Evaluation and Management of Diabetic Patients in a Primary Healthcare Clinic

Jana Luttig

Dissertation submitted in Pharmacy Practice, School of Pharmacy at the Faculty of Health Sciences, in partial fulfilment of the requirements for the degree Magister Pharmaciae at the Potchefstroom campus of the North-West University

Supervisor: Prof. J.J. Gerber

Co-supervisor: Dr. R. Smit

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Faith is being sure of what we hope for

HEB. 11:1

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OPSOMMING

Titel: Evaluering en Hantering van Diabetiese Pasiënte in 'n Primêre Gesondheidsorg Kliniek

Sleutelwoorde: *Diabetes Mellitus*, primêre gesondheidsorg, gewigstatus, bloedglukose monitoring, chroniese komplikasies

In vele Afrikalande, insluitend Suid-Afrika, is die aandag gesentreer rondom die behandeling van die HIV/VIGS en tuberkulose epidemies. Maar daar is 'n groeiende bewustheid in Suid-Afrika dat leefstyl verwante kondisies, soos diabetes en vetsugtigheid, 'n belangrike gesondheidsprioriteit is (Pirie, 2005:42).

Die algemene doel van die studie was om die behandeling van diabetes pasiënte in klinieke op primêre gesondheidsorg vlak te evalueer, en ook 'n sekere bydrae te kan lewer in die voorkoming van diabetiese komplikasies.

Die navorsingsmetode het bestaan uit die studiepopulasie seleksie, data insameling (vraelyste) en die data analise. Daar was geen gestruktureerde manier om te besluit watter pasiënte ondervra sal word nie. Soos die pasiënte vir hul afsprake opgedaag het is die navorser van hul koms in kennis gestel. Geen pasiënte was gedwing om aan die studie deel te neem nie. Na die pasiënte toegestem het tot die onderhoud, het hul 'n vrywaringsvorm onderteken wat die Noord-Wes Universiteit vrystel van enige aanspreeklikheid wat mag voorkom en wat toestemming tot die onderhoud gee.

Die vraelys is so saamgestel dat dit al die relevante aspekte van diabetes dek. Dit sluit in diagnostiese data, leefstyl, welstand, samewerking en monitering. Die navorser het die vraelyste ingevul terwyl die onderhoude met die pasiënte gevoer is. Die data verkry van die vraelyste is statisties verwerk deur gebruik te maak van die Statistical Analysis Sistem (SAS 9.1). Effekgrootte, wat deur die *Phi*-koeffisiënt beskryf word, is gebruik as beskrywende statistiek.

In hierdie spesifieke studiepopulasie was die meerderheid van pasiënte geklassifiseer as tipe 2 diabete. Uit tabel 4.8 bleik dat 62.14% van die totale studiepopulasie geklassifiseer is in groep B, wat beteken dat die pasiënte slegs orale hiplgisemesie middels gebruik om hul toestand te beheer. 'n Verdere 33.98% van die populasie is geklassifiseer in groep C wat daarop dui dat die pasiënte orale hipoglisemiese middels sowel as eksogene insulien benodig om 'n normale lewe te handhaaf. Laasgenoemde bestaan uit pasiënte wie se diabetiese status nie in die verlede gekontroleer was nie, daarom die noodsaak vir

toediening van insulien. Dit impliseer dat die pasiënte nie ingelig is oor hoe die siekte met dieet en lewensstyl intervensies beheer kan word nie.

Lewenstyl, sosio-ekonomiese toestande en opvoeding het 'n groot rol gespeel in die verloop van die siekte by die spesifieke pasiënte. Die gewigstatus van die pasiënte was bepaal en in tabel 4.15 gesien word. Slegs 20.39% van hulle se gewig was binne normale grense met 'n liggaam massa indeks (LMI) tussen 18.5-24.9kg/m^2. 39.81% van die pasiënte was oorgewig met 'n LMI tussen 25-29.9kg/m^2 en die oorblywende 39.81% van die studiepopulasie was geklassifiseer as vetsugtig met LMI's bo 30kg/m^2. Die meerderheid ('n beraamde 80%) van die studiepopulasie was hoër as die optimale gewig. Hierdeur kan die ontwikkeling van chroniese komplikasies soos retinopatie, neuropatie en nefropatie veroorsaak word.

Die sosio-ekonomiese status van die studiepopulasie was relatief swak as gevolg van werkloosheid. Alhoewel 90.07% van hul gesê het dat daar geen probleme ondervind word om 'n spesifieke dieet te volg nie (tabel 4.56) het feitlik die helfte van die pasiënte gesê dat hul probleme ondervind om die regte tipe voedsel te kry om aan hul behoeftes te voldoen. Eersgenoemde mag wees omdat hulle geen veranderinge aan hul eetgewoontes aangebring het nie en laasgenoemde mag wees as gevolg van hulle finansiële status. Werkloosheid beïnvloed hulle lewens tot 'n groot mate . Hul kan nie voedsel bekostig wat voldoen aan hul voedingsbehoeftes nie.

Soos reeds genoem, is pasiëntopvoeding essensieel vir die beheer en hantering van diabetes. Toe die pasiënte gevra is of hul weet wat diabetes is en wat die moontlike komplikasies daarvan is, het meeste van hul geantwoord dat hulle aan 'suiker' ly en dat suikerbevattende voedsel nie meer geëet kan word nie. Dis is duidelik dat hul nie voldoende kennis van die toestand het nie. Nadat aan hul verduidelik is wat die toestand behels, het meeste gesê dat dit nie so aan hul verduidelik is nie en dat dit nou beter verstaan word.

Die gevolgtrekking is gemaak dat die studie populasie onder 'n valse indruk verkeer van wat diabetes in werklikheid behels. Dit is deels as gevolg van beperkte tyd wat tot die kliniek personeel se beskikking is om met elke pasiënt aan opleiding en onderrig te spandeer.

Een aspek wat uitgestaan het tydens die studie was dat slegs 'n geskatte 20% van die studie populasie hul eie bloedglukose monitor besit het (tabel 4.80). Dit is kommerwekkend omdat 'n bloedglukose monitor essensieel is vir gereelde monitering van bloedglukose vlakke om optimale beheer oor bloedglukose vlakke te verseker. 'n Beraamde 70% van die studiepopulasie meet hul bloedglukose vlakke slegs een keer 'n maand wanneer hul besoek by die kliniek aflê (tabel 4.81). Dit is nie voldoende om optimale beheer te verseker nie.

Die gemiddelde bloedglukose vlakke is bereken en bespreek in afdeling 4.7. Selfs met die minimale monitering, wat ongeveer 50% van die pasiënte se bloedglukose vlakke onder

beheer met 'n gemiddeld van tussen 6-9mmol/L (tabel 4.88). Die oorblywende 50% van die populasie was nie onder beheer nie met 'n gemiddeld van onder 5mmol/L of bo 9mmol/L. Dit is kommerwekkend omdat die ongekontrolleerde gevalle die risiko loop om chroniese komplikasies te ontwikkel, behalwe as hulle kontrole oor hul leefwyse begin uitoefen. Hiervoor benodig hierdie pasiënte al die nodige opvoeding van gekwalifiseerde gesondheidsorg voorsieners en die ondersteuning van hul families.

Sekere aanbevelings en beperkings is gemaak en bespreek.

ABSTRACT

Title: Evaluation and Management of Diabetic Patients in a Primary Healthcare Clinic

Keywords: *Diabetes Mellitus*, primary healthcare, weight status, blood glucose monitoring, chronic complications

In many African countries, including South Africa, much attention has been centred on the management of HIV/AIDS and tuberculosis epidemics. However, there is growing awareness in South Africa that life-style related non-communicable conditions, such as diabetes and obesity, represent an important health priority (Pirie, 2005:42).

The general objective of this study was to evaluate the treatment of diabetic patients in clinics on primary healthcare level and to determine what contributions can be made in the prevention of diabetic complications.

The research method consisted out of the selection of the study population, data collection (questionnaire) and the data analysis. There was no structural way of deciding which patients would be selected to be interviewed. As the patients arrived for their appointments the interviewer was informed. No patient was forced to participate in this study and after they agreed to the interview, they signed a consent form that releases the University of any liability that may occur and to give their permission for the interview.

The questionnaire was compiled which covered all the aspects of diabetes. This included diagnostic data, life-style, well-being, compliance and monitoring. The researcher completed the questionnaires whilst interviewing the patients. The data obtained from the questionnaires were statistically analysed by using the Statistical Analysis System, SAS 9.1. Effect size, which was given by the *Phi* coefficient, was used as a descriptive statistic.

In this particular study population, the majority of patients were classified as type 2 diabetics. This can be viewed in table 4.8 where 62.14% of the total study population was classified as group B, which means that these patients use oral glucose lowering drugs to control their disease. A further 33.98% of the population was classified as group C diabetics, which means that these patients need oral glucose lowering drugs as well as exogenous insulin to maintain a healthy life. The latter group obviously consists of patients whose diabetic status was not under control in the past, thus the need for the insulin. This clearly shows that these patients have not been informed about how they can manage the disease by dietary modification and lifestyle interventions.

Lifestyle, socio-economic and education played a major role in the development of this disease in these patients. The weight status of the study population was determined and can

be viewed in table 4.15. Only 20.39% of them were of normal weight with a body mass index (BMI) ranging between 18.5 – 24.9 kg/m². 39.81% of them were overweight with their BMI ranging between 25 – 29.9 kg/m² and the remaining 39.81% of the study population were classified as obese with their BMI's above 30 kg/m². The majority (an estimated 80%) of the study population were above optimal weight. This may cause the development of chronic complications, such as retinopathy, neuropathy and nephropathy.

The socio-economic status of the study population was relatively poor because of unemployment. Although 90.07% of them said they had no difficulty to follow their diet (table 4.56) almost half of the patients said they had some difficulty to get the correct food for their specific needs (table 4.53). The first may be because they are still eating they way they used to with no modifications and the latter may be because of their financial status. Not being able to find work has a major effect on their lives. They cannot afford to buy foods suitable for their needs.

As previously stated, patient education is fundamental in the managing and controlling diabetes. When these patients were asked whether they know what diabetes is, and what the complications of the disease might hold, most of them answered that it means they have 'sugar', and cannot eat sugary foods any more. This clearly indicates that they did not have a complete knowledge of their disease. After having explained to them in uncomplicated terms what the disease implicates, many of them said it had not been not explained to them previously and that they now understood it better.

It was concluded that the majority of the studied population were under a false impression of what diabetes implied. This is partly due to the lack of time the clinic staffs have to spend with each patient, educating them about the disease.

One aspect that was most obvious during this study was the fact that an estimated 20% of all patients studied had their own blood glucose monitor (table 4.80). This is somewhat concerning because to have optimal control over one's blood glucose levels, one needs to has a blood glucose monitor for regular monitoring. An estimated 70% of the studied population measures their blood glucose only once a month when they attend the clinic for their monthly visit (table 4.81). This is not nearly enough to ensure optimal control.

The average blood glucose levels were calculated and described in section 4.7. Even with the minimal measurement, about 50% of these patients' blood glucose levels were fairly under control with an average of 6-9mmol/L (table 4.88). But the other estimated 50% of the population were not controlled with averages of either below 5mmol/L or above 9mmol/L. This is concerning because the possibility that these uncontrolled cases may develop chronic complications, might be unavoidable unless they start taking control of their lives. And for this

to happen, these patients need all the possible education from qualified health care providers and the support of their families.

Certain recommendations and restrictions were formulated and discussed.

EVALUATION OF DIABETIC PATIENTS IN TWO PRIMARY HEALTH CARE CLINICS IN A SEMI RURAL AREA

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ABSTRACT

The aim of this study was to evaluate the treatment of diabetic patients on primary healthcare level and to determine what contributions can be made to the prevention of diabetic complications. There was no structural way of deciding which patients would be selected. Those included had a choice whether they wanted to participate or not. The data obtained from the questionnaires completed by the researcher after interviewing 103 diabetic patients were statistically analysed and described. Of the study population, 3.88% suffered from group A diabetes (using insulin), 62.14% suffered from group B diabetes (using oral hypoglycaemic drugs) and 33.98% suffered from group C (using both insulin and oral hypoglycaemic drugs). Black patients were divided between group B (57.58%) and group C (40.91%). White patients suffered mainly from group B (57.89%) and colored patients predominantly suffered from group B (83.33%). An estimated 20% of the population was of normal weight, 40% were overweight and the remaining 40% were obese. Only 20% of the study population had their own blood glucose monitor. An estimated 53% of the study population's average blood glucose readings were under control (6-9mmol/L). The blood glucose readings of the remaining 47% were not controlled with readings either below 5mmol/L or above 10mmol/L.

Die doel van die studie was om die behandeling van diabetiese pasiënte te evalueer op primêre gesondheidsorgvlak en om te bepaal watter bydrae gemaak kan word om kroniese diabetes komplikasies te voorkom. Daar was geen gestruktureerde manier van pasiënt seleksie en diè ingesluit het 'n keuse gehad of hul wil deelneem of nie. Die data ingesamel vanuit die vraelyste wat deur die navorser ingevul is nadat 103 pasiënte ondervraag is, is statisties geanaliseer en beskryf. Van die studiepopulasie ly 3.88%aan groep A diabetes (slegs insulien gebruik), 62.14% ly aan groep B diabetes (slegs orale hipoglisemiese middels) en 33.98% ly aan groep C diabetes (gebruik beide insulien en orale hipoglisemiese middels). Swart pasiënte was verdeel tussen groep B (57.58%) en groep C (40.91%). Wit pasiënte was oorwegend groep B (57.89%) en kleurlingpasiënte was grotendeels groep B (83.33%). 'n Geskatte 20% van die studie populasie was by normale gewig, 40% was oorgewig en die oorblywende 40% was vetsugtig. Slegs 20% van die studiepopulasie besit 'n bloedglukosemonitor. 'n Geskatte 53% van die studie populasie se gemiddelde bloed glukose lesings was goed gekontroleer (6-9mmol/L). Die oorblywende 47% was nie gekontroleer nie met lesings van of laer as 5mmol/L of hoër as 10mmol/L.

INTRODUCTION AND PROBLEM STATEMENT

There is growing awareness in South Africa that life-style related non-communicable conditions, such as diabetes mellitus (DM) and obesity represent an important health risk (Pirie, 2005:42).

According to Masharani *et al.* (2003:1152) DM is a syndrome with disordered metabolism and inappropriate hyperglycaemia due to either a deficiency of insulin secretion or to a combination of insulin resistance and increased insulin secretion to compensate. Subsequently insulin secretion becomes inadequate. This results in impaired transport of carbohydrates into the cells in the presence of hyperglycaemia.

Type 1 DM develops in childhood or early adulthood. The patient suffers from an absolute deficiency of insulin as a result of immune-mediated destruction of the pancreatic Beta-cells as stated by Wells *et al.* (2003:170).

According to Smeltzer and Bare (2004:1151) the major classifications of DM are:

- Type 1 DM: insulin-dependent DM
- Type 2 DM: non-insulin-dependent DM
- Gestational diabetes: any degree of glucose intolerance with its onset during pregnancy (Smeltzer & Bare, 2004:1154)
- DM associated with other conditions or syndromes

Type 2 DM manifests as insulin resistance, which refers to a decreased sensitivity of tissue to insulin, and impaired insulin secretion (Smeltzer & Bare, 2004:1153). According to Harper *et al.* (2003:1) type 2 DM can be undiagnosed for years, and this can lead to serious long-term complications. These complications can be divided into:

- Those affecting the microvascular system and leading to retinopathy, neuropathy and nephropathy.
- Those affecting the macrovascular system can lead to cardiovascular disease, coronary artery disease and stroke due to accelerated atherosclerosis.

