequate access to food (Steyn *et*

*al.* 2005). The international standardised Household Dietary Diversity Score (HDDS) questionnaire developed by FANTA (2007) provides information on the selection of foods consumed from a number of food groups. Globally, the number of food groups per questionnaire varies from five to up to 17 groups. In this study the HDDS questionnaire was contextualised to include culturally distinctive and local foods consumed in Botswana, especially in Gabane village (Appendix 5).

The average Household Dietary Diversity Score for this study was 2.9 for Gabane village, which is well below the critical cut-off value of 4.0, indicating that the nutritional status and food accessibility of this community is poor. According to Steyn *et al.* (2005) a cut-off point of less than 4 will indicate poor dietary quality. In a South African study conducted by Faber *et al.* (2008), it was shown that the average household dietary diversity score among adults was 4.6, which was slightly higher than the average dietary diversity score of 3.6 observed for 1-8 year-old South African children.

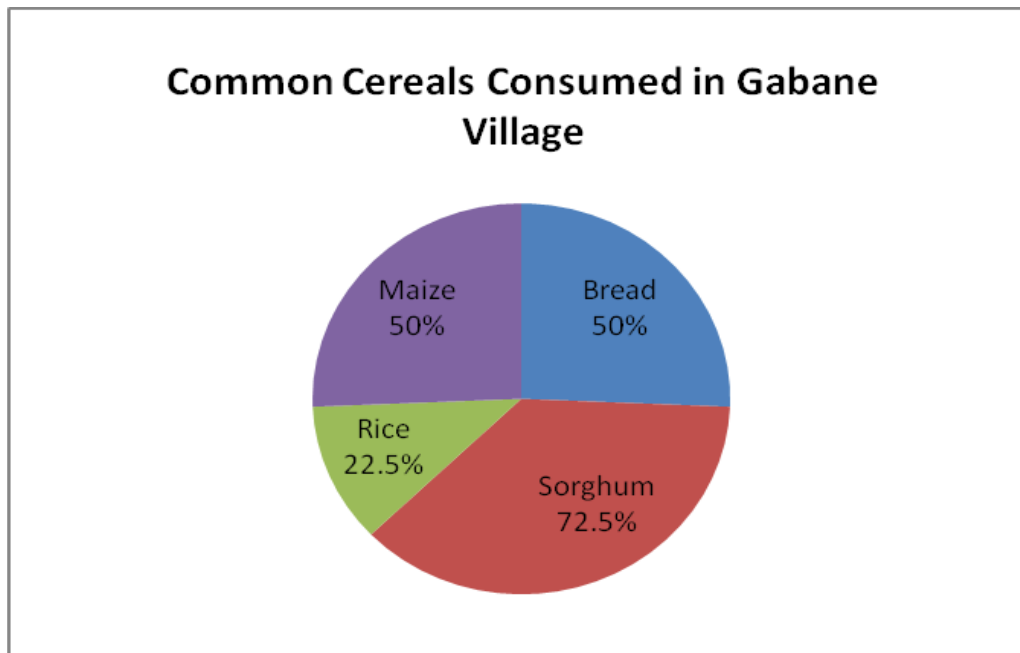
Figure 4.4 shows the percentages of nine food groups consumed in the study.



**Figure 4.4 The percentages of nine food groups consumed.**

#### 4.2.1 Cereal, tubers and roots

Figure 4.5 indicates the common cereals consumed over a period of 24 hours.



**Figure 4.5 Common cereals consumed in Gabane village over a period of 24 hours.**

The cereal group consists of carbohydrate-rich foods to supply energy and to sustain physiological functions required for health. Similarly, tubers and roots are also grouped as starch based foods. White potatoes and sweet potatoes provide vitamin A & K, potassium, magnesium and zinc. People in the developing countries with poor rural households are dependent on cereals (Ruel, 2006). This pattern of high cereal consumption is also a common feature among the poorer people in Botswana and in Gabane, where 95% consumed cereals on the previous day.

A starch-based diet of mainly cereals is a common occurrence in developing countries where it is associated with low-income households and thus a limited intake of nutrients (Ruel, 2006). Staple foods need to be supplemented with a variety of vegetables, fruits and other nutritious foods to enhance intake of adequate quality nutrients to promote quality

health. High-income earners tend to consume less staple foods since they can afford to purchase diverse foods of higher nutrient content (FANTA, 2003).

The consumption of a variety of cereals is essential, because they contribute thiamine, riboflavin, niacin, phosphorus, folic acid, vitamin B6, iron, protein and magnesium, of all which are vital for health and growth (NRC, 2009). The daily use of starch-based foods in this study included a variety of cereals, namely:

- **Sorghum**

Sorghum is the staple food in Botswana and it was consumed by 72,5% households, as indicated in Figure 4.5. Sorghum is commonly accompanied by green leafy vegetables such as cowpeas, spinach, cabbage and chomolia. Sorghum can be substituted with maize-meal or any other starchy food available (Holmboe-Ottesen, 1998). Sorghum is consumed in different forms such as soft and stiff sorghum porridge, which can be fermented to form sour porridge (*ting*), cooked sorghum grains (*lefatana/mosuthwane*) which can be mixed with beans, and tsabana, a sorghum based weaning product (Holmboe-Ottesen, 1998).

- **Maize**

Maize is commonly cultivated in Botswana. In this study 50% of households consumed maize. It can be consumed as soft and stiff maize porridge, soft maize porridge prepared in the form of a drink (*mageu* and *mbila*), cooked maize grains (*kabu*), popcorn, roasted or boiled maize cobs and samp, where maize is mixed with beans (Holmboe-Ottesen, 1998).

- **Bread**

In the study, 50% of households consumed bread in the form of fat-cakes purchased from the supermarket or street vendors. If affordable, bread would be the preferred substitute for porridge (Holmboe-Ottesen, 1998).

- **Rice**

A lower percentage of households, namely 22,5%, indicated that they consumed plain boiled rice. Women from the focus group discussion explained that rice was a luxury food, usually purchased at high cost and not commonly eaten in poor households.

- **Millet**

None of the participants consumed millet (*lebelebele*). Millet is a common starch based food that is similar to sorghum, but differs in colour and texture. Millet is dark brownish and has a coarse texture, compared to sorghum which may be of a lighter colour depending on the type that is used (Holmboe-Ottesen, 1998).

- **Tubers and roots**

The villagers do not have access to a variety of tubers through purchasing or cultivation. This was shown by the low consumption of only 5% of white potatoes. The focus group discussions indicated that the community of Gabane do not grow tubers, therefore have to purchase them at a high price. The women also explained that the soil was not suitable for cultivation of tubers such as potatoes. The poor consumption of tubers could be that they are not easily available for household use and purchasing is not an option if money is not available. The low intake of food from this group could also be a cultural and belief issue (Mugabe *et al.*, 1998).

To summarise, 95% of households consumed foods from the cereal group, 72.5%, consuming stiff sorghum porridge. Maize meal in the form of stiff maize-meal porridge known as *phaletshe* or also known as *papa*, was consumed by 50% of households. Homemade bread or bread purchased from supermarkets was consumed by 20 households while 22.5% of the households consumed rice.

