CHAPTER 2

Literature review

2.1 INTRODUCTION

The literature reviewed in this chapter is centred on diabetes mellitus (types, causes, philosophy and pathophysiology) and its treatment. Under "treatment", different types of orally administered, as well as injections of insulin used in treating diabetes mellitus have been described. The complications of diabetes, their prevention and management as well as factors identified as stumbling blocks to diabetic control, have been described. National and international sources were cited.

2.2 DIABETES MELLITUS

2.2.1 Definition

Diabetes mellitus is a complex, chronic disease. It is a condition characterised by an elevation of the level of glucose in the blood. Insulin, a hormone produced by the pancreas, controls the blood glucose level by regulating the production and storage of glucose. In diabetes there may be a decrease in the body's ability to respond to insulin or a decrease in the insulin produced by the pancreas which leads to abnormalities in the metabolism of carbohydrates, proteins and fats. The resulting hyperglycaemia may lead to acute metabolic complications including keto acidosis and in the long term contribute to chronic micro-vascular complications (Smeltzer & Bare 1992:1022). Phipps et al (1987:601) define diabetes mellitus as a complex, chronic disorder characterised by disruption of normal carbohydrates, fat and protein metabolism and the development over time of micro-vascular and macro-vascular complications and neuropathies.

Black and Matassarin-Jacobs (1993:1775) define diabetes mellitus as a metabolic disorder characterised by glucose intolerance. It is a systemic disease caused by an imbalance between insulin supply and insulin demand. The onset is from 3 years in children and 25 years in adults. According to Friderichsen and Maunsbach (1997:58), the criteria for diagnosis of diabetes mellitus have been explained and include a causal plasma glucose of 11.1mmo1/L or higher, or fasting plasma glucose of 7.0mmo1/L or higher. According to Baumann, Chang and Hoebeke (2002:191), the prevalence of diabetes is higher in minority groups and among those who are socio-economically disadvantaged, but the reason for that has not been given.

2.2.2 Types

There are four major classifications of diabetes mellitus, namely:

- **Type I**

This is known as IDDM. About 5-10% of patients have type I diabetes mellitus. The pancreas produces inadequate amounts of insulin, resulting in the need for insulin injections to control the blood glucose. It is characterised by a sudden onset, usually before the age of 30 years. (Royle & Walsh 1992:597).

According to Lewis, Collier and Heitkemper (1996:1441), in type I diabetes, also called IDDM, auto-immune B-cell destruction is attributed to a genetic predisposition coupled with viral agents and possibly chemical agents. Individuals susceptible to type I diabetes are linked to HLA (Human Leucocytes Antigen) DR3 and DR4 loci (DR3 and DR4 are just numbers used to identify the antigens).

- **Type II**

This is also known as the NIDDM. It results from a decrease in the sensitivity of the cells to insulin and a decrease in the amount of insulin produced. About 90-95% of patients have type II diabetes. This type II diabetes is treated with diet and exercise, and if elevated glucose levels persist, diet is supplemented with oral hypoglycaemic agents. During periods of illness or surgery, individuals who usually control their type II diabetes with diet, exercise and oral agents, may require insulin injections. In some individuals oral agents fail to control hyperglycaemia and insulin injection is required (Royle & Walsh 1992:597).

Whittemore, Chase, Mandle and Roy (2002:18) indicate that type II diabetes accounts for 80-90% of all cases and is the significant cause of morbidity in the United States. The complications of type II result in disruption of lifestyle, psychosocial adjustment and health care expenses. It is often treated with diet, exercise, self-monitoring of blood glucose and hypoglycaemic agents/insulin.

Lewis et al (1996:1442) indicate that there are two subtypes of type II, obese and non obese. Type II has a strong genetic influence but there is no correlation with HLA (Human Leucocytes Antigen) type. Individuals with type II diabetes have a 50% chance of transmitting the disease to their children.

- **Other types (type III)**

This is where diabetes mellitus is associated with other conditions, for example, pancreatic disease, hormonal disorders and drugs such as glucocorticoids and oestrogen-containing preparations. Depending on the ability of the pancreas to produce insulin, the patient may require oral agents or insulin (Smeltzer & Bare 1992:1023).

- **Gestational diabetes mellitus**

The onset of Gestational diabetes mellitus is during pregnancy, usually in the second or third trimester, as a result of hormones secreted by the placenta, which inhibit the action of insulin. It occurs in about 2-5% of all pregnancies. About 30-40% of patients with Gestational diabetes mellitus will develop type II diabetes within 5-10 years (especially if obese). Impaired glucose tolerance and statistical risk groups are examples of Gestational diabetes mellitus. Statistical risk groups are individuals at greater risk than the general population of developing diabetes, and the risk factors include immediate family members with the disease and presence of islet cell antibodies (Royle & Walsh 1992:597; Smeltzer & Bare 1992:1022).

2.2.2 Causes

In Royle and Walsh (1992:596) and Smeltzer and Bare (1992:1025) the causes of type I diabetes are described and include genetic factors, immunologic factors, environmental factors and infectious agents.

2.2.3.1 Type I

- **Genetic factors**

People do not inherit type I diabetes mellitus itself, but they inherit a genetic predisposition towards developing type I diabetes mellitus. This genetic tendency has been found in people with certain HLA. HLA is a cluster of genes responsible for transplantation of antigens and other immune processes. The risk of developing type I diabetes is increased three to five times in people who have one of these two HLA types (Royle & Walsh 1992:596; Smeltzer & Bare 1992:1022).

- **Immunologic factors**

People with type I diabetes have an auto-immune response, and this auto-immune response is an abnormal response in which antibodies are directed against normal tissues of the body, responding to

these tissues as if they are foreign. Auto-antibodies against islet cells and against endogenous (internal) insulin have been detected in people at the time of diagnosis and even several years prior to the development of clinical signs of type I diabetes (Royle & Walsh 1992:596; Smeltzer & Bare 1992:1026).

- **Environmental factors**

It has been proposed that certain viruses or toxins may precipitate the auto-immune process that leads to beta cell destruction, and the events that lead to beta cell destruction are not fully understood (Royle & Walsh 1992:596; Smeltzer & Bare 1992:1026).

- **Infectious agents**

Viral infections may cause insulin independent diabetes mellitus. Indirect evidence is that the onset of IDDM increases, following childhood viral infection (Royle & Walsh 1992:596).

2.2.3.2 Type II

The exact mechanisms that lead to insulin resistance and impaired insulin secretion in type II diabetes are unknown. Genetic factors are said to play a role in the development of insulin resistance. In addition, the following risk factors are associated with the development of type II diabetes: age, obesity, stress, depression, family history and ethnic group (Bain 2001:3; Crowther & Van der Merwe 2001:570; Smeltzer & Bare 1992:1026).