RESEARCH OBJECTIVES

General objective

The aim was to study the treatment of diabetic patients on primary healthcare level and to suggest contributions which

can be made in the prevention of diabetic complications.

Specific objectives

- To determine how age, lifestyle, socio-economic status and education influence DM
- To determine ethnic and cultural barriers in the education about DM
- To determine from the community how accessible healthcare providers are to them
- To determine whether the community receives sufficient information on DM from healthcare providers
- To determine the knowledge of the community about DM
- To investigate methods and techniques in the public health care sector which can ensure access to quality health care
- To formulate recommendations regarding the management of DM on primary health care level

METHOD OF RESEARCH

The research consisted of the selection of a study population (diabetic patients in two primary healthcare clinics in Potchefstroom), the data collection (questionnaire) and the data analysis. Certain recommendations will be made and the limitations of the study will be discussed.

Study Population

There was no way of deciding which patients would be interviewed. As the patients arrived for their appointments, the nurses informed the interviewer about their status. Each patient had the option of being interviewed or not. After they had agreed to the interview, they signed a release form granting the University indemnity from any liability that may occur and giving their consent to the interview.

Of the 103 patients interviewed, 30 were male and 73 were female.

Data Collection

A questionnaire was constructed and covered all the aspects of DM. This included diagnostic data, lifestyle, well-being, compliance, monitoring and frequency of doctor consultations.

The researcher completed the questionnaires whilst interviewing the patients. The reason for this was to ensure the correct information was collected and to explain the questions to the patients in order to guarantee that there were no misunderstandings.

Data Analysis

The data obtained from the questionnaires completed by the researcher after interviewing 103 diabetic patients, were statistically analysed by the Statistical Consultation Service of the Potchefstroom Campus of the North-West University.

Data were analysed by using the Statistical Analysis System®, SAS 9.1 (SAS for Windows, 9.1 2005). Effect size was used as a descriptive statistic (Steyn, 2002:11).

The effect size is given by $w = \sqrt{\frac{X^2}{n}}$, where X^2 is the usual Chi-Square statistic for the contingency table and *n* is the sample size. In the special case of a 2x2 table, the effect size is given by the *Phi* Coefficient. Note that the effect size is independent on sample size.

Cohen (1988) gives the following guidelines for the interpretation of the effect size in the current case:

- Small effect: $W = 0.1$
- Medium effect: $W = 0.3$
- Large effect: $W = 0.5$

A relationship with $W \geq 0.5$ is considered as practically significant, $W \geq 0.3$ is considered as significant and $W \geq 0.1$ as non-significant.

DISCUSSION OF RESULTS

Group A: Type 1 DM requiring only insulin

Group B: Type 2 DM requiring only oral hypoglycaemic medication

Group C: Type 2 DM requiring both oral hypoglycaemic drugs and insulin

Race Frequency

Table 1 describes the race frequency of the total study population. 1.52% of the black patients and 15.79% of the white patients were classified as group A diabetics. 57.58% of the black patients, 57.89% of the white patients and 83.33% of the coloured patients were classified as Group B diabetics. 40.91% of the black patients, 26.32% of the white patients and 16.67% of the coloured patients were classified as Group C patients.

According to the statistics of the correlation between DM and race (Table 18) the *Phi* coefficient of 0.36 means that it has a substantial meaning. This means that in this studied population; race might be a factor in the development of DM. This results showed that the majority of black and coloured patients where divided between Groups B and C and that mostly white patients suffered from Group A DM.

Diabetes Groups

Table 2 describes the different DM groups as classified above. There were only four patients classified as group A DM, three of who were white and one black patient. This type of DM is usually inherited, thus this may show that type 1 is not a disease that habitually occurs in black Africans. It must be taken into consideration that the study population was relatively small and is not a global indication. Of the patients interviewed, 99 patients were type 2 diabetics (Groups B and C), meaning that DM developed later in their lives. The major causes of DM are obesity (BMI > 30kg/m²) and being overweight (BMI > 25 kg/m²), unhealthy eating habits, and limited physical activity. The number of South Africans with DM, has significantly

increased, and is still rising. This is predominantly a result of their adopting a Western diet (Lehohla, 2006).

Weight and BMI

BMI is calculated as follows:

BMI = weight (kg) / height (m)^2

The mean of the BMI's of the total study population is 30.12 kg/m^2. This indicates, according to the BMI conversion, that the average patient interviewed was obese. This is a serious cause for concern because this may eventually lead to all the major complications of DM.

Hypoglycaemic agents

Table 5 describes the types of glucose lowering agents being used by the study population. Only 9.71% of the patients are using subcutaneous insulin, 61.17% of them are using oral glucose lowering agents, and 29.13% of the patients are using both insulin and oral medication.

Table 6 describes the frequencies of insulin types used by the study population. 97.5% of the insulin users are using Actraphane®, which is a biphasic insulin preparation. These are ready mixed preparations containing short-acting and intermediate-acting insulin.

The two oral hypoglycaemic drugs being prescribed in this primary healthcare facilities was metformin and gliclazide. In both clinics studied, eighty-three patients are using metformin which is a biguanide. Metformin is used for the management of type 2 DM when dietary management alone has failed. The biguanides are agents of first choice in the management of obese type 2 diabetics because it induces a mild anorexia and so helps to control weight gain Nolte and Karam (2001:727). Because of its insulin-sparing properties, it does not increase weight or provoke hypoglycaemia. There were fifty-nine patients in total who use gliclazide which is classified as sulphonylamides and urea derivates. These drugs may provide good control of blood glucose and have been shown to reduce the microvascular complications of DM. They are used in management of type 2 DM when dietary management alone has failed and may be used as monotherapy or in combination with metformin or insulin (Patel, 2003:103).

Blood glucose

Table 7 describes the frequency of patients in the total study population who own a blood glucose instrument. One of the single most important pieces of equipment that a diabetic patient needs is an easy to use, functioning blood glucose meter. According to the American Diabetic Association (2007) a diabetic patient is supposed to measure his blood glucose at least three times a day to ensure optimum control. Only 19.42% of the studied patients said they had their own monitor, thus an estimated 80% of them do not have access to a glucose monitor when they need it, only when they have an appointment at the clinic.

The frequency of blood glucose measurement was also determined. The patients were divided into their separate weight statuses: normal weight, overweight and obese. Table 8 describes the frequency of blood glucose measurement by the normal weight patients in the study population. There was only one patient of normal weight who was classified as Group A diabetic. This patient said he measured his blood glucose levels once a week. There were ten normal weight patients who were classified as Group B diabetics. Two of them said they measured their blood glucose levels once a week. One patient of normal weight claimed to measure it once a day, another patient to measure it twice a day, and the remaining six patients of normal weight said it was only measured once a month at the clinic. There were ten patients in the study population who were of normal weight and who were classified as group C diabetics. Two of these patients said they measured their blood glucose levels once a week and the remaining eight said it was only measured once when they attended the clinic for their monthly visit.

According to the statistics for the correlation between the frequency of the total normal weight patients in the study population and the frequency of blood glucose measurement, the *Phi* coefficient of 0.52 means that it has a practical significant effect (Table 18). Thus, this shows that Group A patients tend to measure their blood glucose every week, where group B and C patients mostly measure once a month.

Table 9 describes the frequency of blood glucose measurement by the overweight patients in the study population. There were forty-one overweight patients in the study population. One of the overweight patients in group A said he measured his blood glucose level once a week, another one said he measured it three times a week and the other one of the overweight patients in group A said he measured his blood glucose levels once a day. There were twenty-six overweight patients that fell into group B. Of these patients 7.69% said they measured their blood glucose levels once a week and only 3.85% of them said they measured it once a day. A staggering 88.46% of the overweight patients in group B said their blood glucose levels were measured once a month when they attended the clinic for their monthly visit. Out of the twelve overweight patients who were classified into group C, 8.33% said they measured their blood glucose levels once a week and another 8.33% said they measured it once a day. Only 16.67% admitted to measuring their blood glucose levels twice daily and 66.67% said it was only measured once a month during their monthly clinic visit.

According to the statistics for the correlation between the frequency of overweight patients in the study and the frequency of blood glucose measurement the *Phi* coefficient of 0.79 has a practically significant meaning (Table 18). Thus, group A patients tend to measure their blood glucose more frequently than Group B and C patients.

There were forty-one obese patients in the study population. Table 10 describes the frequency of blood glucose measurement by the obese patients in the study population. Twenty-eight of these patients were classified as group B patients. Of these, 10.71% of said they measured their blood glucose levels once a week, 3.57% said they measured it twice a week, 7.14% said they measured it once a day, and 3.57% said they measured it twice a day. An overwhelming 75% of these obese patients in group B said they measured their blood glucose levels only once a month when they attended their appointments at the clinics. Thirteen obese patients were classified as group C diabetics. Of these, 23.08% said they measured their blood glucose levels once a week, 15.38% said they measured it three times a week and 61.54% of them said they measured their levels once a month.

According to the statistics for the correlation between the frequency of obese patients in the study population and the frequency of blood glucose measurement the *Phi* coefficient of 0.42 has a substantial effect (Table 18). Thus, group C patients tend to measure their blood glucose levels more frequently than group B patients.

Every patient in the clinics has a book where all relevant information is stated; including what medications are taken, blood glucose readings and when the next appointment will be. Thus, the average readings were calculated over the past year as stated in these patients' books. Table 11 describes these average blood glucose readings of the study population. The average blood glucose of 14.56% of the patients was between 3 and 5 mmol/L, 53.4% had an average reading of 6-9 mmol/L and 32.04% had an above normal reading of more than 10mmol/L. This means that an estimated 53% of the patients interviewed were controlled DM, and the rest, an alarming 47% were not under control.

Table 12 describes the frequency of normal weight patients in the study population who experience low blood glucose levels (≤ 3mmol/L). The only normal weight patient in group A said that he experienced low blood glucose levels (3 mmol/L or less) only once a month. Seven of the normal weight patients in group B said that they never experienced low blood glucose levels, one said that he experienced it once a month, the other patient said once in two weeks and the last normal weight patient of group B said he experienced low blood glucose levels once a week. Six of the ten normal weight patients who fell into group C said they have never experienced low blood glucose levels, while the remaining four patients in this group said they experienced it once a month.

According to the statistics for the correlation between the frequency of the normal weight patients in the study population and the patients experiencing blood glucose levels of 3 mmol/L or less the *Phi* coefficient of 0.55 means that it has a significant effect (Table 18). Thus, group B of the normal weight patients in

the study population who use hypoglycaemic drugs tend to be more likely to experience low blood glucose levels.

Table 13 describes the frequency of overweight patients in the study population experiencing low blood glucose levels (≤ 3mmol/L). Of the overweight patients who were classified as group A, 33.33% said they never experienced blood glucose levels lower than 3 mmol/L, another 33.33% said that they experienced it once a month and the remaining 33.33% said they experienced it once in two weeks. Of the overweight patients who fell into group B, 80.77% said they had never experienced low blood glucose levels, 15.38% said they experienced low blood glucose levels once a month and only 3.85% of these patients said they experienced it once in two weeks. Of the overweight patients who were classified as group C patients, 58.33% of patients said that they had never experienced blood glucose levels of 3 mmol/L or less and the remaining 41.67% said they experienced it once a month.

According to the statistics for the correlation between the frequency of overweight patients in the study population and patients experiencing low blood glucose levels (≤ 3mmol/L) the *Phi* coefficient of 0.48 means that it almost has a practically significant effect (Table 18). Thus blood glucose levels of the majority of the overweight patients in this study population who use oral hypoglycaemic drugs, never dropped beneath 3 mmol/L..

Table 14 describes the frequency of obese patients in the study population experiencing low blood glucose levels (≤ 3mmol/L). The majority (85.71%) of the obese patients in group C said their blood glucose levels never plunged beneath 3 mmol/L and 14.29% of these patients said their levels sank below 3 mmol/L only once a month. Of the obese patients who fell in group C, 61.54% said they never experienced low blood glucose levels, 15.38% said they experienced it once a month and a further 15.38% said they experienced it once in two weeks. Only 7.69% of these obese patients in group C said that they experienced low blood glucose levels once a week.

According to the statistics of the correlation between the frequency of obese patients in the study population and patients experiencing low blood glucose levels of 3 mmol/L or less, the *Phi* coefficient of 0.42 has an almost practically significant effect (Table 18). This shows that the blood glucose levels of the majority of the obese patients in this study population, who use oral hypoglycaemic drugs, never dropped beneath 3 mmol/L.

Vision Disorders

A change in vision is a sure symptom of high blood glucose (Masharani *et al.* 2003:1156). Table 15 describes the most frequent vision disorders experienced by diabetics. The most common vision disorder was blurred vision, with 82.52% of the patients suffering from it. Then one gets floaters, which are tiny black or silver

dots floating in one's eyesight, and 39.81% complained about this disorder. Double vision was also a frequent manifestation and 30.1% of patients said it occurred regularly. The least common were visual halos, where a ring of light is seen around objects or lights. Only 0.97% of the patients complained about this disturbance.

Cardiovascular disease

Individuals with DM are at increased risk for cardiovascular morbidity and mortality compared to the general population (Costacou *et al.* 2006:387). Cardiovascular risk appears to be associated with both the level of hyperglycaemia and the duration of DM (Marks & Raskin, 2000:108).

Both angina and heart failure are precursors for ischemic heart disease or stroke (Avendano *et al.* 2006:1288). Heart diseases do not appear to be of relevant significance in this specific population, but these data were obtained from the patients themselves and thus may not be accurate. According to the questionnaire only 8.74% suffered from angina, 7.77% suffered from ischemic heart disease and only one patient had heart failure (Table 16).

Late clinical manifestations of DM include a number of pathological changes that involve small and large blood vessels, cranial and peripheral nerves, the skin, and the lens of the eye. These lesions lead to hypertension, renal failure, blindness, autonomic and peripheral neuropathy, amputations of the lower extremities, myocardial infarction and cerebrovascular accidents (Masharani *et al.* 2003:1180).

Table 17 describes the patients in the study population with possible diabetic complications. The biggest concern of these patients was the possibility of developing retinopathy, because the symptoms experienced were sudden and clear. Even so, a mere 33.01% of the studied patients were concerned about it. Only 13.59% of them were concerned about neuropathy, because many of them suffer from cold hands and feet, pins-and-needles and swelling of the lower limbs. These symptoms are a sign of poor blood circulation, all contributing to neuropathy. Of these patients 7.77% were concerned about nephropathy and only 4.85% were concerned about possible heart diseases. The majority of patients in the study were uninformed about what the implications of having DM were. They did not know how to handle it; they did not know that lifestyle plays a major role in the treatment and most of all they did not know about the long-term complications. Thus, because they did no know, they were not concerned. This is clearly visible in the results.

CONCLUSION

In this particular study population, the majority of patients were classified as type 2 diabetics. This can be viewed in table 2 where 62.14% of the total study population was classified as group B, which means that these patients use oral glucose lowering drugs to control their disease. A

further 33.98% of the population was classified as group C diabetics, which means that these patients need oral glucose lowering drugs as well as exogenous insulin to maintain a healthy life. The latter group is obviously patients whose diabetic status was not under control in the past, thence the need for the insulin. This clearly shows that these patients were not informed about how they can manage the disease by dietary modification and lifestyle interventions.