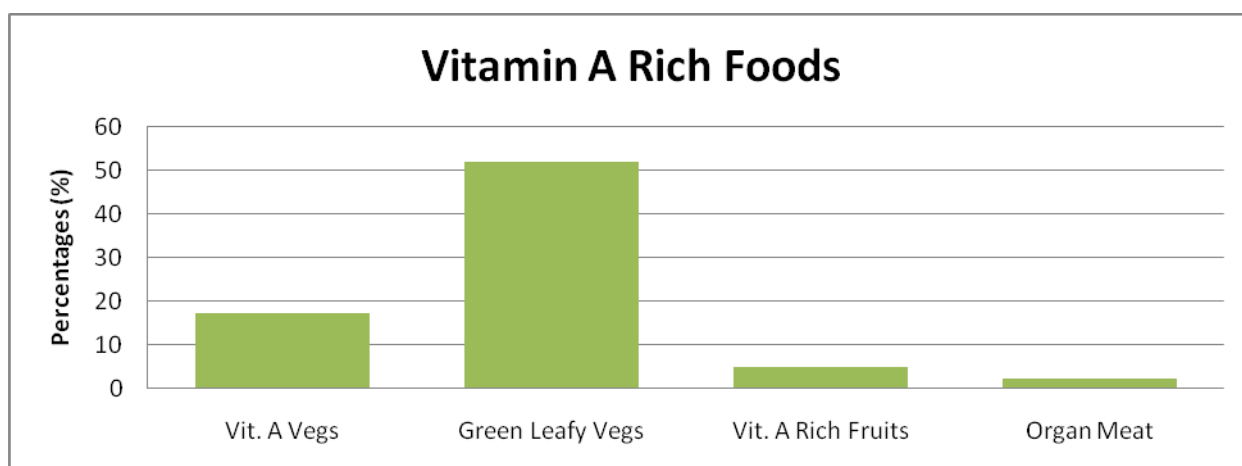
#### **4.2.1.1 Carbohydrate dishes consumed with cowpeas**

In the cowpea consumption survey the respondents indicated different starch-based foods which are tasty when consumed with cowpea leaves. These were 97.5% for maize, 95% for sorghum, 30% for rice, 10% for macaroni and spaghetti, 5% for bread, 5% for samp and 2.5% for millet.

### 4.3 Vitamin A-rich foods

Vitamin A is vital to promote good health, especially in children who tend to be more vulnerable to vitamin A deficiency (Coovadia, 2003). Consuming green leafy vegetables, vitamin A-rich vegetables and fruits will boost the intake of vitamin A and other micronutrients such as iron. The oil content of a diet improves vitamin A absorption in the gastro-intestinal tract.

In this study an expanded HDDS of fourteen food groups was applied to identify specific foods of special interest, namely micro-nutrients such as vitamin A and iron. Figure 4.6 indicates levels of vitamin A consumption from animal products as well as from plant sources.



**Figure 4.6 Vitamin A rich foods from plant and animal products.**

#### 4.3.1 Vitamin A-rich fruits and vegetables

Vitamin A-rich foods are important and needed daily to ensure proper growth and development especially among children and to prevent deficiency diseases such as night blindness, infections and skin disease. It is essential to consume vitamin A-rich fruits and vegetables to improve or sustain one's health.

- **Vitamin A-rich fruits**

Vitamin A deficiency in Botswana results from the poor consumption of vitamin A-rich fruits and vegetables. In this study only three women consumed watermelons. Fruits such as mangoes, pawpaws, persimmons, prunes and watermelons are good sources of vitamin A (Wolmarans, 1992). According to Clausen *et al.* (2005), consumption of more fruit is dependent on cultivation and purchase of fruits at high cost. It appears that people, who are educated and employed, can afford and do purchase a variety of foods for household consumption.

- **Vitamin A-rich vegetables**

Research has shown that in Botswana there is a very poor intake of a variety of vegetables, which could be linked to the people not having frequent meals, with most of the households consuming one or two meals per day (Clausen *et al.*, 2005). In the study, 15% of households consumed pumpkin, spinach, green peppers and chomolia which are vitamin A-rich foods. The results indicated that 17.5% of households consumed the vitamin A vegetables as shown in Figure 4.6 above.

- **Dark green leafy vegetables**

More than 52.5% of the respondents consumed dark green leafy vegetables as is shown in figure 4.6. Cowpea leaves were consumed by 35%, cabbage by 7.5%, spinach by 5%, green peppers by 2.5% and chomolia by 2.5%. The only indigenous vegetable consumed as a dark green leafy vegetable was cowpeas. From the 7.5% of households which consumed cabbage; 2.5% consumed cabbage mixed with green peppers and 5% consumed plain cabbage without vegetables. These dark green leafy vegetables are all vitamin A-rich foods, also providing vitamin C, fibre, folate, riboflavin, pyridoxine, iron, protein and phosphorus, all of which are essential healthy growth (NRC, 2009).

The focus group discussions indicated that most of the green leafy vegetables are purchased from supermarkets, street vendors and markets. Very few of these women had food gardens and a recommendation would be that the community should be



encouraged to cultivate gardens and plant vitamin A rich vegetables, including cowpeas.

Table 2.1 showed cowpeas as being a rich a source of vitamin A compared to cabbage and pumpkin leaves. Although cowpeas leaves can significantly contribute vitamin A during consumption, there is a loss of nutrients in all plant vegetables during cooking, sun drying and storage (USAD, 2003). The use of cultivated foods from household food gardens including cowpeas can be used to supplement the consumption of vitamin A-rich foods, particularly among families that are vulnerable to vitamin A and other micro-nutrient deficiencies and food insecurity (Asiamah, 2004). Cowpea leaves also contain vitamin C and calcium (Babu, 2000).

Other dark green leafy vegetables which were cultivated in the respondents' household gardens or small fields were vitamin A-rich pumpkin leaves and spinach. The seasons of growth, storage and consumption of spinach and pumpkin leaves was indicated as winter from May to July. Fifteen percent of the participants in the focus group discussions indicated that they cultivated cowpeas during rainy season while vegetables such as spinach, pumpkins and lentils are also cultivated mainly for their leaves in winter season.

Green leafy vegetables such as pumpkin leaves and lentil leaves are processed and stored in the same manner as cowpeas leaves. Leaves are pre-cooked, sundried and kept in tightly sealed plastic and metal containers (Lost Crops of Africa, 2006). The women mentioned that they usually harvested enough spinach for the household to consume in one day. Those with refrigerators could store spinach for 1-2 days and pumpkins were stored in dry cool areas inside the house.

#### **4.3.2 Other vegetables and wild vegetables**

- **Other vegetables:**

From the other vegetables group, no vegetables were consumed.

- **Wild vegetables**

None of the households in this study consumed wild vegetables, although the study was conducted during rainy season in April-May, at the end of the harvest season. The focus group discussions indicated accessing wild vegetables in Gabane is a challenge since Gabane is a peri-urban village. This implies that the villagers have to travel long distances to farms, the veldt, forests and any areas where wild foods such as *delele*, *rothwe* and *monyaku*, can be found (Lost Crops of Africa, 2006). From the focus group discussions few women indicated that they only know few wild vegetables which they rarely buy or collect for household consumption. The focus group discussion also indicated that during rainy and ploughing seasons they obtained large amounts of amaranthus known as *thepe* which is very rich in vitamin A with a value of 5 716 mg per 100g (edible portion) (ARC, 2006).