2.2.4 Signs and symptoms

The signs and symptoms present as a result of **hyperglycaemia** (excessive sugar in the blood). There is an increase in urine output (polyuria) which results from the glycosuria (glucose in urine) secondary to hyperglycaemia. Patients experience increased thirst (polydipsia) which is secondary to osmotic diuresis and hyperosmolality. Increased appetite (polyphagia) results because of cellular starvation, and decreased storage of calories. Weight loss in the presence of polyphagia is due to the ineffective metabolism of carbohydrate, protein and fat. Weakness and lethargy are experienced as a result of inadequate energy production (Phipps et al 1987:610).

Fatigue is another symptom of diabetes mellitus. Wounds heal poorly. They take a long time to heal due to poor blood circulation to the lower extremities. Vaginitis may be an early complaint in females. The person may also complain of blurred vision (Lewis et al 1996:1440; Smeltzer & Bare 1992:1024, 1025). Dry

mucous membranes, dry skin, tachycardia and nausea may also manifest if the patient is unable to take in enough fluids to replace the losses through osmotic diuresis (Phipps et al 1987:610).

The signs of **hypoglycaemia** (a deficiency of sugar in the blood) are most commonly seen as side effects of insulin therapy or with the use of oral hypoglycaemic agents in patients with diabetes mellitus. Signs such as sweating, trembling and shakiness, which result from increased sympathetic stimulation, cause considerable discomfort. Patients can also experience palpitations, nervousness, hunger, faintness, weakness, irritability, headaches, visual disturbance, marked personality changes and confusion. A coma and convulsions can follow (Bain 2001:15; Phipps et al 1987:638).

2.2.5 Normal physiology

Insulin is secreted by beta cells in the islets of Langerhans in the pancreas. When a meal is eaten, insulin secretion increases, and moves glucose from circulation into muscle, liver and fat cells. Insulin stimulates storage of glucose in the liver and muscle; it also enhances storage of dietary fat in adipose tissue and accelerates the transportation of amino acids derived from dietary protein into cells. Insulin further inhibits the breakdown of stored glucose, protein and fat. In normal conditions insulin is released continuously into the blood stream. The activity of released insulin lowers blood glucose and facilitates a stable, normal glucose range of approximately 3.9 to 6.7 mmol/l. During fasting periods (between meals and overnight) there is a decreased release of insulin and increased release of glucagon. Glucagon counters the effects of insulin because it stimulates the release and breakdown of glycogen from the liver and thereby increases blood glucose levels. The net effect of the balance between insulin and glucagon levels is to maintain a constant level of glucose in the blood (Lewis et al 1996:1439; Smeltzer & Bare 1992:1024).

2.2.6 Pathophysiology

Smeltzer and Bare (1992:1024) describe the pathophysiology of type I diabetes mellitus, which is marked by a deficiency in the production of insulin by the pancreatic beta cells. Fasting hyperglycaemia occurs as a result of unchecked glucose production by the liver. Glucose from food eaten cannot be stored but remains in the blood stream and contributes to postprandial (after-meal) hyperglycaemia.

If the concentration of glucose in the blood is high, the kidneys may reabsorb all the filtered glucose. The glucose then appears in the urine, the term for which is glucosuria. When excess glucose is excreted in urine it is accompanied by excessive fluid and electrolyte loss. As a result of the excessive loss of fluid, the patient experiences increased urination (polyuria) and increased thirst (polydipsia) (Smeltzer & Bare 1992:1024).

Insulin deficiency also impairs the metabolism of proteins and fats, leading to loss of weight. Patients may experience an increased appetite (polyphagia) due to decreased storage of calories. Breakdown of stored glucose (glycogenesis) and of new glucose from amino acids (glyconeogenesis) occurs as the insulin deficiency progresses. These contribute further to hyperglycaemia (Smeltzer & Bare 1992:1024).

In type II diabetes there are two main problems related to insulin, namely insulin resistance and impaired insulin secretion (Smeltzer & Bare 1992:1025). Insulin resistance refers to decreased sensitivity of the tissues to insulin. Normally insulin binds to special receptors on cell surfaces. As a result of insulin binding to these receptors, a series of reactions involved in glucose metabolism occurs within the cell. The insulin becomes less effective in stimulating glucose uptake by tissues (Smeltzer & Bare 1992:1025).

Excessive secretion of insulin should take place in order to overcome insulin resistance and to prevent the build-up of glucose in the blood. If the beta cells fail to secrete excessive amounts of insulin, the glucose level rises and type II diabetes develops (Smeltzer & Bare 1992:1025).

2.3 MANAGEMENT AND CONTROL OF DIABETES MELLITUS

The focus of the management of diabetes is maintaining a healthy lifestyle by following the correct diet, exercising, and taking medication as prescribed.

2.3.1 Diet

Diet constitutes the foundation of diabetes management. The nutritional management of the patient with diabetes is geared towards the following:

- provision of all the essential food constituents
- meeting energy needs
- maintenance of an ideal weight
- decrease of elevated blood lipid levels
- achievement of blood glucose levels close to normal

The diet that is prescribed for diabetic patients as well as the one that is restricted for them will be discussed. Type II diabetes is treated by diet and exercise, and only when elevated glucose levels persist are supplements of oral agents as well as insulin injections given (Royle & Walsh 1992:597; Whittemore et al 2002:18).

2.3.1.1 Dietary restrictions

Savoca and Miller (2001:225) indicate that previous research showed that people with diabetes found the most difficult component of their self-care regimen to be adhering to a healthy diet. People with diabetes were reported to be more resistant to dietary change when compared to people with other chronic diseases. Fukunishi and Akimoto (1997:1364) and Whittemore et al (2002:22) reported in their research study that diabetics seem to fail in keeping to an appropriate diet for various reasons. The patient may overeat to cope with stress and negative feelings. When the patient eats away from home, it makes it hard for him/her to control what and how much is eaten. The patient may not resist temptation and intense cravings. Deprived feelings, social events and lack of family and friends' support may contribute to poor adherence to the recommended diet.

Toljamo and Hentinen (2001:619) also indicate that social support is important for patients with chronic diseases as it promotes adherence to self-care, thereby achieving better metabolic control. They further indicate that emotional support might be a motivating factor in improving adherence to health recommendations.

In Cleaver and Pollourios (1994:17) and Travis (1997:152), diabetic patients indicated that food restriction is the main reason for failure to adhere to their diet. The reason given is sound because people say the food is nice or well cooked if it is salty, fried or sweetened, but if the food is boiled or unsalted, people often say that the food is not palatable because they need fried, salted food, cakes and sweet drinks. Some patients have a tendency of following a high sodium diet whereas they have been advised to follow a low sodium diet, and others drink tea with sugar and not sweeteners. They are doing this when they think that they are not seen by health care providers, forgetting what the end-result will be.