Lifestyle, socio-economic status and education played a major role in the development of this disease in these patients. The weight status of the study population was determined and can be viewed in table 3. Only 20.39% of them were of normal weight with a body mass index (BMI) ranging between 18.5 – 24.9 kg/m^2; 39.81% of them were overweight with their BMI ranging between 25 – 29.9 kg/m^2 and the remaining 39.81% of the study population were classified as obese with their BMI's above 30 kg/m^2. The majority (an estimated 80%) of the study population were above optimal weight. This may cause the development of chronic complications, such as retinopathy, neuropathy and nephropathy.

Being physically inactive may contribute to the development of insulin resistance. This might cause group B patients to eventually need exogenous insulin, such as happened with the group C patients. This may contribute to the development of chronic complications, especially nephropathy and neuropathy leading to amputation of the lower limbs.

Patient education is fundamental in managing and controlling DM. When these patients were asked whether they knew what DM is, and what the complications of the disease might hold, most of them answered that it meant they had 'sugar', and could not eat sugary foods anymore. This clearly indicates that they had some idea of what DM is. After explaining to them in uncomplicated terms what the disease implicates, many of them said it had not been explained to them and that they now understood it better.

There are numerous primary health care clinics in the Potchefstroom area, meaning that the facilities are accessible to the public. Even though the clinics are readily available for public use, they have staff shortages. This results in patient overcrowding, and these health care providers have limited resources which they receive from the government. Having staff shortages contributes to being pressed for time, thus these personnel cannot spend sufficient time with each patient. This results in a lack of patient education.

One aspect that stood out the most during this study was the fact that an estimated 20% of all patients studied had their own blood glucose monitor (table 7). This is a reason for concern because to have optimal control over one's blood glucose levels, one needs to have a blood glucose monitor for regular monitoring. An estimated 70% of the studied population measures it only once a month when they attend the clinic for their monthly visit. This

is not nearly enough to ensure optimal control.

The average blood glucose levels were calculated as described in section 4.7. Even with the minimal measurement, about 50% of these patients' blood glucose levels were fairly under control with an average of 6-9mmol/L (table 11). But the other estimated 50% of the population were not controlled with averages of either below 5mmol/L or above 9mmol/L. This causes concern because the possibility that these uncontrolled cases may develop chronic complications can not be avoided, unless they start taking control over their lives. And for this to happen, these patients need as much education as possible from qualified health care providers, and the support of their families.

RESTRICTIONS

- It is debatable whether the information supplied by the interviewed patients was absolutely truthful.
- It is plausible that not all diabetic patients in the two clinics involved were interviewed.
- The questionnaire was formulated around aspects of DM, and did not involve possible hypertension levels. This might have been helpful information in establishing more uncontrolled cases.
- In one case language was a definite barrier, because the patient only spoke Zulu and there was no interpreter to translate, thus the patient was not interviewed.

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Table 1: Race frequency of the total study population

	GROUP A	GROUP B	GROUP C	TOTAL
Black	1	38	27	66
Row %	1.52	57.58	40.91	100
White	3	11	5	19
Row %	15.79	57.89	26.32	100
Coloured	0	15	3	18
Row %	0	83.33	16.67	100
Total	4	64	35	103

Table 2: Diabetes group frequencies

B1	Frequency	Percent %
Group A (Type 1 diabetes)	4	3.88
Group B (Type 2 diabetes)	64	62.14
Group C (Type 2 diabetes, requiring insulin)	35	33.98

Table 3: Weight frequencies of the study population

GROUP	FREQUENCY	PERCENT %
Normal	21	20.39
Overweight	41	39.81
Obese	41	39.81

Table 4: Means procedure of the total weight frequencies

VARIABLE	N	MEAN	STD DEV	MIN	MAX
Weight	103	79.9	18.2	39.08	140
Height	103	1.63	0.08	1.47	1.87
BMI	103	30.13	6.56	13.52	53.91

Table 5: Frequency of glucose lowering agents used by the study population

E4	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Insulin)	10	9.71	10	9.71
2 (Tablets)	63	61.17	73	70.87
3 (Combination of tablets and insulin)	60	29.13	103	100

Table 6: Frequency of insulin types used by the study population

E5	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Actraphane)	39	97.5	39	97.5
3 (Protophane)	1	2.5	40	100

Table 7: Frequency of patients in the study population owning a blood glucose monitor

F1N1	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	20	19.42	20	19.42
2 (No)	83	80.58	103	100

Table 8: The frequency of blood glucose measurement by the normal weight patients in the study population

	1 (Once Weekly)	5 (Once daily)	6 (Twice daily)	9 (Once monthly)	Total
Group A (Insulin)	1	0	0	0	1
Row %	100	0	0	0	100
Group B (Oral hypoglycaemic tablets)	2	1	1	6	10
Row %	20	10	10	60	100
Group C (Oral hypoglycaemic tablets and insulin	2	0	0	8	10
Row %	20	0	0	80	100
Total	5	1	1	14	21

Table 9: The frequency of blood glucose measurement by the overweight patients in the study population

	1 (Once weekly)	3 (Three times a week)	5 (Once daily)	6 (Twice daily)	9 (once monthly)	Total
Group A (Insulin)	1	1	1	0	0	3
Row %	33.33	33.33	33.33	0	0	100
Group B (Oral hypoglycaemic drugs)	2	0	1	0	23	26
Row %	7.69	0	3.85	0	88.46	100
Group C (Oral hypoglycaemic drugs and insulin)	1	0	1	2	8	12
Row %	8.33	0	8.33	16.67	66.67	100
Total	4	1	3	2	31	41

Table 10: Frequency of blood glucose measurement by the obese patients in the study population

	1 (Once weekly)	2 (Twice weekly)	3 (Three times a week)	5 (once daily)	6 (Twice daily)	9 (Once monthly)	Total
Group B (Oral hypoglycaemic drugs)	3	1	0	2	1	21	28
Row %	10.71	3.57	0	7.14	3.57	75	100
Group C (Oral hypoglycaemic drugs and insulin)	3	0	2	0	0	8	13
Row %	23.08	0	15.38	0	0	61.54	100
Total	6	1	2	2	1	29	41

Table 11: Frequency of patients' average blood glucose readings in the study population

F3	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
2 (3-5 mmol/L)	15	14.56	15	14.56
3 (6-9 mmol/L)	55	53.4	70	67.96
4 (>10mmol/L)	33	32.04	103	100

Table 12: Frequency of normal weight patients in the study population experiencing low blood glucose levels (≤ 3mmol/L)

	1 (Never)	2 (Once monthly)	3 (Once in 2 weeks)	4 (Once weekly)	Total
Group A (Insulin)	0	1	0	0	1
Row %	0	100	0	0	100
Group B (Oral hypoglycaemic drugs)	7	1	1	1	10
Row %	70	10	10	10	100
Group C (Oral hypoglycaemic drugs and insulin)	6	4	0	0	10
Row %	60	40	0	0	100
Total	13	6	1	1	21

Table 13: Frequency of overweight patients in the study population experiencing low blood glucose levels (≤ 3mmol/L)

	1 (Never)	2 (Once monthly)	3 (once in 2 weeks)	Total
Group A (Insulin)	1	1	1	3
Row %	33.33	33.33	33.33	100
Group B (Oral hypoglycaemic drugs)	21	4	1	26
Row %	80.77	15.38	3.85	100
Group C (Oral hypoglycaemic drugs and insulin)	7	5	0	12
Row %	58.33	41.67	0	100
Total	29	10	2	41

Table 14: Frequency of obese patients in the study population experiencing low blood glucose levels (≤ 3mmol/L)

	1 (Never)	2 (Once monthly)	3 (once in 2 weeks)	4 (Once weekly)	Total
Group B (Oral hypoglycaemic drugs)	24	4	0	0	28
Row %	85.71	14.29	0	0	100
Group C (Oral hypoglycaemic drugs and insulin)	8	2	2	1	13
Row %	61.54	15.38	15.38	7.69	100
Total	32	6	2	1	41

Table 15: Frequency of patients in the study population suffering from vision disturbances

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F8N4N1 (Blurred vision)	1 (Yes)	85	82.52	85	82.52
	2 (No)	18	17.48	103	100
F8N4N2 (Double vision)	1 (Yes)	31	30.1	31	30.1
	2 (No)	72	69.9	103	100
F8N4N3 (Visual halo)	1 (Yes)	1	0.97	1	0.97
	2 (No)	102	99.03	103	100
F8N4N4 (Floaters)	1 (Yes)	41	39.81	41	39.81
	2 (No)	62	60.19	103	100

Table 16: Frequency of patients in the study population with possible heart problems

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F8N5N1 (Angina)	1 (Yes)	9	8.74	9	8.74
	2 (No)	94	91.26	103	100
F8N5N2 (Ischemic heart disease)	1 (Yes)	8	7.77	8	7.77
	2 (No)	95	92.23	103	100
F8N5N3 (Heart failure)	1 (Yes)	1	0.97	1	0.97
	2 (No)	102	99.03	103	100

Table 17: Frequency of patients in the study population with possible diabetic complications

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F9N1 (Nephropathy)	1 (Yes)	8	7.77	8	7.77
	2 (No)	95	92.23	103	100
F9N2 (Neuropathy)	1 (Yes)	14	13.59	14	13.59
	2 (No)	89	66.41	103	100
F9N3 (Retinopathy)	1 (Yes)	34	33.01	34	33.01
	2 (No)	69	66.99	103	100
F9N4 (Heart disease)	1 (Yes)	5	4.85	5	4.85
	2 (No)	98	95.15	103	100

Table 18: Statistical parameters

STATISTICAL PARAMETERS FOR VARIOUS TABLES	*PHI* COEFFICIENT
Table 2: Race frequency of total study population	0.36
Table 8: Frequency of blood glucose measurement by the normal weight patients	0.52
Table 9: Frequency of blood glucose measurement by the overweight patients	0.79
Table 10: Frequency of blood glucose measurement by the obese patients	0.42
Table 12: Frequency of normal weight patients experiencing low blood glucose levels	0.55
Table 13: Frequency of overweight patients experiencing low blood glucose levels	0.48
Table 14: Frequency of obese patients experiencing low blood glucose levels	0.42

INDEX P.

LIST OF FIGURES V

LIST OF TABLES VI

CHAPTER 1: INTRODUCTION AND PROBLEM STATEMENT 1

1.1 INTRODUCTION 1

1.2 PROBLEM STATEMENT 1

1.2.1 MICROVASCULAR COMPLICATIONS 2

1.2.2 MACROVASCULAR COMPLICATIONS 2

1.3 RESEARCH OBJECTIVES 3

1.3.1 GENERAL OBJECTIVE 3

1.3.2 SPECIFIC OBJECTIVES 3

1.4 METHOD OF RESEARCH 3

1.4.1 PHASE ONE: LITERATURE STUDY 3

1.4.2 PHASE TWO: EMPIRICAL STUDY 4

1.5 DIVISION OF CHAPTERS 4

1.6 SUMMARY 4

2.1 INTRODUCTION 5

2.2 CLINICAL CLASSIFICATION 5

2.2.1 AETIOLOGICAL CLASSIFICATION OF *DIABETES MELLITUS* (KUZUYA *ET AL.*, 2002:70-71) 6

2.3 DIAGNOSTIC CRITERIA 8

2.4 DEFINITIONS **8**
2.4.1 TYPE 1 *DIABETES MELLITUS* 8
2.4.2 TYPE 2 *DIABETES MELLITUS* 9
2.4.3 GESTATIONAL DIABETES 9

2.5 TYPE 1 DIABETES **9**
2.5.1 PATHOPHYSIOLOGY 9
2.5.1.1 Immune-mediated type 1 diabetes mellitus 10
2.5.1.2 Idiopathic type 1 diabetes mellitus 10
2.5.2 CLINICAL SYMPTOMS (MASHARANI *ET AL.* 2003:1156) 10

2.6 TYPE 2 *DIABETES MELLITUS* **11**
2.6.1 PATHOPHYSIOLOGY 11
2.6.2 CLINICAL SYMPTOMS (MASHARANI *ET AL.* 2003:1156) 12
2.6.3 *CONTRIBUTING FACTORS* 12
2.6.4 SYNDROME X AND IMPAIRED GLUCOSE TOLERANCE 12

2.7 GESTATIONAL DIABETES **14**
2.7.1 RISK FACTORS FOR DEVELOPING GESTATIONAL DIABETES (READER *ET AL.* 2006:1426) 14

2.8 CHRONIC COMPLICATIONS OF DIABETES **15**
2.8.1 OCULAR COMPLICATIONS 15
2.8.1.1 Diabetic cataracts 15
2.8.1.2 Glaucoma 15
2.8.1.3 Diabetic retinopathy 15
2.8.2 DIABETIC NEPHROPATHY 16
2.8.3 DIABETIC NEUROPATHY 18
2.8.3.1 Gangrene of the feet 18
2.8.4 CARDIOVASCULAR DISEASE 18
2.8.4.1 Hypertension 19
2.8.4.2 Ischemic attack and stroke 20

2.9 MANAGEMENT THERAPY **21**
2.9.1 ALGORITHM 21
2.9.2 SELF-CARE 22
2.9.1.1 AIMS OF DIETARY INTERVENTION (HARDING, 1999:164) 23

2.9.1.2 Current recommendation 24
2.9.2 PHARMACOTHERAPY: ORAL GLUCOSE LOWERING DRUGS 25
2.9.2.1 Biguanides 26
2.9.3.2 Sulphonylamides and urea derivates 28
2.9.3.3 Alpha glucosidase inhibitors 31
2.9.3.4 Thiazolidinediones 32
2.9.3.5 Meglitinides 33
2.9.3.6 Combination of metformin and glibenclamide 34
2.9.4 PHARMACOTHERAPY: INSULIN 35
2.9.4.1 Effects of insulin on its target organs 37
2.9.4.2 Insulin preparations available in South Africa (Gibbons, 2003:71) 37
2.9.4.3 Drug interactions (Gibbon, 2003:73) 39
2.9.4.4 Complications of insulin therapy 39
2.9.5 CONTINUOUS SUBCUTANEOUS INSULIN INFUSION (CSII) 40
2.9.6 INHALED INSULIN 41

2.10 CONCLUSION 42

CHAPTER 3: EMPIRICAL INVESTIGATION 43

3.1 INTRODUCTION 43

3.2 RESEARCH OBJECTIVES 43
3.2.1 GENERAL OBJECTIVE 43
3.2.2 SPECIFIC OBJECTIVES 43

3.3 STUDY POPULATION 44

3.4 RESEARCH DESIGN AND METHODOLOGY 44

3.5 MEASURING INSTRUMENTS 45
3.5.1 FREQUENCY 45
3.5.2 PERCENTAGES 45
3.5.3 CUMULATIVE FREQUENCY 45
3.5.4 CUMULATIVE PERCENT 45

3.6 STATISTICAL ANALYSES **46**
3.6.1 RANGE 46
3.6.2 MEAN 46
3.6.3 STANDARD DEVIATION 46
3.6.4 MINIMUM AND MAXIMUM 46
3.6.5 CHI-SQUARE 46
3.6.6 LIKELIHOOD RATIO CHI-SQUARE (LRX) 46
3.6.7 MANTEL-HAENSZEL CHI-SQUARE 47
3.6.8 EFFECT SIZE 47
3.6.9 THE CONTINGENCY COEFFICIENT 47
3.3.10 CRAMER'S V 47