According to Harris & Mohammed, (2003), wild foods in rural Africa provide food diversity to improve diet quality and can help to alleviate food shortages, but the knowledge of wild foods varies according to ethnic groups and gender. Wild foods can provide an opportunity to generate income when they are collected and traded and can therefore be an important coping strategy for rural communities with food insecurity (Harris & Mohammed, 2003). The consumption of wild vegetables will ensure an adequate intake of micro-nutrients which are needed daily thereby preventing nutritional deficiencies (Kuhnlein, 2003).

#### **4.3.3 Other fruits and wild fruits**

No other fruits or wild fruits were consumed by this group over the previous day. The focus group discussions indicated that the Gabane residents could access some wild fruits during the rainy seasons. Some of the wild fruits within household reach or available in the village district, are *morula*, *mokgalo*, *moretlwa*, *motlopi*, *moretologa*, *mmupudu* and *mmilo*, all rich sources of vitamin A and other micronutrients.

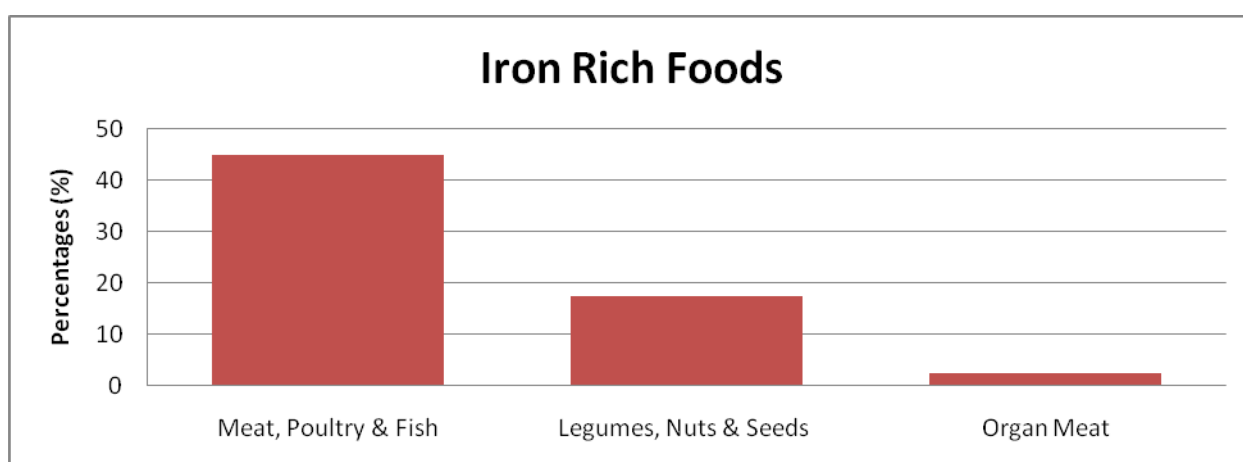
#### 4.3.4 Meat and fish food group

This food group includes meat from chicken, sheep, goats and cattle as well as fish

- **Organ meat**

Only one household on the preceding day consumed tripe, known as *serobe*, which is a mix of liver, kidneys and other internal organs. No one consumed livers, kidneys, gizzards as separate dishes on that day. From the focus group discussion most of the women indicated that they consume organ meats occasionally when they had slaughtered animals for meat. Some of the reasons for not consuming organ meat are that it is believed that when a woman is pregnant, it is a taboo to consume some organ meat as it is believed that she will have difficulties in child bearing.

A good source of vitamin A from organ meat is fried beef liver, where a portion of 80 g contains 8 582 RE, while 5ml cooked chicken livers contributes 1 473 RE vitamin A and an 80 g portions of fried sheep liver contains 6 244 RE (Wolmarans, 1992). Organ meat also contains protein, calcium, phosphorus and other micro-nutrients. Figure 4.7 indicates iron rich foods.



**Figure 4.7 Iron-rich foods consumed by the respondents**

- **Flesh meat**

Only 42.5% of women consumed meat such as chicken (20%), beef (22.5%) or goat (2.5%). Flesh meat contains protein, phosphorus, iron, zinc, niacin, riboflavin, pyridoxine and vitamin B12, which are necessary nutrients to nourish the body, build muscles and to strengthen the immune system (NRC, 2009).

Botswana is one of the meat-exporting countries in Africa, but with foot-and-mouth disease, the meat from cattle slaughtering has become less freely available to avoid any further contamination (Republic of Botswana, 2008). Some of the respondents in the discussion indicated that households reared domestic animals such as chickens, cattle, sheep, goats and other birds. These animals provided them with meat occasionally, but are usually slaughtered only at big events and during festive seasons.

Mrema & Rannobe, (1990) stated that livestock production in Botswana is a very important socio-economic activity. However, cattle ownership is highly skewed, with 10% of the population owning 60% of the national herd in 1990 (MFDP, 1991). The government encouraged goats ownership projects and programmes for poorer sector of farmers which gave women an opportunity to owned more goats than their male counterparts (Mrema & Rannobe, 2005). About 70% of the total areas of Botswana are communal lands where traditional farmers live and most of the goats are found there (Mrema & Rannobe, 1990).

The Government of Botswana assists the community to improve their income through increased production of milk, meat, marketing of small stock, improved handling and marketing facilities, subsidized indigenous goat projects, financial assistance for goats and sheep projects, technical assistance to Botswana Cooperative Union (BCU) responsible for livestock management and marketing, and priority is given to women. An increasing number of animals are sent to the official market, the Botswana Meat Commission (BMC). The government builds dams and assists syndicates in covering the costs of drilling water since there is very little surface water. Ten routes with watering and kraaling facilities and a kilometer yard to hold sick and weak animals have been built to assist those farmers who move their animals to BMC or municipal abattoirs. Disease-control measures such as free vaccination against common diseases, fences in production areas and the establishment of six main Livestock Advisory Centers (LACs) and 25 subsidiaries have been established (Mrema & Rannobe, 1990).

- **Fish**

Only 7.5% of respondents consumed canned fish. Fish is not a rich source of vitamin A, but contributes protein, fat, thiamine, riboflavin, niacin, folate, vitamin B12, iron, zinc and magnesium (NRC, 2009).

The focus group discussion indicated that the lack of a river or dam in Gabane village meant there was no access to fresh fish for consumption. The women stated that fish was an expensive food item to purchase and therefore its consumption would be minimal for women with low or no financial resources.

#### **4.3.5 Eggs**

Although none of the respondents consumed eggs on the day before the interview, the women indicated that they did have chickens and eggs for household consumption. Many respondents could not afford to buy eggs due to their poor financial status and some might not consume eggs for medical, cultural and religious reasons.

Eggs are good sources for protein, fats, thiamine, riboflavin, niacin, folate, vitamin B12, iron, zinc and magnesium, (NRC, 2009). According to Clements, (2009), eggs are good protein source when compared to other animal proteins. Families could benefit substantially from egg consumption. According to Tall, (2009) egg consumption could reduce childhood malnutrition. In 1993 Botswana's malnutrition rates were 15% for under-fives.

#### **4.3.6 Legumes, nuts and seeds**

Of the 20% households that consumed legumes, 5% consumed lentils and 15% consumed cowpea beans. Legumes, nuts and seeds contain protein, phosphorus, riboflavin, niacin, vitamin B12, iron and zinc (NRC, 2009). The essential amino acids obtained from these foods are critical for vegetarians and other groups of people on special diets (NRC, 2009).