Dietary restrictions reduce the social activities of some of the patients, as they no longer attend parties or women's clubs, to mention but a few, for fear of temptation. At social gatherings they eat whatever is available and in the end their blood glucose level is not controlled and they may end up with hyperglycaemia. In the case of hypertensive patients, their blood pressure remains elevated (Cleaver & Pallourios 1994:181).

The diet that is forbidden to diabetic patients is the one that is eaten at parties, for example, cakes, cold drinks, sweets, fatty foods in the form of meat as well as alcoholic beverages. Smeltzer and Bare (1992:1029) indicate that alcohol ingestion needs to be completely restricted by diabetic patients because of the danger of hypoglycaemia when alcohol is taken on an empty stomach.

Alcohol consumption may lead to excessive weight gain due to the high calorie content of alcohol. The patient on diabinese may experience headaches, warmth, nausea, vomiting, sweating and thirst following alcohol consumption.

Excessive alcohol intake may impair a person's ability to recognise hypoglycaemia and to follow a prescribed meal plan in order to prevent hypoglycaemia. Reduction of fat intake is stressed in order to reduce risk factors such as elevated serum cholesterol levels which are associated with the development of coronary heart disease.

2.3.1.2 Prescribed diet

The diet that should be followed by diabetic patients is discussed below, and reference is made to the importance of eating three meals per day and having snacks in between meals to prevent hypoglycaemia. The diet that is recommended for diabetic patients should comprise of the following:

- Carbohydrates like brown bread, maize meal, cereals and potatoes, because they add bulk to the diet, making it difficult to over-eat on these foods even when eating to satisfy the appetite.
- Food rich in fibre, e.g legumes, oats, soya products, vegetables and some fruits – a high fibre diet plays a role in lowering cholesterol in the blood, and improving blood glucose levels, thus decreasing the need for exogenous insulin. There are two types of fibre, soluble and insoluble. Soluble fibre lowers blood glucose and lipid levels. It forms a gel in the gastro-intestinal tract, which slows the emptying of the stomach. The result is a slower rate of glucose absorption from the food, and has a potentially glucose-lowering effect. Insoluble fibre increases stool bulk and prevents constipation (Smeltzer & Bare 1992:1029).
- A low-fat diet is recommended to reduce the risk of elevated serum cholesterol levels, and reduce weight.
- Vegetables can be eaten raw or boiled (without the addition of sugar, salt or butter).
- Spices, herbs and salt meant for hypertensive patients, that are available at selected supermarkets, should be used instead of ordinary salt. These reduce the accumulation of fluids in the body caused by the intake of ordinary salt.
- Snacks such as fruits and provita should be part of the diet and should be taken between meals to prevent hypoglycaemia and to prevent the patient from eating full meals frequently which can lead to weight gain.
- A glass of low fat milk or yoghurt should be taken per day. Although they contain simple sugars, their avoidance is inappropriate (Delport 2002:35; Smeltzer & Bare 1992:1028).

The use of a moderate amount of table sugar is gaining wider acceptance, provided the patient can maintain adequate blood glucose levels, blood lipid levels and weight control. For some patients, a more liberal use of simple carbohydrates can be a major factor in promoting adherence to a meal plan (Smeltzer & Bare 1992:1028). Patients should drink pure juice and diet cold drinks. Sweeteners should be used to sweeten drinks such as tea and coffee. There are two types of sweeteners, namely nutritive and non-nutritive sweeteners. Non-nutritive sweeteners are calorie-free and can be taken in unlimited quantities, whereas nutritive sweeteners should be taken in small quantities as large quantities cause hyperglycaemia (Smeltzer & Bare 1992:1031).

Smeltzer and Bare (1992) indicate that diabetic patients should maintain their ideal weight. It is therefore important that overweight patients adhere to their diet in order to reduce weight. They can adhere to their prescribed diet with the help of ADIFAX capsules, which prevent weight gain while the patient is following the normal diet. This may ensure adherence to the recommended diet as the patient may eat whatever she/he likes, at any time, but still attain the ideal body weight. Another drug said to promote and maintain weight loss is XENICAL. If taken for two years, it prevents weight gain as indicated by the report (Sanders 1995:7; Xenical: New Hope for the Treatment of Obesity 1999:1).

Long-term adherence to the meal plan is one of the most challenging aspects of diabetes management. For those who have lost weight, maintaining the weight loss is often difficult. In order to assist these patients to incorporate new dietary habits into their lifestyles, group support and on-going nutrition counselling is encouraged. The meal plan for all diabetic patients must take into consideration the patient's food likes and dislikes, lifestyle, usual eating times, and ethnic and cultural background (Smeltzer & Bare 1992:1028).

2.3.2 Exercise

Exercise is considered an essential part of diabetic management. It contributes to the reduction of weight and cholesterol level. Exercise is important because of its effect on lowering blood glucose and reducing cardiovascular risk factors. It increases the uptake of glucose by the body muscles and improves insulin utilisation. Patients should be encouraged to exercise daily at the same time and for the same amount to maintain constant, normal blood glucose levels.

Patients need to consult the health care personnel before resuming with exercise to give them advice on when to exercise and when not. This is important because exercising with elevated blood glucose levels will cause increased secretion of glucagons, growth hormone and catecholemines. The liver will then release more glucose, resulting in an increase in blood glucose. Exercise should therefore not be

performed until blood glucose levels are under 14mmol/L. Patients should monitor blood glucose levels before, during and after exercise to determine the effect exercise has on the blood glucose level at particular times of the day. They should be made aware of the possibility of exercise-induced hypoglycaemia, which may occur after exercise (Smeltzer & Bare 1992:1031).

Patients on insulin should take a fruit or snack before engaging in moderate exercise to prevent hypoglycaemia. The fruit or snack taken, needs to be deducted from the regular meal plan. The patient may eat a snack at the end of a strenuous exercise session, and may reduce the dosage of insulin that is peaking at the time of exercise to avoid post-exercise hypoglycaemia. Exercise can be in the form of walking, swimming, aerobics, playing soccer or participating in athletics (Lewis et al 1996:1453; Smeltzer & Bare 1996:1026). Physical activities such as gardening and housework are also regarded as exercise as these also assist in facilitating the effect of insulin and promote a feeling of general well-being which reduces the stress caused by diabetes.

2.3.3 Treatment of diabetes

2.3.3.1 Oral anti-diabetic drugs

Gregory (1997:30), Lewis et al (1996:1451), Pulse (2001:P1), Sanders (1995:9) and The Control of Glucomodulation (1995:67), describe various oral anti-diabetic drugs to be used by diabetic patients in case their blood glucose levels remain elevated in spite of the recommended diet. The four types of oral anti-diabetes drugs described include: Sulphonylureas (Rastinon), Metformin (Glucophage), Acarbose and Actos.