3.7 SUMMARY **48**

CHAPTER 4: RESULTS AND DISCUSSIONS **49**

4.1 INTRODUCTION **49**

4.2 SECTION A: DEMOGRAPHIC INFORMATION **49**
4.2.1 NUMBER OF PATIENTS AT EACH CLINIC 49
4.2.2 STUDY POPULATION 50
4.2.3 DIFFERENT RACES IN THE STUDY POPULATION 50
4.2.4 LANGUAGE PREFERENCE 52

4.3 SECTION B: DIAGNOSTIC DATA **52**
4.3.1 CLASSIFICATION OF DIABETES 52
4.3.2 GENETIC PROBABILITY 55

4.4 SECTION C: LIFESTYLE **58**
4.4.2 EXERCISE 59
4.4.3 SMOKING 62
4.4.4 ALCOHOL 63
4.4.5 DIET 64

4.5 SECTION D: WELL-BEING **78**

4.6 SECTION E: COMPLIANCE **80**

4.7 SECTION F: MONITORING 87

4.8 SECTION G: CONSULTATION 107

4.9 SUMMARY 109

CHAPTER 5: CONCLUSIONS, RECOMMENDATIONS AND RESTRICTIONS 110

5.1 INTRODUCTION 110

5.2 CONCLUSIONS 110

5.3 RECOMMENDATIONS 114

5.4 RESTRICTIONS 115

5.5 SUMMARY 115

BIBLIOGRAPHY 116

APPENDIX A

APPENDIX B

APPENDIX C

APPENDIX D

APPENDIX E

APPENDIX F

APPENDIX G

LIST OF FIGURES

Figures		p.
1	Schema outlining potential interactions between metabolic and haemodinamic factors	17
2	Suggested treatment algorithm for type 2 diabetes	21
3	Food pyramid	22
4	Time-action of Exubera and subcutaneous insulin	41

LIST OF TABLES

Tables		p.
2.1	Criteria of Fasting Plasma Glucose (FPG) and 2h Plasma Glucose (2hPG) following 75g glucose ingestion	8
2.2	A comparison of some of the most widely used definitions for metabolic syndrome	13
2.3	Hypertension-related target organs and consequences on morbidity and mortality	19
2.4	Pharmacological classification and product names of biguanides	26
2.5	Pharmacological classification, product name and dosage of sulphonylamides and urea derivates	29
2.6	Pharmacological classification, product name and dosage of the thiazolidinediones	32
2.7	Pharmacological classification, product name and dosage of the meglitinides	33
2.8	Different dosages of Glucovance®	34
2.9	Pancreatic islet cells and their secretory products	36
2.10	Effects on insulin and its target organs	37
3.1	Frequency of gender in the study population	44
3.2	Frequency of race in the study population	44
4.1	Patient frequency and percentage at each clinic	49
4.2	Study population compared to South Africa's population	50
4.3	Race frequencies in the study population	50
4.4	Correlation between diabetes groups and races in the studied population	51
4.5	Statistical parameters for the correlation between different diabetes groups and races in the studied population	51
4.6	Language preference of the studied population	52
4.7	Diabetes groups frequencies	52

4.8 Correlation between gender and different diabetes groups in the studied population 54

4.9 Statistical parameters for the correlation between different diabetes groups and gender in the studied population 54

4.10 Family history of diabetes 55

4.11 Correlation between different groups of diabetes and inheritance tendency, where one or more family member suffered from the disease 56

4.12 Statistical parameters for the correlation between different diabetes groups and inheritance tendency, where one or more family member suffered from the disease 56

4.13 Correlation between different diabetes groups and close family members with diabetes 57

4.14 Statistical parameters for the correlation between different diabetes groups and close family members with diabetes 57

4.15 BMI explained 58

4.16 Weight frequencies in the total study population 58

4.17 Means procedure of the total weight frequencies 58

4.18 Total frequency of studied population who exercise 59

4.19 Total frequency of exercise types done by the study population 59

4.20 Total frequency of exercise compared to weight status in the studied population 59

4.21 Statistical parameters for the correlation between exercise and weight status in the study population 60

4.22 Frequency of exercise done in a week 60

4.23 Correlation between frequencies of exercise done in a week compared to weight status of the studied population 61

4.24 Statistical parameters for the correlation between frequencies of exercise done in a week and weight status of the studied population 61

4.25 Frequency of smokers in the studied population 62

4.26 Frequency of cigarettes smoked by the study population 62

4.27 Frequency of smokers who considered quitting smoking in the study population 63

4.28 Frequency of total beer consumption per week by the study population 63

4.29 Frequency of total wine consumption per week by the total study population 63

4.30 Frequency and percentage of liquor consumption 64

4.31 Frequency of reasons for eating given by the study population 64

4.32 Comparison between being hungry for a reason for eating and weight status of the study population 65

4.33 Statistical parameters for the comparison between being hungry for a reason for eating and weight status of the study population 65

4.34 Comparison between the reason for eating being prescribed by a dietician and weight status of the study population 66

4.35 Statistical parameters for the comparison between reason for eating being prescribed by a dietician and weight status of the study population 66

4.36 Frequency of meals consumed a day by the study population 66

4.37 Comparison between meals consumed a day and weight status of the study population 67

4.38 Statistical parameters for comparison between meals consumed a day and weight status of the study population 67

4.39 Frequency of fruits, vegetables and meat consumed a day by the study population 68

4.40 Comparison between daily vegetable consumption and weight status of the study population 69

4.41 Statistical parameters for comparison between daily vegetable consumption and weight status of the study population 69

4.42 Frequency of daily carbohydrate and plant proteins consumed 70

4.43 Comparison between weekly consumption of beans and weight status of the study population 71

4.44 Statistical parameters for comparison between weekly bean consumption and weight status of the study population 71

4.45	Frequency of daily fat consumption in the study population	71
4.46	Correlation between daily fat consumption and weight status in the study population	72
4.47	Statistical parameters for the correlation between daily fat consumption and weight status of the study population	72
4.48	Frequency of daily salt consumption in the study population	73
4.49	Comparison between daily salt consumption and weight status of the study population	73
4.50	Statistical parameters for the comparison between daily salt consumption and weight status in the study population	73
4.51	Frequency of daily water consumption in the study population	74
4.52	Comparison between daily water consumption and weight status of the study population	74
4.53	Statistical parameters for the comparison between daily water consumption and weight status of the study population	74
4.54	Frequency of patients finding it difficult to obtain the right food in the study population	75
4.55	Comparison between the frequency of patients finding it difficult to obtain the right food and weight status of the study population	75
4.56	Statistical parameters for the comparison between the frequency of patients finding it difficult to obtain the right food and weight status of the study population	75
4.57	Frequency of patients finding it difficult to follow a specific diet in the study population	76
4.58	Correlation between frequency of patients finding it difficult to follow a specific diet and weight status of the study population	76
4.59	Statistical parameters for the correlation between the frequency of patients finding it difficult to follow a specific diet and weight status of the study population	76
4.60	Frequency of patients' last session attended with a registered dietician	77

4.61 Comparison between last sessions attended with dietician and weight status of the study population 77

4.62 Statistical parameters for the comparison between last sessions attended with dietician and weight status of the study population 78

4.63 Frequency of patients in the study population who visited a dentist, podiatrist and ophthalmologist in the past year 78

4.64 Frequency of emotions towards diabetes in the study population 79

4.65 Frequency of patients feeling isolated because of diabetes in the study population 80

4.66 Frequency of patients with physical complaints in the study population 80

4.67 Frequency of patients in the study population taking medication as prescribed 81

4.68 Frequency of reasons given by the patients in the study population for not taking the prescribed medication 81

4.69 Frequency of patients in the study population whose prescription have been adjusted 82

4.70 Frequency of the main reason for prescription alteration given by patients in the study population 82

4.71 Frequency of glucose lowering agents used in the study population 83

4.72 Frequency of insulin types used in the study population 83

4.73 Frequency of injection sites used by group A and C diabetics in the study population 84

4.74 Frequency of injection site problems reported by the study population 84

4.75 Frequency of patients in the study population using metformin 85

4.76 Frequency of metformin dosages administered by the patients in the study population 85

4.77 Frequency of patients in the study population administering metformin with meals 86

4.78 Frequency of patients in the study population using gliclazide 86

4.79 Frequency of gliclazide dosages administered by the patients in the study population 86

4.80 Frequency of patients in the study population administering gliclazide with meals 87

4.81 Frequency of patients in the study population owning a blood glucose instrument 87

4.82 Frequency of the study populations' frequency of blood glucose measurement 88

4.83 Correlation between the frequency of normal weight patients in the study population and the frequency of blood glucose measurement 88

4.84 Statistical parameters for the correlation between the frequency of normal weight patients in the study and the frequency of blood glucose measurement 89

4.85 Correlation between the frequency of overweight patients in the study and the frequency of blood glucose measurement 89

4.86 Statistical parameters for the correlation between the frequency of overweight patients in the study and the frequency of blood glucose measurement 90

4.87 Correlation between the frequency of obese patients in the study and the frequency of blood glucose measurement 91

4.88 Statistical parameters for the correlation between the frequency of obese patients in the study and the frequency of blood glucose measurement 91

4.89 Frequency of patients' average blood glucose readings in the study population 92

4.90 Correlation between the frequency of normal weight patients in the study and their average blood glucose levels 92

4.91 Statistical parameters for the correlation between the frequency of normal weight patients in the study and their average blood glucose levels 93

4.92 Correlation between the frequency of overweight patients in the study and their average blood glucose levels 93

4.93 Statistical parameters for the correlation between the frequency of overweight patients in the study and their average blood glucose levels 94

4.94 Correlation between the frequency of obese patients in the study and their average blood glucose levels 94

4.95 Statistical parameters for the correlation between the frequency of obese patients in the study and their average blood glucose levels 95

4.96 Frequency of patients in the study population experiencing low blood glucose levels (≤3mmol/L) 95

4.97 Correlation between frequency of normal weight patients in the study population and patients experiencing low blood glucose levels (≤3mmol/L) 96

4.98 Statistical parameters for the correlation between frequency of normal weight patients in the study population and patients experiencing low blood glucose levels (≤3mmol/L) 96

4.99 Correlation between frequency of overweight patients in the study population and patients experiencing low blood glucose levels (≤3mmol/L) 97

4.100 Statistical parameters for the correlation between frequency of overweight patients in the study population and patients experiencing low blood glucose levels (≤3mmol/L) 97

4.101 Correlation between frequency of obese patients in the study population and patients experiencing low blood glucose levels (≤3mmol/L) 98

4.102 Statistical parameters for the correlation between frequency of obese patients in the study population and patients experiencing low blood glucose levels (≤3mmol/L) 98

4.103 Frequency of patients in the study population experiencing symptoms associated with low blood glucose levels 99

4.104 Frequency of patients in the study population experiencing elevated blood glucose levels (≥10mmol/L) 99

4.105 Correlation between normal weight patients in the study population and patients experiencing elevated blood glucose levels (≥10mmol/L) 100

4.106 Statistical parameters for the correlation between normal weight patients in the study population and patients experiencing elevated blood glucose levels (≥10mmol/L) 100

4.107 Correlation between overweight patients in the study population and patients experiencing elevated blood glucose levels (≥10mmol/L) 101

4.108 Statistical parameters for the correlation between overweight patients in the study population and patients experiencing elevated blood glucose levels (≥10mmol/L) 102

4.109 Correlation between obese patients in the study population and patients experiencing elevated blood glucose levels (≥10mmol/L) 102

4.110 Statistical parameters for the correlation between obese patients in the study population and patients experiencing elevated blood glucose levels (≥10mmol/L) 103

4.111 Frequency of patients in the study population experiencing symptoms associated with elevated blood glucose levels 103

4.112 Frequency and percentage of patients in the study population that previously went into a diabetic coma and insulin shock 104

4.113 Frequency of patients in the study population experiencing recurrent diseases 104

4.114 Frequency of patients in the study population who suffered from vision disturbances 105

4.115 Frequency of patients in the study population with possible heart problems 105

4.116 Frequency of patients in the study population with possible diabetic complications 106

4.117 Frequency of patients in the study population who attended doctor consultations in the past twelve months 107

4.118 Frequency of given reasons for the consultations by the patients in the study population 108

4.119 Frequency of patients in the study population being previously hospitalised for diabetes 108

Chapter 1

Introduction and problem statement

1.1 INTRODUCTION

This dissertation will focus on the evaluation and management of diabetic patients in primary health care clinics.

1.2 PROBLEM STATEMENT

In the United States, more than 1 million people, of which 123 000 are younger than 20 years of age, suffer from Type 1 *diabetes mellitus* (Bennet & Kho-Knox, 2004:1075). Type 1 *diabetes mellitus* develops in childhood or early adulthood. The patient suffers from an absolute deficiency of insulin as a result of immune-mediated destruction of the pancreatic Beta-cells as stated by Wells *et al.* (2003:170).

According to Smeltzer and Bare (2004:1151) the major classifications of diabetes are:

- Type 1 diabetes: insulin-dependant *diabetes mellitus*
- Type 2 diabetes: non-insulin-dependant *diabetes mellitus*
- Gestational diabetes: any degree of glucose intolerance with its onset during pregnancy (Brunner & Suddarth, 2004:1154)
- *Diabetes mellitus* associated with other conditions or syndromes

Type 2 *diabetes mellitus* manifests as insulin resistance, which refers to a decreased sensitivity of tissue to insulin, and impaired insulin secretion (Smeltzer & Bare, 2004:1153). According to Harper *et al.* (2003:1) Type 2 *diabetes mellitus* can be undiagnosed for years which can lead to serious long-term complications. These complications can be divided into:

- Those affecting the microvascular system and leading to retinopathy, neuropathy and nephropathy.
- Those affecting the macrovascular system can lead to cardiovascular disease, coronary artery disease and stroke due to accelerated atherosclerosis.

1.2.1 Microvascular complications

Retinopathy, the deterioration of the small blood vessels that nourish the retina, is a serious complication because it can lead to blindness. This is a major cause of concern, especially in the developing countries (Harper *et al.* 2003:1), because when the patient is blind, he can not do his work, which means that there is no income for his family; in other words, there will be no food to eat.

Diabetic neuropathy refers to a group of diseases that affect all types of nerves, including peripheral, autonomic and spinal nerves (Smeltzer & Bare, 2004:1192). Harper *et al.* (2003:1) states that this damage to the nerves may lead to foot ulcers and later to amputation, but according to Sims (1988:12), this can be prevented through adequate patient education and the use of comprehensive screening examinations.

Another major cause of concern is diabetic nephropathy. Nephropathy refers to the damaging of the small blood vessels in the kidneys, which can cause renal failure (Yong – Gui *et al.*, 1993:329). He claims that diabetic nephropathy is the primary cause of end phase renal failure in developing countries, with renal diseases as primary cause of morbidity and mortality in the diabetic population.

1.2.2 Macrovascular complications

According to Costacou *et al.* (2006:387) individuals with *diabetes mellitus* are at increased risk for cardiovascular morbidity and mortality compared to the general population. Macrovascular complications are the leading cause of death and morbidity in patients suffering from *Diabetes Mellitus*. Hypertension is associated with increased insulin resistance. Insulin resistance, even in the absence of diabetes, is an important component of the Metabolic syndrome, having a causative role for the development of cardiovascular disease. Other cardiovascular diseases that may occur are coronary artery disease and stroke due to accelerated atherosclerosis. These complications will be discussed further in the next chapter.