According to Tembe, (2005), legumes' consumption helps to boost adequate nutrient intake and food access thus alleviating poverty, especially when abundantly cultivated

and traded for income. In African developing countries legumes are an important component of the diet and valued as a source of dietary protein to complement cereals, starchy roots and tubers.

Legumes contain 20–30% protein which is generally rich in lysine, but poor in sulphur-amino acids. Legume starch that is more slowly digested than starch from cereals and tubers produces less abrupt changes in plasma glucose and insulin upon ingestion. Similarly, legume protein has been shown to reduce plasma of low lipoprotein density. Starchy legumes are also valuable sources of dietary fibre as well as thiamine and riboflavin (Phillips, 1991). Legumes are important since poor communities can be possibly assisted by combining legumes in a cost-effective way to formulate multi-mixes to meet energy, protein and micronutrient needs without fortification (Amuna *et al.*, 2000).

#### **4.3.7 Milk and milk products**

Some 42.5% of the women consumed milk in small amounts in tea, with a larger amount with sorghum or maize-meal porridge. The dairy group contains proteins, fat, riboflavin, vitamin B12, iron, vitamin A, vitamin D, calcium, zinc and magnesium (NRC, 2009).

In Botswana livestock such as cattle are kept for milk production and can contribute to the milk intake in some households. The focus group discussions indicated that some households reared livestock for milk especially when there was no drought and cattle were able to graze and be productive. Studies in Botswana have indicated that elderly people hardly ever consume dairy products (Clausen *et al.*, 2005).

According to Boitumelo, (2000), the increase in milk production by peri-urban small-scale farmers in Botswana is a major government initiative which will not only increase the supply for household consumption but could also lead to surpluses available for selling. A lack of adequate fodder for cows, especially during the dry season, was identified as a major constraint to sustainable milk production in small-scale farming operations (Boitumelo, 2000).

#### **4.3.9 Oils and Fats**

Only 12% of the women used oils and fats in cooked vegetables and other foods, but usually in small amounts of about 2-3 tablespoons. Oils were used for frying vegetables, meat, and other foods. Fried foods can be a good supply of vitamins A, D, E and K and essential fatty acids which enhance the absorption of vitamin A.

#### **4.4 The dietary diversity score**

The Household Dietary Diversity Score of 2.9 obtained from the study in Gabane village was well below the cut-off point of 4 which is regarded as an indicator of diet quality (Steyn *et al.*, 2005). This low score indicated that the households did not consume enough nutritionally adequate foods from a variety of foods. A poor intake of nutritious meals puts families at risk for macro and micro-nutrient deficiencies.

#### **4.5 Diet diversity and diet quality**

The households had a low consumption of a variety of foods, which are essential to consume to ensure an adequate intake of nutrients thereby preventing nutrient deficiencies. Diet diversity contributes to diet quality, which is necessary for a healthy life. Cowpeas, as a nutritious vegetable, can be used to complement many household diets, improving diet diversity and diet quality especially among those in poor rural areas with low-socio economic status, who cannot afford to purchase enough nutritious foods. This study has indicated poor dietary diversity and diet quality with resulting poor nutritional intake by the community.

Household diets in Gabane need to be nutritionally improved to prevent nutrient deficiencies. Household food access and adequate intake of nutritious foods can be affected by lack of finance, culture, religious beliefs and drought. Studies have shown that the consumption of diverse foods in Botswana is still a problem among the elderly people (Clausen *et al.*, 2005). Asefa, (2007), indicated that Botswana has survived its worst drought without a single death from hunger. This is due to a Food Strategy that has both long-term and short-term policy

dimensions, such as long-term goals to increase food security through improved economy and short-term goals to introduce drought relief programmes, providing food security to the most vulnerable segment of its population. The two components of the Botswana food access programme are household supplementary feeding and cash for work (Asefa, 2007).

#### **4.6 Dietary diversity, food access and the contribution of cowpeas**

The study results indicated household dietary diversity score of 2.9, which reflected poor food access, poor dietary diversity and poor diet quality. It is important to cultivate, access and utilize food from all food groups. Diversified diets contribute significantly to the optimal intake of nutrients. The use, access and consumption of indigenous foods, especially legumes such as cowpeas, can improve household food access since they are drought tolerant (Tembe, 2005). Cowpeas are nutritious and can be utilized for nutritional supplementation especially in households with poor food intake and poor dietary diversity (Asiamah, 2004).

The availability of cowpeas to households ensures food access, dietary diversity, diet quality, and must be considered and made available to households, especially those in poor rural areas with low socio-economic status.

#### **4.7 Wild foods**

Wild foods that are rich in micro-nutrients can add nutritional value and enhance household dietary diversity, especially in poor rural households where families cannot afford to purchase a variety of foods (Kuhnlein, 2003). The use and consumption of wild food contribute to food access which can significantly improve household food access in poverty-stricken families. The study indicated that no wild foods consumed.



## **4.8 Cowpeas as an accessible and nutritious legume**

### **4.8.1 Household consumption of cowpeas**

All the 40 households interviewed indicated that both adults and children consumed cowpeas, with 22.5% of the households consuming them daily, 70% consuming them weekly, 5% consuming them monthly and 2.5% consuming them occasionally.

The focus group discussions indicated that generally in Botswana cowpeas are consumed as a green leafy vegetable and as beans mixed with samp or consumed as such. Cowpeas leaves are usually cooked and consumed with stiff maize porridge and stiff sorghum porridge, while some families consume the cowpea leaves with bread, rice and any pasta depending on their taste and preference

The majority of the women (82%) indicated that they consumed cowpea leaves as a vegetable with any of the commonly consumed starch-based products such as maize-meal, sorghum porridge and rice as indicated in Figure 4.5. Cowpea beans were also consumed. Usually one or more cups of cooked cowpea beans can be consumed per day. About 17.5% women indicated that children from the age of six months consumed cowpeas and some of them preferred cowpeas to any other vegetables. The intake and increase in the utilization of cooked cowpea beans could also depend on the age of children.

### **4.8.2 Cowpeas, nutrition and health**

According to the ARC, (2006), cowpeas leaves are nutritious containing vitamin A at 2250 mg, iron at 4 mg, protein at 4 mg, calcium at 221 mg and folic acid at 107 mg per 100g edible portion.

About 48% of women mentioned that they consumed cowpeas for nutritional purposes, but a very small percentage of 5% stated that they specifically consumed cowpeas to ensure a balanced diet and intake of nutrients. Moreover, 25% of women explained that they consumed cowpeas because the health institutions educated and encouraged them through the media to consume fruits and vegetables such as cowpeas.

Only 17.5% of women indicated that they ate cowpeas to alleviate hunger and 10% of the women used cowpeas as a meat substitute. There was also a belief that cowpeas cleansed the body, helped to prevent constipation and caused no allergies when consumed compared to other foods.

#### **4.8.3 Cowpea cultivation, harvesting, processing, preparation and storage**

Cowpeas are no longer considered as “poor man’s meat” but as an important vegetable to benefit most of food-insecure households, especially those who cannot afford to purchase a variety of foods to ensure an adequate nutritional intake. Many of the households do not cultivate a variety of food in gardens resulting in poor vitamin A intake (Asiamah, 2004).