- **Sulphonylureas (Rastinon)**

They remain the mainstay of the treatment of type II diabetes in older people. They stimulate the release of insulin in the pancreas. Patients using sulphonylureas need counselling regarding the taking of regular meals and the signs and symptoms of hypoglycaemia, because the drug causes hypoglycaemia. If possible it should not be given to the elderly because they do not eat enough due to many problems associated with their age. Sulphonylureas causes an increase in weight and it should therefore be used by thin or normal weight patients (Gregory 1997:30).

- **Metformin (Glucophage)**

It acts by reducing glucose production by the liver. Overweight patients can use this since there is less risk of gaining weight. It also lowers cholesterol concentrations, and does not cause hypoglycaemia (Gregory 1997:32).

- **Acarbose**

The drug delays the absorption of glucose from a carbohydrate-containing meal. It reduces the fluctuation in daily blood glucose levels and can be used by non-insulin dependent diabetic patients. A patient whose blood glucose remains high in spite of the diet and the oral anti-diabetic drugs, may be given insulin injections (Gregory 1997:32).

- **Actos**

This is a new drug known as thiazilidinediones (TZDs) or Glitazones. It tackles insulin resistance by reducing resistance rather than increasing insulin production. Actosis is indicated as an adjunct to diet and exercise to improve glycaemic control in patients with type II diabetes. Actos is effective as monotherapy and reduces the risk of microvascular complications by 2.6% (Mollentze 2000:867).

2.3.3.2 Insulin injections

As mentioned earlier, apart from oral drugs there is the insulin injection. According to Mollentze (2000:862), insulin treatment is usually introduced when a patient with type II diabetes cannot achieve satisfactory metabolic control with diet, exercise and oral agents. Insulin therapy should not be avoided in older type II diabetic patients with unacceptable glycaemic control. Although twice daily injections of insulin is the approach of choice, combining night time insulin with day time metformin was reported to give superior results compared with other regimens in a study that included elderly patients. For those who are "needle phobic", a psychologist should be recommended (Focus on the positive … 1998:18).

The different types of insulin injections range from short-acting and intermediate to long-acting. Examples of commonly used insulin include the following:

- **Short acting**

Short-acting insulin is given 4-6 hourly and includes Humalog (Insulin lispro), Human Actrapid, Humalin S, Human Velosulin and Hypurin reutral. Humalog is a rapid-acting insulin analogue, which has to be injected immediately before or even after the meal, thereby allowing patients more lifestyle flexibility (Mollentze 2000:862). The remaining short-acting drugs listed above are given to patients in keto acidosis, four times daily, 30-45 minutes before each meal and at midnight. Black and Matassarin-Jacobs (1993:1793) define keto acidosis as a condition where the liver produces excessive ketone bodies and these ketone bodies accumulate in the blood and are excreted into the urine.

- **Intermediate acting**

Examples of intermediate acting insulin include Protophane, Human Insulatard, Human I, Semitard MC and Insulatard and are given every 12 hours (Pullen 2002:27).

- **Long acting**

They include Human Monotard, Human Ultratard and Lentard MC and are given daily.

- **Mixture of short and intermediate acting**

These insulins are given subcutaneously and include Rapitard MC, Humalin M2 20/80, and Mixtard 30/70. According to Amiel (1995:65), research findings indicate that new insulin has been developed which requires a patient to inject it one hour before meal-time. This long waiting period might be the cause of poor glucose control as patients might not adhere to the principles of insulin administration.

Previously, before the new insulin was developed, patients were injecting insulin 30 minutes before meal-times and it was later shortened to 15 minutes with human insulin. Many patients found it inconvenient and were injecting it almost immediately before eating. This long waiting period of an hour will create the same problem as before when patients were using insulin which required them to wait 30 minutes before they ate their meals, as they were injecting themselves immediately before eating. And now they are expected to wait for an hour, whereas with 30 minutes they failed. This would not be possible.

According to New Fast-acting Insulin (1997:48), rapid-acting insulin (Humalog) was introduced, which requires a person to inject some seconds before eating. This might help diabetic patients who are working and have a morning rush, including those who are going to school since they will not have to wait long. This

might allow diabetic patients to live a normal lifestyle while controlling their blood sugar level, as balancing of food intake with the required insulin becomes much easier when the food is already on the plate. However, individuals are unique, and hence the Humalog is not going to suit everybody. Other patients saw its fast-acting qualities as an answer to their prayers, while others asked to go back to their normal short-acting insulin (New Fast-acting Insulin 1997:48).

2.3.4 Diabetic control

Aspects which are considered essential to diabetic control include urine and blood glucose self-monitoring, foot care, eye care, attendance of diabetic clinics and counselling. According to Brown and Segal (1996:915), patient belief systems should be considered when developing interventions and when monitoring patient outcomes. These are beliefs of patients relevant to their disease and their evaluation of alternative treatments as recognised by the patients. Brown and Segal (1996:916) showed that individual health and treatment perceptions are related to treatment practices among African and White American diabetics. Compliance with treatment is affected by individual demographic characteristics as well as by beliefs about the cost of treatment and the benefits of home remedies.

According to Kyngas and Rissanen (2001:771), the predictor of good compliance is support from nurses, physicians, parents and friends. When patients are encouraged to actively participate in decisions, they ultimately achieve higher levels of compliance (Rasmussen, Wellard & Nankervis 2002:629).

Bain (2001:4) defines diabetes as a self-managed condition and as such patients should acquire relevant knowledge, skills and attitudes for successful management of diabetes. They should be educated about diagnosis, recognition of diabetes symptoms, blood glucose and urine monitoring, as well as appropriate action in response to abnormal findings (Bain 2001:15).

Patients, friends and family members should be educated and the information should include the following:

2.3.4.1 Urine glucose self-monitoring

Diabetic patients should be taught and encouraged to test their urine for glucose and acetone, although this is not as accurate as blood glucose monitoring. They need to be taught that the basis for urine glucose measurement is that glucosuria is correlated with hyperglycaemia. Various tests used as part of urinalysis should be made known to diabetic patients. The procedure involves applying urine to a reagent strip or tablet and matching colours on the strip with the colour chart at the end of a specified period. The procedure has the following disadvantages:

- Results do not reflect the blood glucose level at the time of the test.
- It is difficult to detect hypoglycaemia because a negative urine glucose result may occur when blood glucose ranges from 0 to 180mg/dl (10mmol/L).
- Some medications may interfere with test results, e.g. aspirin, vitamin C (Phipps et al 1991:1126; Smeltzer & Bare 1996:1030).

2.3.4.2 Blood glucose self-monitoring

Blood glucose self-monitoring is preferable to urine monitoring. Patients and family members should be instructed on how to do blood glucose self-monitoring. It should be done daily and the data used to self-adjust the diet, exercise, and medication. Blood glucose monitoring assists in identifying and treating hyper- and hypoglycaemia. It is more reliable than urine testing which is influenced by age and medication taken. It can measure the degree of hypo- or hyperglycaemia. Patients and family members should be taught how to monitor their blood glucose, using various types of monitors.