According to Wells *et al.* (2003:172) the goals of diabetic treatment are to improve symptoms of hyperglycaemia, reduce the onset and progression of complications, reduce mortality and improve quality of life. It is therefore essential to identify effective ways for the prevention and treatment of diabetic complications.

Bennet and Koh-Knox (2004:1072) emphasise that the pharmacist should not only assist in the purchasing of diabetes care products, but should also try to determine whether a diabetes care plan is being followed by the patient.

1.3 RESEARCH OBJECTIVES

1.3.1 General objective

The aim of this dissertation is to study the treatment of diabetic patients on primary health care level and to suggest contributions which can be made to the prevention of diabetic complications.

1.3.2 Specific objectives

- To determine how age, lifestyle, socio-economic status and education influence diabetes
- To determine ethnic and cultural barriers in education about diabetes
- To determine from the community how accessible healthcare providers are to them
- To determine whether the community receives sufficient information on diabetes from healthcare providers
- To determine the knowledge of the community about diabetes
- To investigate which methods and techniques in the public health care sector can ensure access to quality health care
- To formulate recommendations regarding the management of *diabetes mellitus* on primary health care level

1.4 METHOD OF RESEARCH

1.4.1 Phase One: Literature study

The literature study will be divided into two steps. The first step focuses on the discussion of diabetic care. The second step focuses on the factors that influence the management of diabetes on primary health care level.

a) Step one

- Definition, description and classification of *diabetes mellitus*
- Symptoms, signs, complications and risk factors
- Prognosis, management and care of the condition

- Clinical monitoring and patient self-monitoring

b) Step two

- Educational and cultural barriers in the treatment of this disease
- The use of traditional remedies for the management of diabetes
- The factors that influence medicine usage in diabetic patients

1.4.2 Phase Two: Empirical study

This phase consists of five parts:

1) The selection of a study population

2) The selection of the measuring instrument

3) Data analysis

4) Report and discussion of the results

5) Recommendations

1.5 DIVISION OF CHAPTERS

Chapter 1: Introduction and problem statement

Chapter 2: *Diabetes mellitus:* complications and treatment

Chapter 3: Empirical investigation

Chapter 4: Results and discussion

Chapter 5: Conclusions, recommendations and restrictions

1.6 SUMMARY

An overview of the problem statement is presented in this chapter. The general and specific research objectives are stipulated, and the research method as well as the division of chapters is described.

Chapter 2

Diabetes mellitus, complications and treatment

2.1 INTRODUCTION

In many African countries, including South Africa, much attention has been centred on the management of HIV/AIDS and tuberculosis epidemics. However, there is growing awareness in South Africa – a country that is undergoing a prolonged period of socio-economic and cultural transformation – that life-style related non-communicable conditions, such as diabetes and obesity, represent an important health priority (Pirie, 2005:42).

2.2 CLINICAL CLASSIFICATION

According to Masharani *et al.* (2003:1152) *diabetes mellitus* is a syndrome with disordered metabolism and inappropriate hyperglycaemia due to either a deficiency of insulin secretion or to a combination of insulin resistance and increased insulin secretion to compensate; subsequently insulin secretion would become inadequate. This results in impaired transport of carbohydrates into the cells in the presence of hyperglycaemia.

Kuzuya *et al.* (2002:66) state that a long duration of metabolic derangement, specific complications of diabetes (retinopathy, nephropathy and neuropathy) may occur and that atherosclerosis is also accelerated. Depending on the severity of the metabolic abnormality, diabetes may be asymptomatic, or may be associated with symptoms such as thirst, polyuria and weight loss or may progress to ketoacidosis and coma.

The WHO state that the abnormalities of carbohydrate, fat and protein metabolism are due to deficient action of insulin on target tissues resulting from insensitivity or lack of insulin. Catabolism of other energy sources results, so that free fatty acids and amino acids are derived from fats and proteins, gluconeogenesis is increased and, if insulin deficiency is absolute, ketogenesis prevails (Gibbon, 2003:70).

2.2.1 Aetiological classification of *diabetes mellitus* (Kuzuya *et al.*, 2002:70-71)

1. Type 1 *diabetes mellitus*

- Immune mediated
- Idiopathic.

2. Type 2 *diabetes mellitus*

3. Due to specific mechanisms or diseases

- Genetic abnormalities of pancreatic β-cell function.
- Genetic abnormalities of insulin action.
- Exocrine diseases:
  - ❖ Pancreatitis
  - ❖ Trauma of pancreas
  - ❖ Neoplasm of pancreas
- Endocrine diseases:
  - ❖ Cushing syndrome
  - ❖ Glycagonoma
  - ❖ Hyperaldosteronism
  - ❖ Hyperthyroidism
- Liver diseases:
  - ❖ Chronic hepatitis
  - ❖ Liver cirrhosis
- Drug or chemical induced:
  - ❖ Glucocorticoids
  - ❖ Interferons
  - ❖ Thiazide diuretica

- Infections:
  - ❖ Congenital rubella
  - ❖ Cytomegalo virus
  - ❖ Epstein-Barr virus
  - ❖ Coxackie virus
  - ❖ Mumps virus

- Rare forms of immune-mediated diabetes:
  - ❖ Anti-insulin receptor antibodies
  - ❖ Stiffman syndrome
  - ❖ Insulin autoimmune syndrome

- Various genetic syndromes:
  - ❖ Down syndrome
  - ❖ Prader-Willi syndrome
  - ❖ Turner syndrome
  - ❖ Klinefelter syndrome
  - ❖ Werner syndrome
  - ❖ Wolfram syndrome

4. Gestational *diabetes mellitus*

2.3 DIAGNOSTIC CRITERIA

The WHO states that the requirements for diagnostic confirmation for a person presenting with severe symptoms and gross hyperglycaemia differ from those for the asymptomatic person with blood glucose values found to be just above the diagnostic cut-off value. Also, severe hyperglycaemia detected under conditions such as acute infection, trauma, circulatory problems or other stress may be transitory and should not in itself be regarded as diagnostic for diabetes.

According to Kuzuya *et al.* (2002:83), the cut-off plasma glucose levels for each category are the same, but a term 'type' is added to each category. Subjects with 1hPG ≥ 10mmol/L are advised to be treated similarly to borderline type, even if they belong to normal type, because it is known that such individuals are at higher risk of developing diabetes than those with 1hPG < 10mmol/L .

Kuzuya *et al.* (2002:83) states that borderline type is defined as neither diabetic nor normal type when oral glucose tolerance test is performed. Diabetes is generally diagnosed when 'diabetic type' hyperglycaemia is confirmed on two or more occasions, and diabetes can be diagnosed on a single 'diabetic type' hyperglycaemia if the patient has typical symptoms of diabetes, HbA_1 C is higher than 6.5% or diabetic retinopathy.

Table 2.1: Criteria of Fasting Plasma Glucose (FPG) and 2h Plasma Glucose (2hPG) following 75g glucose ingestion (Kuzuya *et al.*, 2002:73)

	Normal range	**Diabetic range**
FPG	< 6.1mmol/L	≥ 7.0mmol/L
2h PG after 75g glucose	< 7.8mmol/L	≥11.1mmol/L
Evaluation of oral glucose tolerance test.	Normal type: If both values belong to normal range. Borderline type: Neither normal nor diabetic type: Pre-diabetes. Impaired glucose tolerance.	Diabetic type: If any of the two values falls into diabetic range.

2.4 DEFINITIONS

2.4.1 Type 1 *diabetes mellitus*

Schwinghammer (2003:170) states that type 1 was formerly known as insulin-dependent or juvenile-onset diabetes, and generally develops as a result from immune-mediated destruction of pancreatic β-cell, resulting in an absolute deficiency of insulin, and develops in childhood or early adulthood. The factors that initiate the autoimmune process are unknown,

but the process is mediated by macrophages and T lymphocytes with circulating autoantibodies aimed at various β-cell antigens (e.g., islet cell antibody, insulin antibody).

2.4.2 Type 2 *diabetes mellitus*

The WHO 1999, states that type 2 diabetes is characterized by disorders of insulin action and insulin secretion, either of which may be the predominant feature. Both are usually present at the time that this form of diabetes manifests clinically, but the specific reasons for the development of these abnormalities are not yet known.

2.4.3 Gestational diabetes

According to Kuzuya *et al.* (2002:70-71) this type of diabetes is any state of glucose intolerance occurring or detected for the first time during pregnancy.

2.5 TYPE 1 DIABETES

According to the Pirie (2005:43), type 1 diabetes is poorly characterized in South Africa, both in terms of the epidemiology of the condition and the factors related to its development and that currently, there is no register of people with type 1 diabetes in South Africa. It appears that the peak age for onset of this type of diabetes in South Africans is some years later than that in people in most developed countries.

2.5.1 Pathophysiology

The pathophysiology of "typical" type 1 diabetes is thought to be due to an absolute insulin deficiency without significant insulin resistance that results in hyperglycaemia, spontaneous ketosis, and if untreated, diabetic ketoacidosis (Pinero-Pilona & Raskin, 2001:329). This absolute deficiency is thought to be caused by autoimmune β-cell destruction, triggered by unknown mechanisms.

Despite much research, no environmental agent or agents responsible for triggering type 1 diabetes have been uncovered. To date, environmental risk determinants subject to the most widespread investigation can be classified into three groups: viral infections (e.g. coxsackie virus and cytomegalovirus), early infant diet (e.g. breast feeding versus early introduction of cow's milk components) and toxins (e.g. N-nitroso derivates) (Atkinson *et al.* 2001:222).

Masharani *et al.* (2003:1153) states that certain human leukocyte antigens (HLA) are strongly associated with the development of type 1 diabetes. According to Nolte and Karam (2001:71) an underlying genetic defect to pancreatic β-cell replication or functioning may predispose to the development of β-cell failure after viral infection. In addition, specific HLA genes may increase susceptibility to a diabetogenic virus or may be linked to certain immune

response genes that predispose patients to a destructive autoimmune response against their own islet cells (autoaggression). In the study of Pinero-Pilona And Raskin (2001:330) evidence was found that suggests that there may be mechanisms other than the autoimmune destructions of β-cells that cause β-cell failure in idiopathic type 1 diabetes, but little is known about this "non-immune-mediated" diabetes pathogenesis.

2.5.1.1 Immune-mediated type 1 diabetes mellitus

According to Masharani *et al.*, (2003:1153) immune-mediated type 1 is felt to result from an infectious or toxic insult to persons whose immune systems are genetically predisposed to develop a vigorous autoimmune response either against altered pancreatic β-cell antigens or against molecules of the β-cell resembling the viral protein (molecular mimicry). They state that intrinsic factors that affect β-cell function include damage caused by viruses such as mumps or coxsackie B4 virus, by toxic chemical agents, or by destructive cytotoxins and antibodies released from sensitized immunocytes.

2.5.1.2 Idiopathic type 1 diabetes mellitus

Fewer than 10% of subjects exhibit no evidence of pancreatic β-cell autoimmunity to explain their insulinopenia and ketoacidosis (Masharani *et al.* 2003:1153); most of these are of Asian or African origin. According to Pinero-Pilona and Raskin (2001:328) this type is called "atypical diabetes" because these individuals have the phenotypic characteristics of type 2 diabetes, but present the clinical picture of type 1, by having unprovoked diabetic keto-acidosis as their initial manifestation of diabetes.

2.5.2 Clinical symptoms (Masharani *et al.* 2003:1156)

Type 1 diabetes occurs in young people with acute onset, but may occur at any age, sometimes with slow progression (Kuzuya *et al.* 2002:70). The following symptoms may be observed:

- Increased thirst, urine volume and frequency of urine.
- Recurrent infections.
- Unexplained weight loss.
- High levels of glucosuria.
- Drowsiness and coma in severe cases.
- Blurred vision.

- Postural hypotension due to lowered plasma volume.
- Paresthesias may be present at time of diagnosis.
- Ketoacidosis exacerbates the dehydration and hyperosmolality by producing anorexia, vomiting and nausea, interfering with oral fluid replacement.
- Fruity breath odour of acetone suggests diabetic ketoacidosis.

2.6 TYPE 2 *DIABETES MELLITUS*

This type of diabetes was previously called non-insulin-dependent *diabetes mellitus*. In this type, the mass of pancreatic β-cells and their function are preserved to some extent, and insulin injection is seldom needed to sustain life (Kuzuya *et al.,* 2002:70). However, according to Hirsch *et al.* (2005:79) the deterioration in β cell function occur both in patients controlled by diet and in those treated with sulphonylureas and metformin, thus suggesting that neither of these agents slow the rate of decline. It is, therefore, reasonable to conclude that most patients with type 2 diabetes will eventually need exogenous insulin.

More than 90% of people who have diabetes, have type 2 diabetes. The onset is usually in middle age and in most cases it is thought to be due to some form of insensitivity to the action of insulin rather than insulin deficiency (www.monitordiabetes.com.br/t.htm).

2.6.1 Pathophysiology

The pathogenesis of type 2 is complex, but is probably related to the presence of obesity and insulin resistance initially, with insulin secretory defects occurring later (Pinero-Pilona & Raskin, 2001:330).

According to Nolte and Karam (2001:711) circulating endogenous insulin is sufficient to prevent keto-acidosis, but is often either subnormal or relatively inadequate because of tissue insensitivity. Masharani *et al.* (2003:1153) state that in addition to tissue insensitivity, there is an accompanying deficiency in the response of pancreatic β-cells to glucose. Both the tissue resistance to the insulin and the impaired β-cell response to glucose appear to be further aggravated by increased hyperglycaemia, and both defects are ameliorated by treatment that reduces hyperglycaemia toward normal. But, even in the presence of adequate glucose control, there is progressive β-cell failure and this progressive decline in insulin secretion may be the reason why many individuals with type 2 diabetes eventually require insulin therapy (Pinero-Pilona and Raskin 2001:330).

2.6.2 Clinical symptoms (Masharani *et al.* 2003:1156)

- Many patients may present with increased urination and thirst, while others have an insidious onset of hyperglycaemia and are initially asymptomatic.
- May present with evidence of neuropathic or cardiovascular complications.
- Chronic skin infections.
- Pruritis and vaginitis.
- Recurrent blurred vision.
- Weakness and fatigue.

2.6.3 Contributing factors

According to Kuzuya *et al.* (2002:70) the majority of diabetes type 2 patients are obese or have been obese in the past and this is where Syndrome X manifests. Diabetes is associated more with obese patients with localization of fat deposits on the upper segment of the body (abdomen, chest, neck and face) and relatively less fat on the appendages, which may be quite muscular (Masharani *et al.*, 2003:1156). Kuzuya *et al.* (2002:71) state that genetic abnormalities have not yet been identified in most patients, but rather polygenic inheritance is presumed.

2.6.4 Syndrome X and impaired glucose tolerance

There are currently six separate definitions of metabolic syndrome (Ritchie & Connell, 2006:319-320). Four of these are summarised in table 2.2.