#### **4.8.4 Cowpeas cultivation**

Cowpea leaves are harvested by hand four weeks after planting. After the flowering stage, cowpea beans are produced and harvested as fresh pods and later stored as dry pods (Van den Heever, 2007). Half of the respondents said that in a day they were able to harvest cowpea leaves to fill 2-5 containers of 12,5kg each, similarly with dry pods.

The study results showed that 95% of the women grew cowpeas in their household gardens of about 250 square metres and in small fields of approximately 1000 square metres. In this village only 5% did not grow cowpeas. The respondents were familiar with the different varieties of cowpeas for cultivation, such as *Porogwane*, *Mma-Claapa*, *Gopolanare*, *Tau*, and *Masiela*. *Tsilwane* is a common variety of cowpea that has a good yield of both leaves and beans.

Almost all respondents mentioned that cowpeas were cultivated to produce cowpea leaves (*morogo*) and beans (*dinawa*) which are then called “*morogo wa dinawa*”, meaning a vegetable accompaniment from bean leaves. Cowpea production is reliant on rainfall during the planting and harvesting season. Only 12.5% of the households used tap water to irrigate cowpeas growing in a household garden.

- **Processing**

Regarding processing, 92.5% of the women indicated that they washed the cowpea leaves thoroughly to remove soil and other particles then pre-cook it by low heat boiling in a bulk of about 50kg-60Kg for about 5-8 hours. The pre-cooked leaves get mashed or pounded in any cooking liquid remaining and then sundried. Well-dried cowpeas can be kept for 1-2 years without spoiling. If dried beans and leaves are kept in sealed containers they can be steadily used over an extended period of time. (Van den Heever, 2007).

- **Preparation**

Pre-cooked cowpea leaves are usually re-boiled for 10-30 minutes, and dried for one to two hours. Steaming is also a suitable applicable method of preparing the pre-cooked cowpea leaves. Almost all women (95%) mentioned that cowpeas could be mixed with other vegetables such as onions, tomatoes and potatoes seasoning such as salt added for palatability. Cowpeas are cooked in the same manner as spinach and pumpkin leaves and different vegetables can be added to enhance the taste (Nkouannessi, 2005).

Only 12.5% of women mentioned that sometimes crushed seeds of watermelon, traditional melon (*makatane, marotse*), goat's milk or peanut butter were added to cowpea leaves. Most of the women (85%) mentioned that cowpea beans could be mixed with samp or refined maize-corn while 42.5% said that they mixed the beans with unrefined maize-corn (*Kabu*). Some 17.5% households consumed beans as a soup or a relish and 20% mixed cowpea beans with unrefined sorghum grains (*mosutlhwane or lefatana*).

- **Storage**

After cowpea leaves have been precooked and sun dried, the leaves are stored in clean plastic or metal containers with tight fitting lids (Lost Crops of Africa, 2006). The dried beans are also stored in a similar way as the leaves, although they are stored precooked. Cowpeas can be stored for one year and more depending on storage conditions (Lost Crops of Africa, 2006).

#### **4.8.5 Cultural and indigenous knowledge of cowpeas**

Cowpeas are an indigenous vegetable that can be cultivated but they also grow as wild vegetables. The majority of respondents reported that they were introduced to cowpeas as a *Tswana* cultural food by their parents and grand-parents. Cowpea leaves, used as a relish, are commonly referred to as “*morogo wa setswana*”.

#### **4.8.6 Accessibility of cowpeas through buying and selling**

A good number of respondents (62.5%) purchased cowpeas as beans or leaves from a supermarket or street vendors, whilst 75.5% accessed it from their cultivated household gardens or small fields, with surplus sold in the community. The focus group discussions also indicated that families can receive cowpeas as gifts from their relatives and neighbours who would have cultivated and had a surplus harvest. About 60% of the women from the focus groups indicated that they usually bought the pre-cooked dry cowpeas leaves at P3.00 (R3.50) per cup from street vendors, or paid P5.00 (R5.50) per cup at the supermarket. Dry raw beans were also sold at P5.00 (R5.50) per cup from the street vendors and P8.00 (R8.50) from the supermarket.

#### **4.8.7 Summary of cowpeas consumption as a nutritious legume**

Studies have indicated that cowpeas are nutritious and can contribute to improved dietary diversity, diet quality and food access, especially in rural households which depend predominantly on starch-based foods such as sorghum porridge and maize-meal porridge (Ruel, 2006).

The micronutrients contained in cowpeas such as vitamin A, iron, calcium and potassium can make a significant contribution to adequate intake of nutrients thereby preventing deficiencies (Lost Crops of Africa, 2005). Cowpeas can be used to enhance the intake of micro-nutrients such as vitamin A and iron especially in some low-socio economic households which are vulnerable to poverty and can hardly purchase foods rich nutrients. The surplus production of cowpeas can also be helpful to maintain household food access

and even to sell the community to generate income for purchasing a variety of foods for household consumption.

## Chapter 5

### Summary and Recommendations

#### 5.1 Introduction

The focus of this study was to determine whether the consumption of cowpeas could make a contribution to diet diversity, diet quality and food access among households living in Gabane, a peri-urban area of Gaborone.

#### 5.2 Summary of study results

##### 5.2.1 Socio-demographic data

- The size of households was large, with on average of 6 people per household. These households are composed of extended family members which poses a critical need for a stable household food security. In most of the Southern African countries, including Botswana, households with more than seven members are more vulnerable to food insecurity and overall poverty. Furthermore, in Botswana, increased household size and HIV/AIDS infected household members has seriously affected household food security.
- The largest group of women (27.5%) were unmarried women staying without a partner, with less than 20% being unmarried women cohabiting with a partner.
- The largest group of women, namely 32.5%, had primary school education only, with 30% of the older group of 56 years of age and above with no education.
- Most of the households indicated that they were not in full-time or part-time employment to provide them with salaries or monthly income. Most of the women stated that they received money from their relatives who are working, parents who receive pensioner's allowance, by selling surplus from cultivated food and by part-time jobs whenever available in the village. This includes some of the governmental project for drought relief known as "*ipelegeng or namola-leuba*".

### **5.2.2. Diet diversity and diet quality**

The household dietary diversity of this study was very inadequate, with a diversity score of only 2.9, well below the cut-off point of 4. Diversity scores above 4 would be indicative of dietary intakes of a variety of foods and enhanced diet quality. The findings among these households indicated a poor intake of a variety of food from all food groups. The diet quality and vitamin A and iron intake was poor since the households did not consume nutritious diets.

The households predominantly consumed starchy foods especially sorghum, maize-meal, bread and rice. The majority of women, namely 95%, consumed foods from the cereal group, 52.5% consumed vitamin A rich fruits and vegetables but none consumed other fruits and other vegetables. Twenty percent consumed legumes, nuts and seeds, 50% meat, poultry and fish, 42.5% milk and milk products and 12.5% oils and fats.

The results of this study support the findings that in developing countries such as Botswana, people have a high reliance on starch based diets. A very low intake of fruit and vegetables would indicate a daily diet low in micro-nutrients, essential to health.

### **5.2.3. Diet diversity and food access data**

The study results indicated poor food access and poor diet diversity with a household dietary diversity score of 2.9. Diet diversity will assist households to change from monotonous diets to a more varied or diversified diets which will contribute to increased intakes of macronutrients and essential micronutrients. The consumption of diversified diets is mainly influenced by food access which is a key element for communities to achieve a good healthy and nutritional status.