The following steps should be taught to all patients performing capillary blood glucose monitoring:

- They should wash their hands in warm water and avoid using alcohol swabs.
- They should let their arms hang for few minutes if it is difficult to obtain an adequate amount of blood for testing.
- The puncture is made on the side of the finger pad, not near the centre, because there are fewer nerve endings along the side of the finger pad.
- They should avoid a very deep puncture as this causes pain.

Patients and family members should be taught to use chemstrip bG with their meters or to use chemstrip bV which does not require a meter.

The procedure for self-monitoring of blood glucose is simple. There is a strip which is placed in the meter first before blood is applied to it. Then the patient pricks his/her finger and applies a drop of blood to the strip. Once blood is placed on the strip, it remains there for the duration of the test, and the meter automatically displays the results (Lewis et al 1996:1455; Phipps et al 1991:1125; Smeltzer & Bare 1996:1027; The Primary Health Care Package for South Africa 2002).

2.3.4.3 Foot care

The importance of appropriate foot care for diabetics cannot be over emphasised, the reason being to prevent injury to the feet as one of the complications of diabetes. Peripheral vascular disease causes arterial occlusion in the lower extremities (discussed in 2.6.1.3) with the result that wounds heal poorly. Another complication, neuropathy (discussed in 2.8.3), causes loss of sensation. Diabetics may therefore more easily suffer injuries to their feet. Diabetic foot ulcers are the most common foot injuries which may lead to amputation of the lower extremities. It is estimated that 15% of all diabetics will develop a serious foot problem which can threaten a limb (Naude 2003:2). Diabetic patients' feet should be assessed by health care providers during check-up visits. They should be given guidelines for foot care which include:

- daily inspection of feet for redness, blisters, calluses or ulceration and thickening of toenails. If they have a visual impairment or decreased joint mobility, they should request a family member to inspect their feet or use a mirror for inspecting the bottom of their feet
- daily washing of the feet with mild soap and warm water
- checking the temperature of water before washing
- patting dry in between the toes
- applying lanolin to the feet to prevent dry skin
- using a mild foot powder if feet are sweating
- avoiding walking with bare feet as they can be injured without being aware
- cutting nails straight across when they are still soft and then filing them
- avoiding cutting corns on their own, and instead, consulting a podiatrist for calluses, corns and ingrown toenails
- separating overlapping toes with cotton wool pads
- breaking in new shoes slowly and avoiding wearing high heeled, open toed shoes
- wearing well-fitting leather shoes
- inspecting the interior surface of shoes for foreign objects
- having their feet examined at least every six weeks by a podiatrist
- avoiding the use of hot water bottles or electric pads to warm the feet
- avoiding smoking, prolonged sitting or standing, and crossing the legs
- not immersing the feet in cold water (Diabetes Education 1998:22; Foot lesions 1997:34; Long-term Complications[sa]:36; Naude 2003:4; New Fast-acting Insulin 1997:50; Sanders 1995:10; Smeltzer & Bare 1992:1063)

2.3.4.4 Eye care

Frequent eye examination is encouraged to preserve vision, because this allows for the detection of any retinopathy. Diabetic patients should be referred to an ophthalmologist every six months. Patients should be taught to apply eye patches, especially after ophthalmic procedures in order for the eye to rest, and also to protect it from light. Dark glasses may be worn instead of eye patches. Patients should be counselled, bearing in mind that their visual impairment differs. All patients should have a routine glaucoma evaluation at age 35 years and periodic re-evaluation every 2-5 years (Smeltzer & Bare 1996:1634, 1639).

2.3.4.5 Attendance at diabetic clinic

Attendance at diabetic clinics forms part of diabetic management. Diabetic patients should attend diabetic clinics monthly for check-ups or as indicated by health care providers. Diabetic clinics exist to review treatment and control blood glucose, to screen for early detection of complications like retinopathy and neuropathy, and for the provision of ongoing health education. Coates (1994:268) indicated that clinic attendance is associated with reduced diabetic morbidity. Jacobsen in Coates also found that diabetic patients who were attending the diabetic clinic infrequently were having poor glycaemic control as compared to those who attended regularly. Kritzinger (1990) in Coates (1994:265) stated that patients need to attend clinics regularly to monitor their vision for signs of retinopathy. She noted that if they wait until they are experiencing loss of vision they will not benefit fully from treatment.

2.3.4.6 Counselling

Both patients and family members should be counselled by health care providers in order to accept the condition and the fact that lifelong therapy will be necessary. They should be reassured about the continuity of care and the value of compliance with the treatment regimen (Bain 2001:15). Counselling of patients should include emphasis on self care with reference to wearing a Medic alert bracelet, carrying of sweets for immediate treatment of hypoglycaemia, regular home monitoring of blood and urine glucose levels, weight control and reading food package labels to ensure that forbidden food is not purchased. Patients should keep social contact with friends and local interest groups and the family should be involved in the treatment regimen to offer support and encouragement (Bain 2001:15). According to Westaway, Rheeder, Van Zyl and Seager (2002:69), various studies have indicated the importance of clear communication and information, courtesy, consideration, partnership building, more social conversation, more immediate and positive non-verbal behaviour and interpersonal competence when dealing with diabetic patients. The length of consultation, frequency of contact, technical competence and service availability were factors identified as increasing patient satisfaction.

2.4 FACTORS IDENTIFIED AS STUMBLING BLOCKS TO DIABETIC CONTROL

2.4.1 Support system

Thompson (1995:1276) defines a support system as an organised group of individuals who encourage or assist. In this study a support system will mean a group of people who come together with the aim of assisting diabetic patients with their daily life skills.

According to findings of Chen-Yen and Fensle (1996:468), Gowers, Jones, Kiana, North and Price (1995:995), Keller (1998) in Cleaver and Pallourios (1994:176) and Ruth (1999:420), the patient's type of support system does have an influence on his/her adherence to the diabetic regimen. Individuals are more likely to adhere to their diabetic health regimen if the quality of their interaction and relationship with their health providers is good and if the individuals have good social support. Patients whose families are supportive take their medication correctly, follow a diabetic diet such as low fat, high carbohydrate and fruit, and participate in various exercises such as walking, running, rugby and swimming (Gowers et al 1995:995). Keller (1998) also maintains that the diabetic patient's adjustment to the disorder depends largely on family support, and that negative patterns of interaction within the family affect the adherence to the diabetic regimen, and can lead to lack of control and even to attacks of keto acidosis (Cleaver & Pallourious 1994:176).