Table 2.2: A comparison of some of the most widely used definitions for metabolic syndrome (adapted from Ritchie & Connell, 2006:320)

WHO (1999)	EGIR (1999)	ATPIII (2001)	IDF (2005)
Diabetes, impaired glucose tolerance, glucose intolerance or insulin resistance, plus two or more of the following: • BMI>30kg/m² • TG≥1.7mmol/L or HDL-C<0.9(M) or <1.0mmol/L(F) • BP>130/90mmHg • Albumin excretion>20µg/min	Insulin resistance deemed by fasting insulin values, plus two or more of the following: • Central obesity with WC≥94cm(M) or ≥80cm(F) • TG>2.0mmol/L or HDL<1.0mmol/L • BP≥140/90mmHg or on antihypertensive medication • FBG≥6.1mmol/L	Three or more of the following: • WC>102cm(M) or >88cm(F) • TG>1.7mmol/L • BP≥135/85mmHg or antihypertensive medication • FPG≥6.1mmol/L	Central obesity, plus any two of the following: • TG>1.7mmol/L or on specific treatment • HDL-C<1.03(M) or <1.29mmol/L(F) or on specific treatment. • BP≥130/85mmHg or on antihypertensive treatment • FPG≥5.6mmol/L or previously diagnosed type 2

WHO: World health organisation
EGIR: the European Group for the Study of Insulin Resistance
ATPIII: the National Cholesterol Education Program Adult Treatment Panel III
IDF: International Diabetes Federation
BMI: Body Mass Index
BP: Blood pressure
F: Female
M: Male
FPG: Fasting Plasma Glucose
HDL-C: High Density Lipoprotein Cholesterol
TG: Triglycerides
WC: Waist circumference

In obese patients with type 2 diabetes, the association of hyperglycaemia, hyperinsulinemia, dyslipidemia and hypertension, which leads to coronary artery disease and stroke, may result from a genetic defect producing insulin resistance (Masharani *et al.,* 2003:1155). Insulin resistance is not the only cause of the Metabolic syndrome, but fat accumulation, especially in the visceral compartment plays a central role (Lamounier-Zepter *et al.,* 2006:356+360). Insulin resistance can be diagnosed if BMI > 27.5 kg/m^2, together with a family history of diabetes and elevated triglyceride levels.

The WHO categorized impaired glucose tolerance (IGT) as a stage in the natural history of disordered carbohydrate metabolism, which is often associated with the Metabolic syndrome / Insulin resistance syndrome / Syndrome X. Impaired fasting glucose (IFG) refers to fasting glucose concentrations which are lower than those required to diagnose *diabetes mellitus* but, higher than "normal" reference range. The range for IFG is 6,1mmol/l > 7mmol/l.

IGT and IFG are not clinical entities in their own right, but rather risk categories for future diabetes and cardiovascular disease (WHO,1999). Often a person with IGT or diabetes, will be found to have at least one or more cardiovascular disease risk components. These, together with hypertension, central (upper body) obesity and dyslipidemia, with or without hyperglycaemia have been labelled as Syndrome X.

2.7 GESTATIONAL DIABETES

According to Kuzuya *et al.* (2002:70-71) gestational diabetes is any state of glucose intolerance occurring or detected for the first time during pregnancy. Reader *et al.* (2006:1426) state that this definition applies whether medication or only nutrition therapy is used for treatment and whether glucose intolerance continues after pregnancy. After pregnancy, glucose tolerance in most women with gestational diabetes (81% - 94%) returns to normal, but they are at higher risk of developing gestational diabetes in subsequent pregnancies and are at increased risk for developing prediabetes and type 2 diabetes.

2.7.1 Risk factors for developing gestational diabetes (Reader *et al.* 2006:1426)

- Age older than 25
- Overweight or obesity, with a BMI >25kg / m
- Previous abnormal glucose tolerance
- Gestational diabetes in previous pregnancy
- Strong family history of diabetes and/or gestational diabetes

2.8 CHRONIC COMPLICATIONS OF DIABETES

According to Harper *et al.* (2003:82) diabetes can remain undiagnosed for many years and this delay in the detection of diabetes has serious consequences.

Type 2 diabetes is associated with a number of vascular complications that can have significant consequences for patients' quality of life, and often the onset of complications is the first sign of the disease (Viberti, 2003:168).

Late clinical manifestations of *diabetes mellitus* include a number of pathological changes that involve small and large blood vessels, cranial and peripheral nerves, the skin, and the lens of the eye (Masharani *et al.* 2003:1180). These lesions lead to hypertension, renal failure, blindness, autonomic and peripheral neuropathy, amputations of the lower extremities, myocardial infarction and cerebrovascular accidents.

2.8.1 Ocular complications

2.8.1.1 Diabetic cataracts

Premature cataracts occur in diabetic patients and seem to correlate with both the duration of diabetes and the severity of chronic hyperglycaemia (Masharani *et al.,* 2003:1180). The study of Furic *et al.* (2005:170) shows that biochemical markers of early eye lens changes characterizing diabetic microangiopathy and progressive development of cataract are not completely understood, but the current hypothesis of diabetic cataract formation considers it to be a consequence of non-enzymatic glycosylation of lens proteins.

2.8.1.2 Glaucoma

According to Masharani *et al.* (2003:1181) glaucoma occurs in approximately 6% of diabetic patients. Neovascularisation of the iris in diabetics can predispose to closed-angle glaucoma, but this is relatively uncommon except after cataract extraction, when growth of new vessels has been known to progress rapidly, involving the angle of the iris and obstructing outflow.

2.8.1.3 Diabetic retinopathy

Diabetic retinopathy involves damage to the retina of the eyes and can lead to blindness (Harper *et al.,* 2003:82).

Blindness is a major concern in developing countries, where much of the working population find employment in the labour/manufacturing industries. Hence, without sight, a person can expect to be out of work and also unable to attend the fields in order to provide the family with income and food (Harper *et al.* 2003:82).

According to Furic *et al.* (2005:169) at the time of diagnosis less than 5% of diabetes patients have retinopathy. They claim that after 10 years of manifest diabetes the prevalence to

retinopathy intensifies to 40% - 50%and, after 20 years more than 90% of patients have some retinal abnormality.

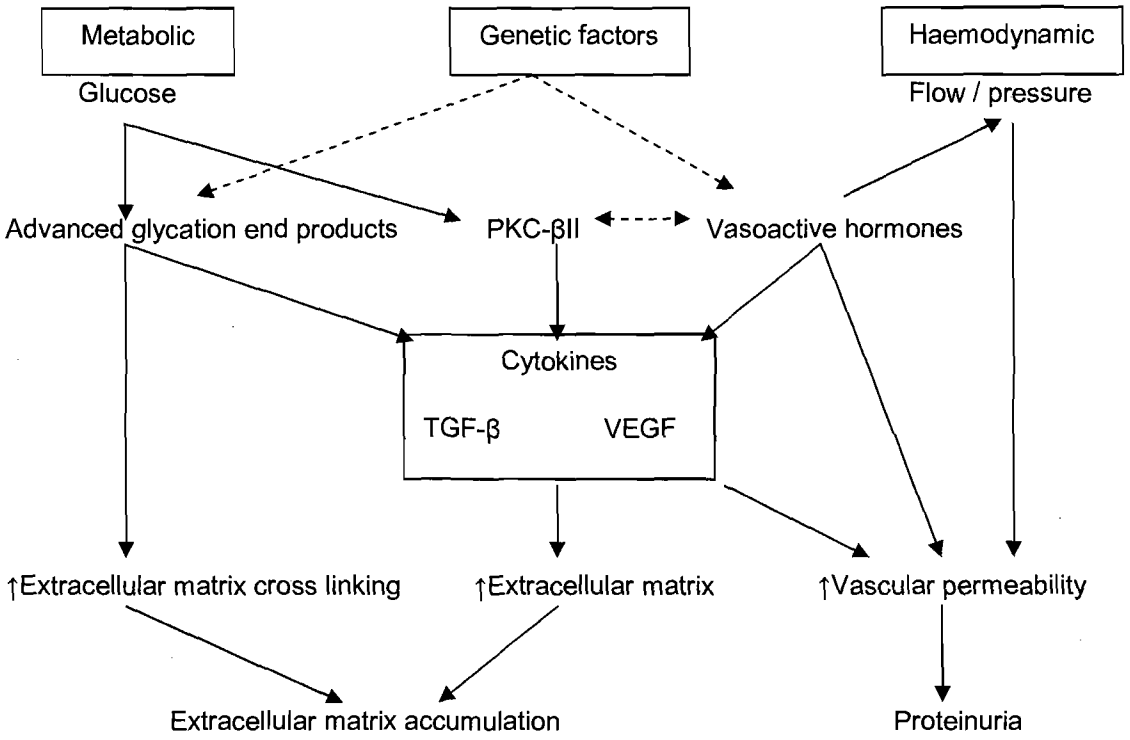
Another contributing factor according to Harper *et al.* (2003:89) is that high glucose levels increase a patient's likelihood of developing retinopathy. Thus, supplying dietary guidelines and stipulating the importance of exercise may help reducing the occurrence of retinopathy in type 2 diabetes patients.

2.8.2 Diabetic nephropathy

Diabetic nephropathy is characterised by the development of overt proteinuria, increasing systemic blood pressure, and declining renal function (Cooper *et al.* 1998:3). According to Chowdhury *et al.* (1996:320) it is the leading cause of end-stage renal disease and leads to a heavy burden of dialysis and renal transplantation. Wu *et al.* (2006:445) state that end-stage renal failure with renal disease is a major cause of morbidity and mortality in the diabetic population.

The etiology of nephropathy appears to be multifactorial, and that hereditary factors are of major importance (Chowdhury *et al.* 1996:322). Cooper *et al.* (1998:3) state that nephropathy occurs as a result of the interplay of metabolic and haemodynamic factors in the renal microcirculation.

Figure 1: Schema outlining potential interactions between metabolic and haemodynamic factors (adapted from Cooper *et al.* 1998:4)



TGF-β = Transforming growth factor β, VEGF = Vascular endothelial growth factor, PKC = Protein kinase C.

Viberti (2003:168-169) states that the earliest manifestation of nephropathy is microalbuminuria, defined as a supranormal urinary albumin excretion rate of 30 – 300 mg/day. Microalbuminuria is also associated with an increased prevalence of retinopathy, neuropathy and cardiovascular disease and the risk for early death is at least 2.4 times higher in this group than in type 2 diabetes patients without microalbuminuria. According to Cao *et al.* (2006:372) it is possible that microalbuminuria is related to cardiovascular disease because it is associated with factors such as altered homeostasis in the coagulation system, increased vascular permeability and enhanced inflammatory response that cause atherosclerosis to destabilize and become a clinical disease.

According to Masharani *et al.* (2003:1181) the cumulative incidence of nephropathy differs between the two major types of diabetes. Patients with type 1 diabetes have a 30% - 40% chance of having nephropathy after 20 years, in contrast to the much lower frequency in type 2 diabetes patients, of whom only 15% - 20% develop clinical renal disease.

2.8.3 Diabetic neuropathy

Neuropathy is damage to nerves and can eventually lead to foot ulceration and amputation (Harper *et al.*, 2003:83). Neuropathy affects around 60% of type 2 diabetes patients and is a major cause of morbidity (Viberti, 2003:169).

According to Simms *et al.* (1988:1887) the most frequently reported diabetic foot complication is plantar foot ulceration. This results because of a loss of protective sensation in the foot. The risk of ulcers or amputation, which have a major impact on quality of life in people with diabetes, is greater in patients who have had diabetes ≥10 years, have poor glucose control, or have cardiovascular disease, retinal or renal complications (Viberti, 2003:169).

Foot infections are a frequent complication, accounting for up to 20% of diabetes related hospital admissions (Frykberg, 2003:44). Although infection is rarely a component cause in the pathway leading to ulceration, it is certainly a significant underlying risk factor for lower extremity amputation.

2.8.3.1 Gangrene of the feet

According to Masharani *et al.* (2003:1182) ischemia, peripheral neuropathy and secondary infection are the main risk factors for the development of gangrene. Cigarette smoking is one of the main contributing causes of ischemia, which involves both micro-angiopathy and atherosclerosis of medium- and large-sized arteries and thus should be avoided.

Patients should be instructed to inspect their feet daily and clinicians should inspect the feet at each visit. The clinician must advise patients as necessary on filing calluses with an emery board, cutting toenails straight across, not walking barefoot, and avoiding tight shoes. The prevention of foot disease should be emphasized, since treatment is difficult once ulceration and gangrene have developed (Masharani *et al.*, 2003:1182).

2.8.4 Cardiovascular disease

According to Costacou *et al.* (2006:387) individuals with *diabetes mellitus* are at increased risk for cardiovascular morbidity and mortality compared to the general population. Cardiovascular risk appears to be associated with both level of hyperglycaemia and the duration of diabetes (Marks & Raskin, 2000:108).

Insulin resistance, even in the absence of diabetes, is an important component of the Metabolic syndrome, playing a causative role in the development of cardiovascular disease (Lamounier-Zepter *et al.*, 2006:356). Zalewski *et al.* (2006:418) state that the prevalence of coronary disease is as high as 55% among adult patients with diabetes compared with 2% -

4% among the general population.

2.8.4.1 Hypertension

Hypertension is defined as an elevated blood pressure but according to Cohuet *et al.* (2006:82), it is in fact a segment of the skewed Gaussian distribution of blood pressure values in a population. Patients are considered hypertensive if their blood pressures reach or exceed 140/90mm Hg (Cohuet & Struijker-Boudier, 2006:82). Hypertension is a common health problem worldwide which remains asymptomatic until late in its course.

Hypertension is associated with insulin resistance, in individuals with normal as well as those with elevated blood pressure (Lamounier-Zepter *et al.*, 2006:355). Fasting insulin levels correlate with systolic and diastolic blood pressure independent of age, weight and serum glucose levels.

According to the study of Lamounier-Zepter *et al.* (2006:356+358) it is unlikely that hypertension may cause insulin resistance, but insulin resistance may cause hypertension. Insulin has a direct vasodilatory effect through the stimulation of endothelial nitric oxide synthase, however, in insulin resistant states; this insulin-mediated endothelial vasodilatation is greatly diminished or abolished. This imbalance between endothelial vasodilators and vasoconstrictors lead to elevated blood pressure and endothelial dysfunction.

Hypertension is a major risk factor for cardiovascular mortality and morbidity through its effects on target organs like the brain, heart, and kidneys (Table 2.2).

Table 2.3: Hypertension-related target organs and consequences on morbidity and mortality (adapted from Cohuet & Struijker-Boudier, 2006:82)

TARGET ORGAN	MORBID EVENTS	MORTALITY
Eye	Retinopathy	Blindness
Brain	Dementia Ischemia	Cerebrovascular accidents
Kidney	Microalbuminuria Glumerulopathy	End-stage renal disease
Heart	Ischemia	Heart failure
Periphery	Arteriosclerosis Ischemia	Heart failure

Hypertension is influenced by both the function and the structure of blood vessels (Cohuet & Struijker-Boudier, 2006:82). Elevated blood pressure causes a reduction in arterial elasticity and wall damage appears which can lead to cholesterol and fat deposition on those lesions and eventually to obstruction of the vessels. This is the basis of most of the target organ damages induced by hypertension.

Uncontrolled hypertension causes alterations of the retinal microcirculation (Cohuet & Struijker-Boudier, 2006:83). Advanced retinopathy is nowadays confirmed as hypertension-induced target organ damage.

2.8.4.2 Ischemic attack and stroke

A transient ischemic attack is an acute episode of temporary and focal loss of cerebral function (Cohuet & Struijker-Boudier, 2006:83). This is usually caused by atherosclerotic materials along the arterial walls. These materials cause complete or temporary blockade of the arteries by forming deposits called plaques, which narrow the artery and lead to the formation of blood clots.