The cultivation, accessibility and availability of foods such as exotic, wild and indigenous food including cowpeas can diversify and improve the quality of household diets and ultimately improve household food access. Most of the communities need to fully depend on the cultivation of food for household consumption, especially those in poor rural areas who cannot afford to purchase diversified of foods to meet the nutritional needs.

#### **5.2.4. Cowpeas and its potential contribution to diet diversity and food access**

The study indicated that 35% of household consumed cowpea leaves on a previous day of the interview. The study also indicated that 100% of adults and children consume cowpeas as leaves and beans. The study showed that cowpeas can contribute to household food access, diet diversity and diet quality.

Food access is directly influenced by factors such as the availability of finances to purchase nutritious foods, land to cultivate food, favourable climatic conditions including fertile soil, water and equipment to maintain such plants.

Cowpeas are a nutritious vegetable which grows well in semi-arid areas such as in Botswana. Cowpeas can be cultivated, accessed and utilized for household consumption thus contributing to diet diversity and food access. With the use of cowpeas for household consumption, both macro and micro nutrient intake are enhanced, especially vitamin A and iron. The underlying social, economic, and institutional factors within a community that affect households to achieve optimum diet diversity, food access and diet quality should be solved.

### **5.3. Recommendations**

This study indicated the need for improvement of diet diversity, diet quality and better food access for households. The results of this study could assist government to help the community realise the importance of cultivating cowpeas to obtain micronutrients such as vitamin A and iron as well as the value of eating a variety of foods.

#### **5.3.1 Diet diversity, diet quality, food access and cowpeas.**

The community should be empowered to improve their dietary diversity, diet quality and food access through kgotla meetings, support groups and any other local groups where people can gather and share ideas. The government can also assist the local groups to be empowered by providing relevant professionals to educate the community on improving their food access and diets.



### **5.3.2 Cowpeas, diet diversity and food access**

The cultivation, utilization and consumption of cowpeas should be encouraged in poor rural households who cannot afford to purchase variety of foods to promote and enhance their adequate intake of micronutrients. Cowpeas can be utilised by all households across the community and nationally for the promotion of micro-nutrient intake especially vitamin A and iron.

Women can also be empowered by the government to improve the cultivation of cowpeas for commercial purposes and through the income gained, households could benefit to purchase the necessary food needed to improve the health status of families.

## **5.4 Governmental ministries**

With reference to diet diversity, diet quality, food access and cowpeas cultivation, utilization and consumption, it is recommended that the Botswana Ministries of Education, Agriculture, Health and other stakeholders should jointly work to promote the consumption of a variety of foods, including cultivation and consumption of cowpeas to improve and sustain diet quality and food access

### **5.4.1 Ministry of Education**

- The Ministries of Education, Agriculture and Health can develop and disseminate the message of the importance of consuming diverse diets, including cowpeas, through the use of media such as news papers, booklets, brochures, handouts, radio and television. Teachers, students and other stakeholders working for the educational sectors can assist the government to plan, implement and monitor the dissemination of the information.

#### **5.4.2 Ministry of Agriculture**

- Agricultural training conducted by agricultural extension officers and other relevant stakeholder should be provided to assist the communities with cultivation of cowpeas in food gardens. Proper cultivation skills and knowledge are essential to provide a varied diet and information regarding cowpeas cultivation, storage, processing and consumption.
- The provision of quality seeds and effective equipment by government, donors and other organization can be of great assistance in improving the cultivation and propagation of cowpeas.
- Training on how food cultivation seasons can be maximised to produce enough food for households to access all year round should be provided.

#### **5.4.3 Ministry of Health**

- The Ministry of Health (MOH) can invest in health education to the community to know and understand the importance of vitamin A and iron. The use of cowpeas for vitamin A supplementation can also help to extend the vitamin A programme in clinics and during vitamin A campaigns.
- The Ministry of Health can conduct a study to analyze the nutrient content of cowpeas leaves and how it is influenced by preparation methods.
- Health Promotion Programmes should be established to:
  - Decrease nutritional losses due to processing, storing and cooking methods applied on cowpeas.
  - Encourage consumption of vitamin C rich fruits to improve bioavailability of iron.

- Food Product Development Programmes can be established to encourage research on new cowpea food products that are culturally acceptable and preferred by the community.

### **5.5 Further research on diet diversity, diet quality, food access and consumption of cowpeas.**

The study revealed the need for additional research to be conducted regarding diet diversity, diet quality, food access and consumption of cowpeas in peri-urban areas.

Future in-depth research and intervention programmes could indicate critical solutions on how the consumption of diversified diets and nutritious meals can be maintained. This could include simple methods and actions on how households can easily and affordably consume at least three nutritious meals per day. Further investigation on simple and sustainable ways of cultivating cowpeas all year round can be made to improve and sustain the cultivation of cowpeas.

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## **Appendices**

### **Appendix 1**

#### **Ethics letter of consent**

**Research Project and Title:** The Contribution of Cowpeas to Dietary Diversity and Food Access in peri-urban Gaborone, Botswana.

**Primary Investigator and contact details:** Ms O.B Olesitse

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**Supervisor:** Prof. EA Albertse

**Contact person:** Mrs. FM Ferreira

I....., have been informed on the nature and purpose of the research and I understand that the aims of the study is to find out the contribution of cowpeas as a legume crop for human consumption to household food security and to document findings of cowpeas as a potential legume vegetable to improve household food security and help to reduce food insecurity in the community.

I understand and agree to the following:

- That I am participating voluntarily
- That I can withdraw from the study at any time during the study without penalty or negative consequences
- That all information collected during the study will be treated as confidential and will remain anonymous and only made known if a participant's health is in danger. A code will be assigned to indicate my name and address
- That information collected in this study could, on completion, be made available to the community if so requested.
- That my participation will have no financial benefit to myself or the university
- That should questions arise or if clarification is needed, the researchers can be contacted at the telephone numbers below.
- That where applicable, institutional consent has been obtained.
- That information will be collected by using an interview with a questionnaire.

**Date:** .....

**Participant:** .....

## **Appendix 2**

### **Socio-demographic data questionnaire**

#### **Section 1**

##### **Participant's Details:**

Name: \_\_\_\_\_ Surname: \_\_\_\_\_

Village: \_\_\_\_\_ Ward (*kgotla*) \_\_\_\_\_

House Code: \_\_\_\_\_ Address: \_\_\_\_\_

No. of adults living in this household: [F] \_\_\_\_\_ [M] \_\_\_\_\_

No. of children living in this household: [F] \_\_\_\_\_ (Ages): \_\_\_\_\_

[M] \_\_\_\_\_ (Ages): \_\_\_\_\_

B1. What is your age in years? (Choose the correct range)

17-25	
26-35	
36-45	
46-56	
56+	

B2. What is your marital status?

Married	1
Unmarried, staying with a Partner	2
Unmarried, staying without a partner	3
Divorced	4
Widowed	5
Separated	6

B3. What is your highest educational level?

No formal education	1
Read and write	2
Junior primary	3
Primary	4
Secondary	5
Tertiary	6

## **SECTION 2**

### **Cowpeas consumption survey questionnaire**

#### **1. General Knowledge on Cowpeas**

1.1. Do you eat any beans, bean-leaves and other vegetable leaves in your household daily or weekly?

Yes	
No	

(a). If Yes, please explain why?