Brown and Segal (1996:903) indicate that non-compliance rates are higher among patients with symptomatic chronic diseases, requiring long term or lifetime medication therapy. Brown and Segal further indicate that failure to "comply" with prescribed medication regimens does not mean that the patient goes untreated. It is conceivable that patients who are labelled as non compliant by the medical establishment may actually be managing their condition in ways most consistent with their models of illness, for example, a person may not be "compliant" with his/her prescribed regimen but be perfectly "compliant" with some alternative regimen. In fact, many ethnic minority patients make simultaneous use of both the formal and informal medical care systems. It can therefore be deduced that quality interaction between health providers and diabetics and well-informed family members who support their diabetic relatives, contribute towards diabetic patient compliance to treatment regimen.

2.4.2 Some of the feelings of frustration

Cleaver and Pallourious (1994:178) and Richardson, Adner and Nordstrom (2001:759) indicate that initially, before the persons are diagnosed as diabetic patients, life is enjoyable. They are free to do anything they feel like, for example, they are free to eat anything without restriction; they participate in exercise freely.

However, once the diagnosis is made, their lifestyles change and this is often experienced as loss of control which can lead to an acute crisis which requires great moral strength to hold the personality together. Patients are not free to participate in sports as before, since exercises have to be limited and treatment has to be increased before resuming the exercises. The patient also has to carry some snacks in his/her pocket every time he/she leaves the house to boost the sugar level when feeling weak, and has to cope with the disease for the rest of his/her life (Cleaver & Pallourious 1994:178; Richardson et al 2001:759).

This required change in behaviour is regarded as punishment by some people. The diabetic patients fear the uncertainty as they do not know what will happen to them in future, and how other members of the family feel about them (Cleaver & Pallourious 1994:178). Andrews and Boyle (1995:241) indicate that feelings of frustration may be aggravated by sexual dysfunction, more especially among married couples whose sexual needs are not met, and this may lead to poor adherence to treatment with the aim of trying to overcome the problem of sexuality. It is therefore necessary that diabetic patients and their family members be educated about the condition and treatment in order to delay or avoid the occurrence of complications. Alternate methods of sexual satisfaction may be discussed with them.

Insulin injection also causes feelings of frustration in patients using injections, especially in working individuals. A patient finds it frustrating if he/she has to inject himself/herself and has to wait for some time before having his/her breakfast whereas he/she is late for work (The Control of Glucomodulation 1995:64). In the case of tablets, the diabetic can carry them along and take them when he/she reaches the work place, whereas the injection is impossible to carry because it must be kept in a refrigerator, otherwise a cooler box is required to maintain the cold chain.

Cleaver and Pallourious (1994:179) found that apart from the delays which are caused by insulin injections to working diabetic patients, the insulin needles cause pain and marks which are embarrassing. These marks cause a feeling of frustration in the female patient because she's no longer going to wear shorts if she was used to doing so, due to embarrassment because of black marks caused by needle pricks.

Expense was reported in New Fast-acting Insulin (1997:30) as another factor contributing to frustration. If diabetics want to sweeten their food they have to use sweeteners which can be obtained at the pharmacy. If they have elevated blood pressure they should use the special salt recommended for them. All these cost money and are expensive compared to the normal cane sugar and iodised salt used daily.

2.5 ASSOCIATED SOCIO-CULTURAL AND RELIGIOUS BELIEFS WHICH MAY INFLUENCE PROGNOSIS

A belief can be defined as trust or acceptance of a thing as true or existing (Thompson 1995:67).

Dietary beliefs and practices are sometimes difficult to discard, even when they are not good for health. Food may be eaten for cultural as well as nutritional reasons. From a clinical perspective these cultural influences may affect nutrition in two ways:

(i) They may exclude much-needed nutrients from the diet (by defining them as non-food or profane, lower class food).

(ii) They may encourage the consumption of certain food or drink (by defining them as sacred, medicine or as a sign of social, religious or ethnic identity) which is actually dangerous to health. When these influences co-exist then there is likely to be an increased risk of malnutrition like obesity and its consequences (Helman 1994:50).

A study done by Stroud (1994) among immigrants in the United Kingdom (UK) indicates that West Indian children are more in danger of obesity than of under nutrition. Since many of their families came from communities where malnutrition was common, many of the West Indian mothers seem to have a very deep-seated desire to see their children as big, fat babies and are not satisfied with their average growth along the fiftieth centile. As these children grow up being obese, they can be at risk of developing diabetes mellitus (Helman 1994:55).

Burkitt in Helman (1994:60) sees obesity as the commonest form of malnutrition in the West, and it is also associated with some of the Western diseases. He estimates that over 40% of people in the UK are overweight, and the problem is just as serious in the United States of America (USA). Burkitt relates the dramatic increase in frequency of Western diseases, diabetes mellitus being one of them, to culture change, that is, where Western customs are adopted. He indicates that fat consumption has increased by less than 50% while sugar consumption has doubled over the past 100 years. The quantity of fibre consumed in the diet has dropped markedly. Porridge oats which has a high fibre content has gone out of fashion and has been replaced by low-fibre packaged cereals. His study suggests how changes in technology and dietary culture may be related to the increased incidence of diabetes mellitus (Helman 1994:60).

Certain foods act as medicine in some cultures, for example, in Latin America "high blood" is treated by taking lemon juice, vinegar, sour oranges, pickles, olives or sauerkraut. Medicines, medically prescribed or

self-prescribed, may also be regarded as a form of nutrition, without which people might weaken or die. Examples include insulin therapy, certain cardiac or hypotensive drugs, and thyroid and other hormone replacement therapy. When these drugs are regularly taken at meal times they may become incorporated into the meal as a symbolic form of food (Helman 1994:45).

Mulemfo (1995) indicates that men and women since the earliest ages were making use of plants from which they prepared certain remedies, and from those they determined their efficacy by trial and error. These first experiences showed that plants, and certain minerals and animals, effected the healing which was required of them, and as a result a trust of that curative source developed. Consequently, the use of medicinal plants has been accepted universally. This use of medicine derived from plants was practised in ancient civilisations such as Egypt, Greece, Persia, Rome, China, Africa, India and America. Setswe (1999:56) indicates that up to 80% of African patients in South Africa consult a traditional healer before going to a primary health care practitioner. He further indicates that there are four types of traditional healers, namely traditional doctor, diviner, faith healer and traditional birth attendant.

According to Cocks and Dold (2000:1505), self-medication is documented as an integral part of health care therapy in developing countries. In South Africa the types of illnesses that are referred to both traditional healers and biomedical practices have been documented, though very little literature exists on self-diagnosis, self-medication or sources of the medicines used for self-medication.

The lack of literature is contributed to by anthropologists who focus on the later stages of the illness referral system when treatment is sought from “a specialist for symptoms which have not responded to forms of self-medication”. Amayeza Stores (African chemists) are an important source of medicines for self-diagnosed illnesses (Cocks & Dold 2000:1505).