Stroke precursors (Avendano *et al.* 2006:1288)

- Hypertension, hypercholesterolemia
- Transient ischemic attack, angina pectoris
- *Diabetes mellitus*
- Heart failure, peripheral artery disease
- Carotid artery atherosclerosis

Risk factors (Cohuet & Struijker-Boudier, 2006:83)

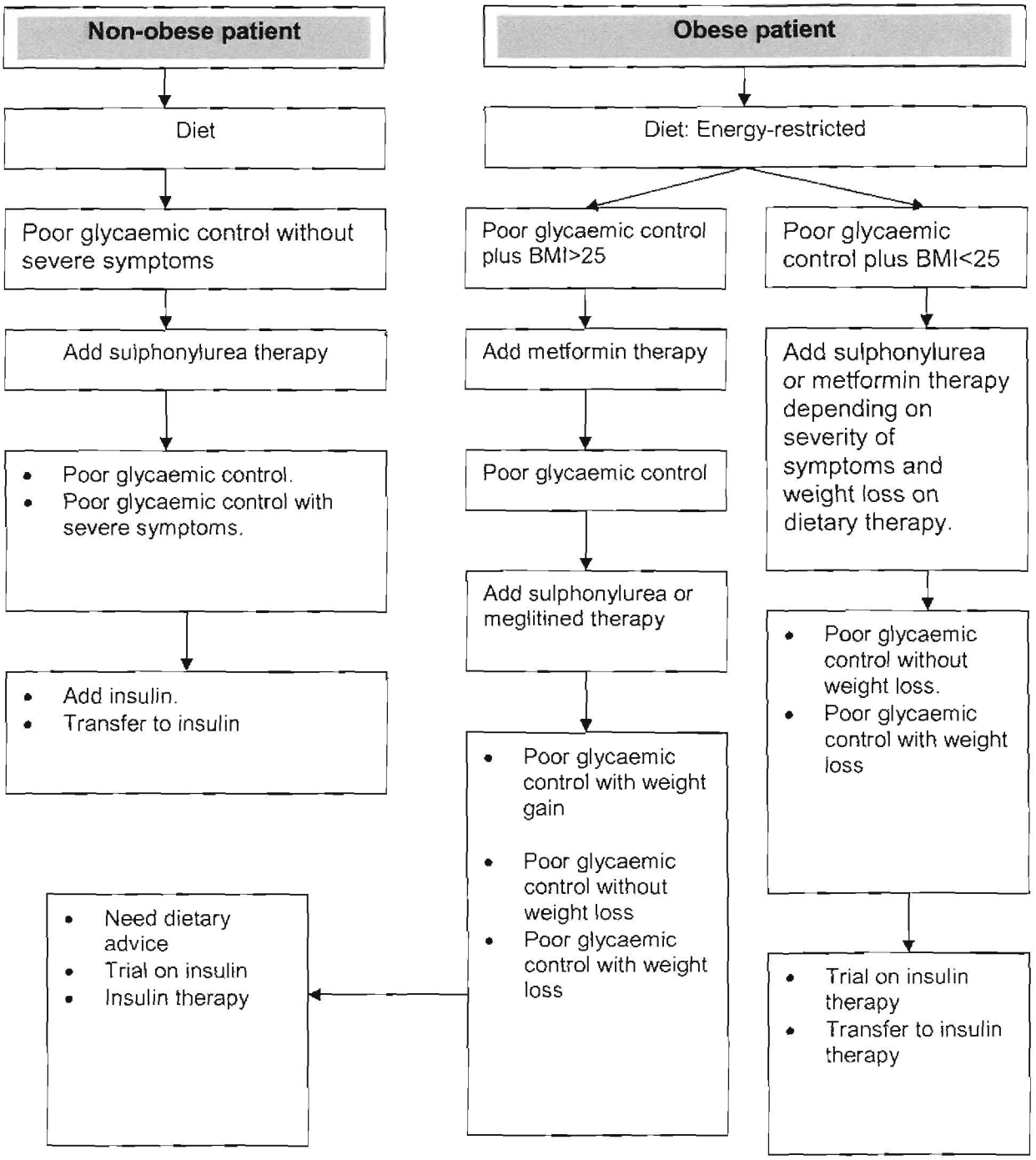
- Age
- Gender, usually males
- Family history
- Ethnicity, usually African
- Heart disease like myocardial infarction, congestive heart failure, atrial fibrillation, and valvular defects
- Limited physical activities, overweight
- Smoking

2.9 MANAGEMENT THERAPY

2.8.5 Algorithm

According to Wyne *et al.* (2003:67) it is difficult to create treatment algorithms because therapy should be individualized for each patient. However, algorithms are useful as an initial guide for management.

Figure 2: Suggested treatment algorithm for type 2 (adapted from Patel, 2003:71)



2.9.2 Self-care

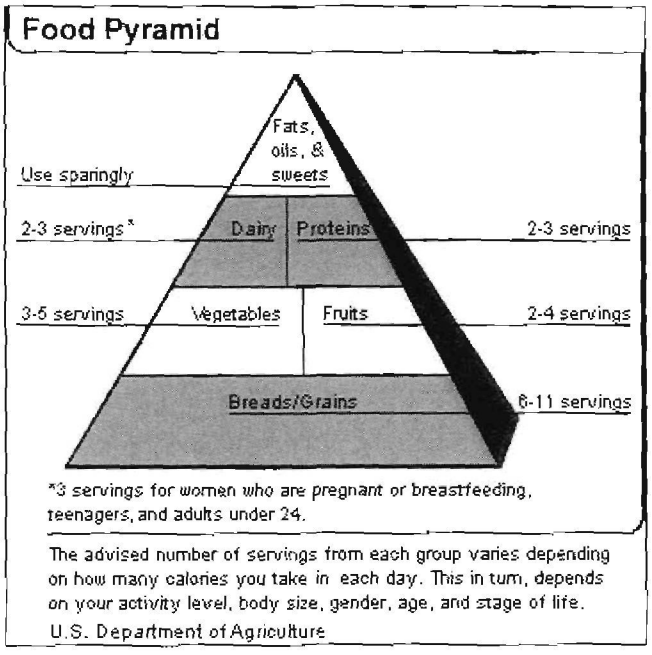
Diabetes mellitus requires ongoing medical care as well as patient and family education, both to prevent acute illness and to reduce the risk of long-term complications. It is fundamental for all patients to monitor their glucose levels every day and try to manage it by their dietary intake.

Masharani *et al.* (2003:1159-1160) state that a well-balanced, nutritious diet remains a fundamental element of therapy. Dietary requirements differ from obese diabetes patients to non-obese diabetics. Weight reduction by calorie restriction is the primary goal for obese diabetics. Thus, the essential treatment of insulin-requiring non-obese patients such as timing of meals, or periodic snacks, is less important in the treatment of obese diabetics.

Harding (1999:164) states that historically evidence has shown that dietary modification has played a key role in the control of diabetes for over 200 years. Before the wide-spread use of insulin therapy in the 1920s, a starvation diet was typically prescribed to relieve the symptoms of diabetes.

According to Blanchette (1996:1) there is no such thing as a single "diabetic diet". The diet that a person with diabetes follows to help manage his or her blood glucose levels is based on the same nutrition principles that any healthy person, with or without diabetes, should follow for good health.

Figure 3: Food pyramid (http://www.lifeclinic.com/focus/nutrition/food-pyramid.asp)



People living with diabetes should follow the nutrition guidelines in the food pyramid, while paying special attention to carbohydrate intake, especially high fibre carbohydrate foods such

as wholegrain breads and cereals, vegetables and fruit. It is important to space meals throughout the day, eating 3 meals with 2-3 snacks, instead of eating heavy meals once or twice a day (http://www.lifeclinic.com/focus/diabetes/diet.asp).

2.8.5.1 Aims of dietary intervention (Harding, 1999:164)

The primary goal of dietary modification is to minimize blood glucose variation through providing sufficient dietary carbohydrates.

In attempting to achieve the primary goal the following additional factors have been considered:

- Avoidance of extremes of hyper/hypoglycaemia.
- Maintenance of ideal body weight.
- Minimization of the risks of long-term micro/macrovascular disease,
- Maintenance of normal social functioning.

Blanchette (1996:2) states that the goal of a diabetes nutrition plan is to provide a mixture of fats, carbohydrates and proteins at each meal at an appropriate calorie level to provide essential nutrients as well as create an even release of glucose into the blood from meal to meal and from day to day.

Studies have shown that patients in general are unable to, or are unwilling to follow a strict regime of counting exchanges (Harding, 1999:165). Thus, a qualitative diet has been suggested and is based on healthy-eating advice promoted for the population as a whole. This consists of a low sugar, low fat and high fibre diet with an emphasis on regular meals and snacks containing starchy carbohydrates with the aim of avoiding a large variation in carbohydrate intake.

Despite the importance of good blood glucose control, strict dietary prescription can have the following psychosocial implications (Harding, 1999:166):

- The negative effects of peer pressure
- Potential development of eating disorders
- Possible feelings of guilt and inadequacy in the event of non-compliance
- Rebellion against dietary restraint with negative consequences for diabetic control

The digestion of fat, protein and fibre has a significant effect in the absorption of

carbohydrate. As a result of the Jenkins *et al.* (1984:388) study, the glycaemic index was developed which allowed the relative effects of different foods on blood glucose response to be quantified based on a reference food (Harding, 1999:166).

$$\text{Glycaemic index} = \left\{ \left[\frac{\text{Blood glucose response of test food}}{\text{Blood glucose response of reference food}} \right] \text{x100} \right\}$$

2.8.5.2 Current recommendation

A) Carbohydrate distribution

Regular amounts of unrefined carbohydrate at each meal and snack are the basis of the current BDA guidelines of diet for children and adolescents. They recommend that at least 50% of calorie intake should be from carbohydrate sources and fat intake being reduced to 30% - 50% (Harding, 1999:167).

B) Dietary fibre

Advice should emphasize starchy 'filling' carbohydrate during meals and snacks, preferably high in fibre. In particular, foods containing soluble fibre, such as beans, vegetables, fruit and oats, with a lower glycaemic index should be encouraged. (Harding, 1999:167).

C) Fat

It is important to distinguish between the effects of fat and sugar on diabetes. Diabetes patients can easily become too caught up with buying low-fat foods whilst forgetting that a low-sugar diet is necessary for good glycaemic control (Harding, 1999:167). Saturated fats that are found in animal products, such as full cream milk, ice creams, butter and cheese, should be avoided. Small amounts of unsaturated fats like olive, canola and sunflower oil, oily fish, avocado and nuts may be consumed.

D) Sweeteners

Artificially sweetened foods are now very much part of our culture with the increasing promotion of healthy eating. Non-nutritive sweeteners such as Aspartame and Acesulfame K are used widely and provide a considerable choice of low-sugar products for people with diabetes (Harding, 1999:167).

E) Exercise

Along with healthy eating, physical activity is important. It is an important part of managing cardiometabolic health; improve blood glucose, blood pressure and cholesterol. Exercise helps relieve stress, increases energy, improves sleep and blood circulation. (http://www.diabetes.org/weightloss-and-exercise/exercise/types-of-exercise.jsp)

According to the American Diabetes Association there are three kinds of activities that diabetic patients can do to improve their health:

- Aerobic exercise which increases your heart rate, works your muscles, and raises your breathing rate. This type of exercise increases insulin sensitivity and, along with proper nutrition, helps restore normal glucose metabolism by decreasing body fat.

- Strength training helps build strong bones and muscles. Its main benefit is increasing glucose uptake by the muscles and enhancing the ability to store glucose as well as decreasing body fat by raising the metabolism.

- Flexibility exercises, also called stretching, help to keep joints flexible and reduce chances of injury during other activities.

The American Diabetes Association recommends that anyone with diabetes have a thorough medical exam to see if there are risks for coronary artery disease and that blood glucose control is adequate before starting an exercise programme.

2.8.6 Pharmacotherapy: Oral glucose lowering drugs

Oral antidiabetic agents should not be resorted to in the management of type 2 diabetes before all lifestyle approaches have been adequately tried. It is essential to try lowering blood glucose levels by lifestyle and diet modifications before prescribing blood glucose lowering drugs.

If a type 2 patient's glucose levels are controlled by antidiabetic agents, it is rarely necessary to start using insulin therapy. Only when there is noncompliance from the patient or when the antidiabetic drugs do not seem to have the required effect on blood glucose levels, is it necessary to start with insulin therapy.

Oral glucose lowering agents available in South Africa:

- Biguanides

- Sulphonamides, urea drivates

- Alpha glucosidase inhibitors
- Thiazolidinediones
- Meglitinides

2.8.6.1 Biguanides

Table 2.4: Pharmacological classification and product names of biguanides

Pharmacological class	Product
Metformin	Glucophage®
	Rolab-Metformin®

According to Nolte and Karam (2001:727) a full explanation of the mechanism of action of biguanides remains elusive, but their blood glucose lowering action does not depend on the presence of functioning pancreatic β cells.

There are four proposed action mechanisms:

- Direct stimulation of glycolysis in tissues, with increased glucose removal from blood
- Reduced hepatic gluconeogenesis
- Slowing of glucose absorption from the gastrointestinal tract, with increased glucose to lactate conversion by enterocytes
- Reduction of plasma glucagon level

The biguanides are agents of first choice in the management of obese type 2 diabetics, but the small risk of lactic acidosis demands that they be used with caution.

Risk factors for lactic acidosis (Gibbon, 2003:73):

- Impaired renal or hepatic function
- Cardiopulmonary insufficiency
- Presence of infections
- Excessive alcohol intake

- Certain systemic illnesses for example, leukaemia
- Skipping meals
- Reluctance to take medication as prescribed

According to Patel (2003:113) metformin is used for the management of type 2 diabetes when dietary management alone has failed. Metformin is useful in the management of obese diabetics because it induces a mild anorexia and so helps to control weight gain. Because of its insulin-sparing properties, it does not increase weight or provoke hypoglycaemia. Thus, it offers obvious advantages over insulin or sulphonylureas in treating hyperglycaemia in such patients (Nolte & Karam, 2001:728).

A) Dosage

The initial dose is 500mg three times a day or 850mg twice daily. The daily maximum is 3g, but to minimize the risk of lactic acidosis the dose should not exceed 500mg three times a day or 850mg twice daily. (Gibbon, 2003:74).

B) Adverse reactions

The dosage of Metformin should always be divided, since ingestion of more than 850mg at any one time usually provokes significant gastrointestinal side effects, which occur in up to 20% of patients (Nolte & Karam, 2001:728).

- Anorexia
- Nausea
- Vomiting
- Abdominal discomfort
- Reduced Vitamin B12 absorption
- In 3-5% of patients, the use of metformin may have to be discontinued because of persistent diarrhoea

C) Contraindications (Patel, 2003:115)

- Renal and hepatic impairment, including alcoholic liver disease
- Predisposition to lactic acidosis or history of lactic acidosis

- Cardiac or respiratory insufficiency, likely to cause hypoxia or reduced peripheral perfusion
- Severe infection or trauma, could lead to decreased tissue perfusion
- Dehydration, could lead to reduced peripheral perfusion
- Alcohol dependence. Alcohol abuse with binge drinking sufficient to cause hepatotoxicity; moderate alcohol intake is not a contraindication, if liver function is normal

D) Drug interactions

The following are agents that may impair glucose tolerance and a diminished hypoglycaemia response may result (Gibbon, 2003:73-74):

- Thiazide diuretics
- Furosemide
- Glucocorticosteroids
- Oral contraceptives
- Sulphonylureas – there is an increased risk of serious and prolonged hypoglyceamia when using sulphonylureas together wit metformin, thus small doses of both should be carefully adjusted according to response

2.9.3.2 Sulphonylamides and urea derivates

According to Nolte and Karam (2001:723) the major action of sulphonylureas is to increase insulin release from the pancreas. Two additional mechanisms of action have been proposed – a reduction of serum glucagon levels and an extra pancreatic effect to potentiate the action of insulin on its target tissues – but are of questionable clinical significance.