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(b). If No, please explain why? \_\_\_\_\_

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1.2. What do you generally know about cowpeas? (e.g. origin, production, storage, consumption, e.t.c.).

Origin	Production	Storage	Consumption	Other

1.3 (a) Who introduced you to cowpeas as food?

Relative	
Friend	
Community member	
Other	

(b). When was that?

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1.4 (a). Do you grow cowpeas?

Yes	
No	

(b). If Yes, where do you grow it: (please tick in the table below)

Backyard	
Fields (Masimo)	

(c). If No, please explain why.

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(d). Where do you get the water supply for the growth of your cowpeas? (please indicate below).

Tap water	
Rainfall	
Well	
Dam	
Borehole	

1.5. If you know more about cowpeas will you be willing to grow it? Yes /No

(a). If yes,  
why? \_\_\_\_\_

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(b). If no,  
why? \_\_\_\_\_

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1.6 If yes, please attend to the table below.....what was the question

	Cowpeas Leaves	Cowpeas Beans	Other Beans	Green leafy Veggies.
Best months for growing.				
Harvesting • No. of cups/bags per day				
Rainfall seasons (increase when)				
Drought effects. (decrease when)				

1.8. Do you purchase cowpeas as beans or greens (leaves) from supermarket or street vendors?

(a).

Yes	
No	

(b). If No, but your household does access/eat cowpeas, please indicate where you get it from?

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1.9. If Yes, please fill in the price list table below indicating how much in \*Pula (P) does it cost for both cowpeas beans and cowpeas leaves.

Street Vendor Prices (Pula (P) per cup)		Supermarkets Prices (Pula(P) per cup)		
beans	leaves	Beans	Leaves	

## 2. Cowpeas Consumption Habits

2.1. Do you eat cowpeas? Yes/ No

(a). If Yes, why?

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(b). If No, why?

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2.2. Do you like it or enjoy it? Yes/ No

(a). If Yes, why?

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(b). If No, Why?

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(c). How much per serving do you eat cowpeas? (Please give measures in table spoons).

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2.3. How often do you eat cowpeas? (Please tick where appropriate).

- ☐ Daily\_\_\_\_\_
- ☐ Weekly\_\_\_\_\_
- ☐ Monthly\_\_\_\_\_
- ☐ Occasionally\_\_\_\_\_

2.4. Do children eat cowpea dishes?

Yes	
No	

(a). If yes, at what age do they start to consume it?

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(b). How is it prepared/cooked for children?

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(c). How much per serving do children eat it? (Please give measures in tablespoons).

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2.4.1. In general how much per serving do adults eat cowpeas? (Please give measures in table spoons).

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2.5. Who eats the most cowpeas in this household?

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### 3. Preparation for consumption

- 3.1. Please tick in the table below the appropriate cowpeas parts for the appropriate cooking method and the time it takes to cook (minutes/hours).

<b>Cooking Methods</b>	<b>Fresh cowpeas beans</b>	<b>Fresh cowpeas pods</b>	<b>Dry cowpeas beans</b>	<b>Cowpeas leaves (fresh or dry)</b>	<b>Mixed (beans &amp; leaves)</b>
Boiling					
Steaming					
Frying					
Other					

- 3.2. Please give a brief description of how cowpeas parts below are consumed with other vegetables or ingredients (e.g. common vegetables usually added).

<b>Cowpeas Parts</b>	<b>Consumed with other</b>
Cowpeas beans	
Cowpeas leaves	

3.2. Indicate all other foods that can be well eaten together as an accompaniment with cowpeas.


3.3. Define the consumption of cowpeas in your household?

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NB: \* Pula (BWP.) is Botswana's currency.

### Appendix 3

#### Household Dietary Diversity Score questionnaire

NB: (the meal record should be based on the previous day meal consumed).

Question number	Food group	Examples		YES= 1 NO = 0
1	CEREALS	Bread ( <i>mangwinya, diphaphatha</i> )		
		Spaghetti, Macaroni, Noodles e.t.c.		
		millet, sorghum ( <i>bogobe jwa mabele/ting, kana jwa lerotse</i> ), <i>lefatana</i>		
		maize ( <i>phaletshe, mmedi, kabu, mageu</i> ),		
		Rice-meal, maize ( <i>mmelerice</i> ).		
		biscuits, cookies		
2	VITAMIN A RICH VEGETABLES AND TUBERS	Pumpkin, carrots, squash, or potatoes that are yellow or orange, ( <i>lerotse, makatane</i> ).		
3	WHITE TUBERS AND ROOTS	White potatoes, white yams, cassava or foods made from roots ( <i>digwere</i> ).		
4	DARK GREEN LEAFY VEGETABLES	Green pepper		
		spinach		
		chomolia		
		cabbage		
		cowpea leaves ( <i>morogo wa dinawa</i> )		
		Delele		
5	OTHER VEGETABLES (including wild vegetables)	<i>Rothwe</i>		
		<i>Thepe</i>		
		<i>Dikhushibele</i>		
		Any other wild vegetables ( <i>Merogo e mengwe ya naga</i> ).		
6	VITAMIN A RICH FRUITS	Ripe mangoes		
		papayas		
		Water melon ( <i>magapu</i> )		
		pawpaw		
7	OTHER FRUITS (including wild fruits)	<i>Mokgalo,</i>		
		<i>moretlwa</i>		
		<i>mmupudu,</i>		
		<i>mogorogorwana</i>		
		<i>motsokojane</i>		

8	ORGAN MEAT (IRON-RICH) other organ meats or blood based.	Liver ( <i>sebeta</i> )				
		Kidney ( <i>diphilo</i> )				
		Heart ( <i>dipelo</i> )				
		tripe ( <i>serobe, /mateng</i> )				
		gizzards ( <i>dintshuu</i> )				
		<i>lebete</i>				
9	FLESH MEATS	Beef				
		pork				
		goat				
		lamb				
		Rabbit ( <i>mmutle</i> )				
		chicken				
		wild game ( <i>nama ya diphologolo tsa naga</i> )				
10	EGGS	duck, or other birds ( <i>dikgaka, dinoyane</i> )				
11	FISH	<i>Mae a dikoko le a dinonyane</i>				
		Fresh fish				
		dried fish				
		Shellfish				
		Canned fish				
12	LEGUMES, NUTS AND SEEDS	Beans ( <i>dinawa</i> ) (specify) • soya • black-eyed				
		cowpeas				
		peas ( <i>ditloo</i> )				
		lentils ( <i>letlhodi</i> )				
		nuts ( <i>manoko</i> )				
		seeds ( <i>diithotse</i> )				
		<i>Morama</i> (wild nut)				
13	MILK AND MILK PRODUCTS	Milk, cheese, yoghurt and other milk products sour milk ( <i>madila</i> )				
14	OILS AND FATS	oils, fats or butter added to food or used for cooking ( <i>mafura</i> )				
15	SWEETS	Sugar, honey, sweetened soda or sugary foods such as chocolates, sweets or candies				
16	SPICES AND CAFFEINE OR ALCOHOL BEVERAGES	Spices, coffee, tea, alcoholic beverages or local examples				
				YES = 1 NO = 0		
Household level only	Did you or anyone in your household eat anything (meal or snack) OUTSIDE of the home yesterday?					