Diabetic patients therefore have their beliefs regarding diabetes mellitus and its treatment, and these influence their adherence to their regimen, which leads to poor glycaemic control. Whether a person is educated or illiterate, culturally based myths and beliefs play a role in the treatment of diabetes among black people. According to a report by Sanders, one diabetic patient, who is a graduate, believes in cinnamon as a treatment of diabetes mellitus. He adds cinnamon to everything he eats (Sanders 1995:16).

A study done by Williams (1999) indicated differences in the social behaviour of diabetics, which are attributed to gender. According to Williams (1999:390), the majority of girls interviewed in his study were found to incorporate diabetes into their social identities. This manifested itself in various ways, including girls’ telling people about their condition and being prepared to treat themselves in public settings. In contrast, most of the boys with diabetes made it as invisible as possible, particularly in public settings. They

managed this in many ways, including not talking about their condition in public, and not allowing the treatment regimens to "spill over" into their public lives. The condition was not seen to be an integral part of their social identities, but as something separate.

Williams (1999:390) indicated that the extent to which the girls and boys interviewed incorporated their conditions into their identities, reflects the differential gendered meanings of chronic illnesses.

Williams (1999:391) also indicated that there was a difference in the number of daily insulin injections which the girls and boys interviewed gave themselves. The majority of the girls injected themselves 4 times a day, followed by those who injected themselves 3 times a day, whereas the majority of the boys opted to inject themselves twice a day. Boys chose not to inject themselves in public settings, but tried to keep the diabetes contained within the private sphere, at home. This enabled them to manage their condition at home.

A study done by Strang, Strang and Ternestedt (2002:55) revealed that nursing staff should pay attention to patients' spiritual needs, as these form part of holistic care. They further indicated that nurses are aware of the patients' needs but they cannot provide spiritual care because of lack of such education.

2.6 COMPLICATIONS OF DIABETES MELLITUS

Thompson (1995:272) defines complication as a confused condition aggravating or arising out of a previous one. Complications are becoming more common as more persons live longer with their diabetes. The general categories of chronic diabetic complications include macrovascular disease, microvascular disease and neuropathy.

2.6.1 Macrovascular complications

Smeltzer and Bare (1992) describe macrovascular diseases as atherosclerotic changes in the larger blood vessels. Different types of macrovascular diseases may result, depending upon the location of the atherosclerotic lesions.

2.6.1.1 Coronary artery disease

Atherosclerotic changes in the coronary arteries lead to an increased occurrence of myocardial infarctions in persons with diabetes. It may account for 50-60% of all deaths in patients with diabetes. Sometimes ischemic symptoms may be absent and the patient may not experience early warning signs of decreased

coronary blood flow. In such cases the patient may have 'silent' myocardial infarctions which can be detected through the use of electrocardiogram (Smeltzer & Bare 1996:1053).

2.6.1.2 Cerebral vascular disease

These are atherosclerotic changes in cerebral blood vessels or the formation of an embolus elsewhere in the vasculature that then lodges in a cerebral blood vessel which can lead to transient ischemic attacks and strokes. Recovery from stroke may be impaired in diabetic patients whose blood glucose level is elevated at the time of diagnosis. The following are symptoms of cerebro-vascular disease: dizziness, decreased vision, slurred speech and weakness (Smeltzer & Bare 1996:1054).

2.6.1.3 Peripheral vascular disease

Atherosclerotic changes in the large blood vessels of the lower extremities are responsible for an increased incidence of occlusive peripheral arterial disease. Signs and symptoms of peripheral vascular disease may include diminished peripheral pulses, intermittent claudication, that is, pain in the buttocks, thigh or calf when walking, and cold feet. Most cases of gangrene and amputations in diabetic patients occur as a result of severe arterial occlusions in the lower extremities (Reuter 2001:1; Smeltzer & Bare 1992:1056).

2.6.2 Microvascular complications

These are the diseases of small blood vessels where the basement membrane in the capillaries and arterioles thickens (Smeltzer & Bare 1992:1057). The retina of the eye and the kidney are affected. This results in diabetic retinopathy and nephropathy. Diabetic retinopathy is the leading cause of blindness in people aged between 20 and 74 years, and one out of every four individuals on dialysis has diabetic nephropathy.

2.6.2.1 Diabetic retinopathy

Diabetic Retinopathy is any disease of the retina, usually associated with impairment of vision, distortion of objects and oedema, and sometimes haemorrhages into the substance of the retina.

Retinopathy is classified as background retinopathy, preproliferative retinopathy and proliferative retinopathy. Background retinopathy is where there is partial occlusion of the small blood vessels in the retina which result in microaneurysms in the capillary wall. These microaneurysms are weak and capillary fluid leaks out causing edema and intraretinal haemorrhages.

Preproliferative retinopathy indicates further destruction of retinal capillaries. Proliferative retinopathy is the severe form and the capillaries become occluded, and new blood vessels are formed to supply the retina with blood. It is caused by damage to the sensitive blood vessels in the eyes. Retinopathy can be worsened by severe hypertension because of the additional stress it places on the blood vessels. Diabetic patients should be referred to ophthalmolgists for annual eye examination (Baumann, Chang & Hoebeke 2002:191; Butterworth Medical Dictionary 1990:1467; Campbell, Pearson, Ratner & Wysham 1997:69; Long term Complications [sa]:36; Recognition [Sa]:31; Smeltzer & Bare 1992:1057).

2.6.2.2 Nephropathy

This is the end-stage renal disease which usually shows no symptoms before this stage, and requires dialysis or transplantation. Nephropathy is indicated by protein in urine which is measured using a dipstick (Ganguli 2003:6; Reuter 2001:2; Smeltzer & Bare 1992:1060). It occurs in diabetic patients who have had the disease for the past 10-20 years. People with diabetes account for about 25% of patients with end-stage renal disease.

The only interventions that can slow the progression of renal disease include:

- control of hypertension
- prevention or vigorous treatment of urinary tract infections
- avoidance of nephrotoxic substances
- taking a low sodium diet
- taking a low protein diet

Once the progression of renal disease takes place it is treated either with dialysis or kidney transplant. Kidney transplantation involves transplanting a kidney from a living donor or human cadaver to a recipient who has end-stage renal disease. It is done to patients who have been on dialysis for months or years (Annual Congress … 2000:68; Smeltzer & Bare 1992:1061).

Kidney transplants from well-matched living donors who are related to the patient are more successful than those from cadaver donors. The transplanted kidney is placed in the patient's iliac fossa. The ureter of the transplanted kidney is transplanted into the bladder or anastomosed (joined) to the ureter of the recipient, i.e., the person receiving the kidney (Smeltzer & Bare 1992:1061, 1197).

2.6.3 Neuropathy

Diabetic patients often suffer from some degree of neuropathy. Smeltzer and Bare (1992:1061) define neuropathy as a group of diseases that affect all types of nerves, including peripheral (sensori motor), autonomic and spinal nerves. Neuropathy causes a loss of sensation or an alteration in the sensitivity of the feet and legs (Naude 2003:2). Elevated blood glucose levels over a period of years have been implicated in the etiology of neuropathy.

Sensori motor neuropathy affects the distal portion of the nerves, more especially the lower extremities. Symptoms include pricking, tingling and burning sensations at night. The feet may become numb. Decreased sensations of pain and temperature place patients with neuropathy at increased risk of injury and undetected foot infections. This neuropathic pain can resolve on its own within 6 months in some patients, whereas, for others, the pain persists for many years.

Different approaches to pain management can be used, such as analgesics, phenytoin, tricyclic, antidepressants or transcutanous electrical nerve stimulation (TENS). A new topical medication Capsaicin is said to decrease the neuropathic pain. Diabetic patients should control their blood glucose in order to prevent the development of gangrene or foot ulcers. Gangrene or foot ulcers may not heal if patients have peripheral vascular disease, because there will be a decreased supply of oxygen, nutrients and antibiotics to the injured tissue (Smeltzer & Bare 1992:1062, 1063).

Apart from sensori motor neuropathy there is an autonomic neuropathy which covers a broad range of dysfunctions affecting almost every organ and system of the body. The main effects of autonomic neuropathy include urinary, gastrointestinal, sexual dysfunction and cardiovascular conditions. These include bladder dysfunction where the patient has infrequent urination, is unable to void completely or dribbles when urinating, and experiences urinary retention. Patients experiencing these conditions need reassurance and catheterisation (Smeltzer & Bare 1992:1062).

Conditions associated with gastrointestinal autonomic neuropathy include constipation, diarrhoea and faecal incontinence. The patient should be reassured and advised to do the following:

- take enough fluids and high fibre in the diet to prevent constipation
- in the case of diarrhoea, prepare an oral glucose and electrolyte solution and drink it to rehydrate their bodies
- take anti-diarrhoea drugs as prescribed
- express their fears or worries about being embarrassed by lack of control over bowel elimination

- follow good perianal care to prevent excoriation of the perianal area due to enzymes contained in the stool causing local irritation (Smeltzer & Bare 1992: 1062)

Neuropathy can be prevented or delayed through blood glucose control, and transplanting tissue from the islets of Langerhans can be done as another method of preventing development of neuropathy. Tegretol may be used to provide some relief from severe pain (Campbell et al 1997:55; New Fast-acting Insulin 1997:50; Recognition and Management … [sa]:32; Sanders 1995:11).

2.6.4 Sexual dysfunction

Schmidt (2000:242) defines sexual dysfunction as the inability (lasting at least 3 months) to obtain an erection or to maintain it long enough for satisfactory sexual function.

It has already been indicated that diabetic patients often suffer from neuropathy. This also affects the nerves controlling the penis, hence causing erectile dysfunction in men and inability to reach orgasm in women. Over 75% of diabetic men over the age of 40 years may suffer from impotence (The Viagra Boom 1998:20).

Sexual dysfunction is due to lack of energy, and damage to nerves and blood vessels serving the penis caused by poor glycaemic control. Erectile dysfunction can be due to the knowledge of potential complications causing performance-anxiety and depression, or some drugs such as Aldomet, Aldactone, Tagamet, Inderal and Canoxin which are given for the treatment of hypertension and heart disease. These anti-hypertensive drugs are related to diabetes in the sense that non-insulin dependent diabetes mellitus can develop in hypertensive people as a side effect of certain hypertensive drugs and being associated with hypertension in certain endocrinopathies like acromegaly and Cushing's Syndrome (Mollentze 2000:864).

There is little evidence to show that sexual dysfunction exists in diabetic females. Women may experience decreased vaginal lubrication and dyspareunia. Patients should therefore control their blood glucose in order to prevent or delay the development of sexual dysfunction (Campbell 1997:61; Recognition and Management … [sa]:35; Sanders 1995:11; Smeltzer & Bare 1992:1340; The Viagra Boom 1998:20).

Health professionals should inform diabetic patients with erectile dysfunction about methods which can be used to correct the problem. In The Viagra Boom (1998:22) various methods of helping to alleviate sexual dysfunction have been listed, though their actions have not been explained. These include hot baths, cold compresses, rubbing in some ointments which the author did not give examples of, and intrapenile injection

therapy where the patient administers medication inserting a needle into the base of the penis to cause a rush of blood and engorgement of the penis. This is done 5-15 minutes before sexual intercourse. Patients using intrapenile injection therapy should take care of the dosage as prolonged erection may cause damage to the delicate erectile tissue.

The person with sexual dysfunction can also use a surgical prosthesis. This is a cylinder which is surgically inserted into the penis. In The Viagra Boom (1998:21), a certain drug called Sildenafil, commercially known as Viagra, has been indicated as effective in overcoming the problem of sexual dysfunction, though it was initially developed to treat heart conditions. Viagra acts by dilating the arteries of the penis thereby increasing blood flow. In Schmidt (2000:248) Sublingual apormorphine 2 – 6 mg and Phentolamine 40 mg have been mentioned as effective in the treatment of sexual dysfunction. Phentolamine is not available in South Africa but it is said to have a moderate effect of about 20 minutes.

2.6.5 Infections and skin disorders

Elevated blood sugar inhibits the action of white blood cells which fight against micro-organisms. This makes the diabetic patient susceptible to infections. Once infection sets in it spreads more rapidly. Foot lesions occur as a result of neuropathy, as the patient does not have sufficient sensory function to be aware of trauma like blisters, tight shoes, etc. The person may tread on a sharp object such as a thorn or nail without feeling any pain. As there is poor circulation this may result in a high risk of infection. Patients are advised to wear footwear and avoid activities that can traumatise the feet (Long term Complications [sa]:36; Smeltzer & Bare 1992:1063).

The chronic complications of diabetes place an enormous burden on health care resources, with foot ulceration representing a major cause of hospital bed occupancy for people with diabetes (Donohoe, Fletton, Hook and others 2000:582). Loss of sensation may lead to serious injuries like cuts, which may lead to infection if detected late and if blood sugar is not controlled. The infection can be so severe that the affected limb needs to be amputated, particularly when the patient has peripheral vascular disease, as it results in decreased oxygen, nutrients and antibiotics reaching the injured tissue. It is therefore important that diabetic patients and their family members be advised on foot care to prevent some of the infections (discussed in 2.3.4).

2.7 CONCLUSION

In this chapter, diabetes mellitus and its treatment and control have been described. Various complications, ways of preventing them and their management have been described, together with factors identified as stumbling blocks to diabetic control. Associated cultural and religious beliefs which may influence the prognosis have been described. In the next chapter the research methodology will be discussed.