Version of May, 2007 by Food Agricultural Organization (FAO)/Nutrition and Consumer Protection Division from the FANTA Household Dietary Diversity Score.

#### **Appendix 4**

##### **Fourteen food groups collapsed to nine food groups**

<b>Fourteen food groups</b>	<b>Nine food groups</b>
1. Cereals	1. Cereals, roots and tubers
2. White tubers	2. Vitamin A rich fruits and vegetables
3. Vitamin A rich vegetables	3. Other fruits
4. Vitamin A rich fruits	4. Other vegetables
1. Other fruits	5. Legumes and nuts
2. Dark green leafy vegetables	6. Meat, poultry and fish
3. Other vegetables	7. Milk
4. Organ meat (iron rich)	8. Eggs
5. Flesh meat	9. Fats and Oils
6. Eggs	
7. Fish	
8. Legumes, nuts and seeds	
9. Milk and milk products	
10. Oils and fats	

## **Appendix 5**

The Internationally Standardized HDDS contextualized for Botswana (FAO, 2008)

<b>Internationally Standardised Food Groups (FAO, 2008)</b>	<b>Botswana contextualised Food Groups</b>
<b>1. Cereals:</b> corn/maize, rice, wheat, sorghum, millet or any other grains or foods made from these (e.g. bread, noodles, porridge or other grain products) + insert local foods e.g. <i>ugali</i> , <i>nshima</i> , porridge or pastas or other locally available grains.	<b>1. Cereals:</b> Bread (mangwinya, diphaphatha), biscuits and cookies, Spaghetti, Macaroni, Noodles, millet, sorghum ( <i>bogobe jwa mabele/ting</i> , <i>kana jwa lerotse</i> , <i>lefatana</i> , maize and maize-cob ( <i>phaletshe</i> , <i>mmedi</i> , <i>kabu</i> , <i>mageu</i> ) and maize-rice ( <i>mmelerice</i> ).
<b>2. Vitamin A Rich Vegetables:</b> Pumpkin, carrots, squash, or potatoes that are orange inside and other locally available vitamin-A rich vegetables (e.g. red sweet pepper).	<b>2. Vitamin A Rich Vegetables:</b> Pumpkin, carrots, squash, or potatoes that are orange, ( <i>lerotse</i> , <i>makatane</i> ).
<b>3. White Tubers and Roots:</b> White potatoes, white yams, white cassava or other foods made from roots.	<b>3. White Tubers and Roots:</b> White potatoes, sweet potatoes and other foods made from roots ( <i>digwere</i> ).
<b>4. Dark Green Leafy Vegetables:</b> dark green leafy vegetables, including wild ones and locally available vitamin A rich leaves such as amaranth, cassava leaves, kale and spinach.	<b>4. Dark Green Leafy Vegetables:</b> Green pepper, spinach, chomolia, cabbage, cowpea leaves ( <i>morogo wa dinawa</i> ) and Delele
<b>5. Other Vegetables:</b> other Vegetables (tomato, onion, eggplant) including wild vegetables.	<b>5. Other Vegetables (including wild vegetables):</b> <i>Rothwe</i> , <i>thepe</i> , <i>dikhushibele</i> and any other wild vegetables ( <i>Merogo e</i>



	<i>mengwe ya naga</i> ).
<b>6. Vitamin A Rich Fruits:</b> Ripe mangoes, cantaloupe, apricots (fresh or dried), ripe papayas, dried peaches and other locally available vitamin A-rich fruits.	<b>6. Vitamin A Rich Fruits:</b> Ripe mangoes, papayas, water melon ( <i>magapu</i> ) and pawpaw.
<b>7. Other Fruits:</b> other fruits including wild fruits).	<b>7. Other Fruits (including wild fruits):</b> <i>Mokgalo, moretlwa, mmupudu, mogorogorwana and motsokojane.</i>
<b>8. Organ Meat (iron-rich):</b> Liver, Kidney, Heart or other organ or blood based meats.	<b>8. Organ and blood based Meats (iron-rich) :</b> Liver ( <i>sebeta</i> ), Kidney ( <i>diphilo</i> ), Heart ( <i>dipelo</i> ), tripe ( <i>serobe, /mateng</i> ), gizzards ( <i>dintshuu</i> ) and <i>lebeta</i> .
<b>9. Flesh Meats:</b> Beef pork, goat, lamb, Rabbit, chicken, wild game, duck and other birds.	<b>9. Flesh Meats:</b> Beef pork, goat, lamb, Rabbit ( <i>mmutle</i> ), chicken, wild game ( <i>nama ya diphologolo tsa naga</i> ), duck and other birds ( <i>dikgaka, dinoyane</i> ).
<b>10. Eggs:</b> chicken, duck, guinea hen or any other birds' eggs.	<b>10. Eggs:</b> chicken eggs and birds eggs ( <i>Mae a dikoko le a dinonyane</i> ).
<b>11. Fish:</b> Fresh fish, dried fish or shellfish.	<b>11. Fish:</b> Fresh fish, dried fish, shellfish and canned fish.
<b>12. Legumes, Nuts and Seeds:</b> Beans, peas, lentils, nuts, seeds, or foods made from these.	<b>12. Legumes, Nuts and Seeds:</b> Beans ( <i>dinawa</i> ); soya, cowpeas black-eyed, peas ( <i>ditloo</i> ), lentils ( <i>letlhodi</i> ), nuts ( <i>manoko</i> ), seeds ( <i>diithotse</i> ), and <i>morama</i> (wild nut).
<b>13. Milk and Milk Products Milk:</b> milk, cheese, yoghurt and other milk products.	<b>13. Milk and Milk Products Milk:</b> cheese, yoghurt and other milk products such as sour milk ( <i>madila</i> ).



14. <b>Oils and Fats:</b> oils, fats and butter added to food or used for cooking (mafura).	14. <b>Oils and Fats:</b> oils, fats and butter added to food or used for cooking ( <i>mafura</i> ).
15. <b>Sugar:</b> Sugar, honey, sweetened soda or sugary foods such as chocolates, sweets and candies.	15. <b>Sugar:</b> Sugar, honey, sweetened soda or sugary foods such as chocolates, sweets and candies.

## Appendix 6

### Research permit letter

TELEPHONE: 3658400 TELEGRAMS: REFERENCE: CLG 14/14/3/1 XXV II (29) FAX: 3952382/3952384		MINISTRY OF LOCAL GOVERNMENT PRIVATE BAG 006 GABORONE BOTSWANA
<b>REPUBLIC OF BOTSWANA</b>		
May 6, 2008		
 Senior Chief's Representative Gabane Customary Court P. O. Box 21 Gabane		
<b>TO WHOM IT MAY CONCERN</b>		
<p>This letter serves to inform you that Ms. Olebogeng Olesitse has been issued with a research permit in order to conduct her research and/or interviews in Gabane village. She is working on an academic project entitled <b>Cosumption of Cowpeas and its Contribution to Household Food Security in Botswana.</b></p> <p>Please assist her in all ways possible as her research will be of great benefit to the country and other Batswana.</p>		
<p>Yours Faithfully</p> <p> K. Senthulne For P. S.</p> <p><b>MINISTRY OF LOCAL GOVERNMENT</b> <b>PRIVATE BAG 006</b> <b>GABORONE</b> <b>BOTSWANA</b></p>		