These drugs may provide good control of blood glucose and have been shown to reduce the microvascular complications of diabetes. They are used in the management of type 2 diabetes when dietary management alone has failed and, may be used as monotherapy or in combination with metformin or insulin (Patel, 2003:103).

Table 2.5: Pharmacological classification, product name and dosage of sulphonylamides and urea derivates (adapted from Gibbon, 2003:75-76)

PHARMACOLOGICAL CLASS	PRODUCT	DOSAGE
Glibenclamide	Daonil® Euglacon® Glyclomin® Diacare® Norton-glibenclamide®	Initially 2.5mg in the morning, increased gradually with increments of no more than 2.5mg at weekly intervals Maximum 15mg per day
Gliclazide	Diamicron® Diaglucide® Glucomed® Glycron® Rolab-gliclazide®	Initially 40-80mg daily with breakfast Maximum of 320mg per day Doses exceeding 80mg per day should be divided into morning and evening doses
Glipizide	Minidiab®	Initially 2.5-5mg daily, 15-30 minutes before breakfast Maximum 40mg per day
Glimepiride	Amaryl®	Initially 1mg per day before breakfast Maximum 8mg per day
Chlorpropamide	Hypomide®	This drug has been associated with serious and prolonged hypoglycaemia, and has no place in therapy

A) Adverse reactions (Patel, 2003:106-108)

- Hypoglycaemia, especially with the longer-acting sulphonylureas such as chlopropamide and glibenclamide. The risk is greater in elderly patients and patients with hepatic or renal impairment
- Sulphonylureas may induce weight gain in all patients who do not have absolute insulin deficiency
- Chlorpropamide-induced hyponatraemia (rare) is water retension due to sensitisation of the renal collecting ducts and may be exacerbated by concurrent use of thiazide diuretics
- Gastrointestinal disturbances
- Headache and facial flushing after drinking alcohol

B) Contraindications (Gibbon, 2003:76)

- Brittle or unstable diabetes
- Diabetes complicated by ketosis, acidosis and coma

- Severe renal impairment
- In patients with severe infections, trauma or undergoing major surgery – treatment should be changed to insulin
- Pregnancy
- Paediatrics
- Lactation

C) Drug interactions

According to Gibbon (2003:74-75) an advanced hypoglycaemia response to the sulphonylureas may occur with:

- Aspirin and possibly other non-steroid anti-inflammatory drugs
- Sulphonamides
- Clofibrate and Chloramphenicol
- Cimetidine
- Fluconazole, ketoconazole and miconazole
- Increased plasma concentrations of warfarin and sulphonylureas initially, dosage adjustment of both agents may be required
- An increased risk of hypoglycaemia, and potential for alcohol intolerance leading to flushing, headache, nausea and vomiting when taking sulphonylureas with alcohol
- Beta blocking agents may mask warning symptoms of hypoglycaemia and produce hypoglycaemia in certain diabetics
- A diminished hypoglycaemic effect may occur with:
    - Meprobamate
    - Phenytoin
    - Rifampicin

- Thiazide diuretics
- Glucocorticosteroids
- Furosemide
- Oral contraceptives

2.9.3.3 Alpha glucosidase inhibitors

Only monosaccharides, such as glucose and fructose, can be transported out of the intestinal lumen and into the bloodstream. Complex starches, oligosaccharides and disaccharides must therefore be broken down into individual monosaccharide molecules before being absorbed in the duodenum and jejunum. This digestion is facilitated by enteric enzymes, including pancreatic α-amylase and α-glucosidases, which are attached to the brush border of the intestinal cells (Nolte & Karam, 2001:729).

The pharmaceutical product Glucobay® which contains acarbose as its active ingredient, acts by delaying the digestion of carbohydrates, so that they are digested throughout the small intestine rather than the upper third of the jejunum (Gibbon, 2003:76). Patel (2003:119) states that acarbose is used in combination with other antidiabetic drugs for reducing post-prandial hyperglycaemia.

A) Dosage

Initially 25mg with the evening meal for one week, increasing to 25mg before breakfast and supper for two weeks, then to three times daily. The dosage may be increased to 50-100mg three times daily if response is inadequate (Gibbon, 2003:77).

B) Adverse reactions (Gibbon, 2003:76)

- Flatulence
- Abdominal distension
- Diarrhoea
- Colic

C) Contraindications (Gibbon, 2003:76)

- Inflammatory bowel disease

- Gastrointestinal obstruction
- Hepatic impairment
- Paediatrics

D) Drug interactions (Gibbon, 2003:76)

- Cholestyramine may enhance the effects of acarbose on post-prandial blood glucose
- Neomycin may enhance effect of acarbose on post-prandial blood glucose and increase the severity of gastrointestinal disturbances
- Pancreatin and charcoal may decrease the effect of acarbose (Patel, 2003:121)
- Acarbose may potentiate the hypoglycaemic effects of hypoglycaemic agents and insulin
- Concomitant use of gastrointestinal absorbents may decrease effect of acarbose

2.9.3.4 Thiazolidinediones

According to Nolte and Karam (2001:728) the thiazolidinediones are a recently introduced class of oral antidiabetic drugs that enhance target tissue sensitivity. These drugs are mostly used as add-on treatment with another oral agent, or with insulin.

Their exact mechanism of action is not yet understood, but they appear to have an acute postreceptor insulin-mimetic activity as well as chronic effects on the transcription of genes involved with glucose and lipid metabolism mediated through the peroxisome proliferator-activated receptor gamma nuclear receptor. Thus, these agents improve glyceamic control by reducing cellular insulin resistance.

Table 2.6: Pharmacological classification, product name and dosage of the thiazolidinediones (adapted from Gibbon, 2003:77)

PHARMACOLOGICAL CLASS	PRODUCT	DOSAGE
Pioglitazone	Actos®	15-30mg once daily Maximum 45mg daily
Rosiglitazone	Avandia®	4mg daily in a single or two divided dose Maximun 8mg daily

A) Contraindications

- Type 1 diabetes
- Impaired liver function
- Cardiac failure

B) Adverse reactions (Patel, 2003:125-126)

- Initial deterioration in glycaemic control when metformin or sulphonylurea is replaced with a thiazolidinedione in combination therapy because of the slow onset of the effect of thiazolidinediones
- Cardiovascular effects
- Liver failure
- Weight gain of 3-4 kg has been reported in the first year of treatment with thiazolidinediones but is less when used in combination with metformin
- Gastrointestinal disturbances, headache, visual disturbances, proteinuria, decreased hematocrit and haemoglobin

2.9.3.5 Meglitinides

These agents are a new class of insulin secretatogues. Unlike sulphonylureas, they have no direct effect on insulin exocytosis, but modulate β cell insulin release by regulating potassium efflux through the potassium channels (Nolte & Karam, 2001:727).

Table 2.7: Pharmacological classification, product names and dosage of the meglitinides (adapted from Gibbon 2003:77)

PHARMACOLOGICAL CLASS	PRODUCT	DOSAGE
Nateglinide	Starlix®	120m 30minutes before meals three times daily
Repaglinide	NovoNorm®	0.5mg 30 minutes before meals Maximum single dose of 4mg Maximum daily dose of 16mg

A) Contraindications

- Type 1 diabetes

- Diabetic ketoacidoses
- Renal or liver impairment
- Paediatrics

B) Adverse drug reactions (Patel, 2003:130)

- Hypoglycaemia
- Constipation
- Diarrhoea
- Nausea and vomiting

C) Drug interactions (Gibbon, 2003:77)

- Sulphonylureas

2.9.3.6 Combination of metformin and glibenclamide

Glucovance® offer type 2 diabetics the best of both worlds in one tablet. It is the first combination treatment available in South Africa to treat type 2 diabetics and consist of metformin and glibenclamide, which is an insulin secretagogue (Raabe *et al.* 2000). Glucovance® is prescribed as initial therapy in type 2 diabetes where diet and exercise alone do not achieve adequate glycaemic control or as 2nd line therapy in type 2 diabetes where diet, exercise and initial sulphonylurea/metformin treatment do not achieve adequate glycaemic control.

Table 2.8: Different dosages of Glucovance® (Trevorrow, 2005)

INDICATION	DOSAGE
When diet and exercise alone are inadequate	500/2.5mg daily before meals
Inadequate monotherapy glycaemic control	1 tablet of 500/2.5mg strength daily before meals
Substituting bi-therapy of metformin and insulin secretagogue	1-2 tablets of 500/2.5mg or 500/5mg strength, total daily dose of 4 tablets of 500/5mg not to be exceeded

A) Contraindications (http://www.medicinenet.com)

- Sulphonylurea hypersensitivity

- Insulin dependent diabetes
- Keto-acidosis
- Diabetic pre-coma
- Chronic liver disease
- Acute alcohol intoxication
- Pregnancy and lactation

B) Side effects (http://www.medicinenet.com)

- Lactic acidosis
- Gastrointestinal disturbances
- Rash and photosensitivity
- Central nervous system effects
- Alcohol intolerance

C) Drug interactions (http://www.medicinenet.com)

- Phenylbutazone increases hypoglycaemic effect
- Fluconazole increases half-life of glibenclamide
- B-blockers
- Oral contraceptives and Estrogen (Premarin®)
- Calcium channel blockers
- Diuretics
- Monoamine oxidase inhibitors

2.9.4 Pharmacotherapy: Insulin

The 1921 discovery of insulin was initially thought to represent a cure for the disease, a concept that remains common among those unfamiliar with the disorder. However, acute

morbidity and mortality as well as a series of chronic complications still occur (Atkinson & Eisenbarth, 2001:226).

The basic metabolic defect in *diabetes mellitus* is that glucose cannot enter the cells, either because there is a lack of insulin (deficiency) or because the insulin that is present is ineffective (resistance). Insulin decreases blood glucose concentrations by promoting glucose uptake from blood into cells where it has major effects on carbohydrate, lipid, liver and protein metabolism (Patel, 2003:79).

According to Hirsch *et al.* (2005:78) insulin is considered the most effective treatment for lowering extremely high glucose. This is important because inhibition of glucotoxicity may be beneficial in preserving functional β cell mass. Oral agents do not work as quickly or lower glucose enough to effectively address glucotoxicity in many patients.

The endocrine pancreas in the adult human consists of approximately 1 million islet of Langerhans interspersed throughout the pancreatic gland (Nolte & Karam, 2001:711). Within the islet, at least four hormone producing cells have been identified:

Table 2.9: Pancreatic islet cells and their secretory products (adapted from Nolte and Karam, 2001:711)

CELL TYPE	SECRETORY PRODUCTS
A cell (Alpha)	• Glucagon • Proglucagon
D cell (Delta)	• Somatostatin
F cell (PP cell)	• Pancreatic polypeptide (PP)
B cell	• Insulin • Proinsulin • C-peptide • Islet amyloid polypeptide

2.9.4.1 Effects of insulin on its target organs

Table 2.10: Effects of insulin on its target organs (Nolte & Karam, 2001:715)

TARGET	EFFECT
Liver	**Reversal of catabolic features of insulin deficiency:** • Inhibits glycogenolysis • Inhibits conversion of fatty acids and amino acids to ketoacids • Inhibits conversion of amino acids to glucose **Anabolic action:** • Promotes glucose storage as glycogen • Increases triglyceride synthesis and very los density lipoprotein formation
Adipose tissue	**Increased triglyceride storage:** • Lipoprotein lipase is induced and activated by insulin to hydrolyze triglycerides from lipoproteins • Glucose transport into cells provides lycerol phosphate to permit esterification of fatty acids supplied by lipoprotein transport • Intracellular lipase is inhibited by insulin
Muscle	**Increased protein synthesis:** • Increases amino acid transport • Increases ribosomal protein synthesis **Increased glucogen synthesis:** • Increases glucose transport • Induces glycogen synthase • Inhibits phosphorylase

2.9.4.2 Insulin preparations available in South Africa (Gibbons, 2003:71)

A) Ultra fast-acting insulin

- Humalog® (Insulin Lispro)
- Novorapid® (Insulin Aspart)

The latest human insulin analogues have an almost immediate onset of absorption and biological activity, and a reduced period of action. They are clear solutions, usually administered subcutaneously.

B) Fast-acting insulin

- Actrapid®
- Humulin®

These soluble insulins are clear solutions and may be administered intravenously, intramuscularly or subcutaneously. They are administered subcutaneously for everyday control of diabetes, usually in combination with longer-acting insulin. In diabetic keto-acidosis

and during surgery they may be given intravenously.

C) Intermediate-to-long-acting insulin

- Humulin®N
- Humulin®L
- Monotard®HM
- Protophane®HM

These are suspensions and are bound to protamine or zinc as retarding agents to prolong their duration of action. They can only be administered subcutaneously. They are usually administered once, or more commonly twice daily, and may be combined with short-acting insulins.

D) Biphasic insulin

- Actraphane®30/70HM
- Humulin®30/70
- Humalog®Mix25
- Mixtard®20/80

Ready mixed preparations containing short-acting and intermediate-acting insulin. These may be useful in many patients and are administered subcutaneously once, or usually twice daily.

E) Ultra-long acting insulin

- Ultratard®HM

These are conjugated with zinc molecules to delay absorption and prolong the duration of action. They are suitable for once-daily subcutaneous injection, but provide an erratic rate of absorption.

F) Insulin analogs

Insulin analog preparations are modified human insulin products synthetically derived through recombinant DNA technology (Takiya & Dougherty, 2005:8). These analogs are absorbed three times more quickly from subcutaneous sites than human insulin. Thus, there is a more rapid increase in plasma insulin concentrations and earlier hypoglycaemic

response. Injection of the analogs directly before a meal affords glycaemic control similar to that from an injection of human insulin given 30 minutes before a meal. Presently the most clinical experience with a rapid-acting insulin analog has been with Lys (B28) and Pro (B29) human insulin. This analog is identical to human insulin aside from positions B28 and B29, where the order of the two residues has been reversed to match the sequence of IFG-I, a polypeptide that does not self-associate (Davis & Granner, 1996:1505).

Meece (2006:42) states that Lispro is a rapid-acting analog, which is quickly absorbed and begin acting within 15 minutes. Peak insulin concentrations are reached within 30 to 90 minutes to correspond with the peak postprandial glucose load. These analogs are cleared within 3 to 6 hours, reducing the possibility of between-meal or nocturnal hypoglycaemia.

According to Meece (2006:42) insulin analogs compared to older insulin formulations, provide dosing flexibility, which may improve patient satisfaction and adherence to therapy. These analogs are associated with a lower risk of hypoglycaemia and better postprandial and fasting glycaemic control.

2.9.4.3 Drug interactions (Gibbon, 2003:73)

- Oral contraceptives, diuretics and corticosteroids may decrease glucose tolerance, thus insulin requirements may possibly increase
- Alcohol, salicylates and mono amine oxidation inhibitors potentiate the hypoglycaemic effect of insulin
- The interference of Beta blocking agents (propranolol) with carbohydrate metabolism poses risks of hypo- or hyperglycaemia
- All Beta blocking agents have the potential to mask signs and symptoms of hypoglycaemia

2.9.4.4 Complications of insulin therapy

A) Hypoglycaemia

According to Nolte and Karam (2001:721) are hypoglycaemic reactions the most common complication of insulin therapy, and may result from a delay in taking a meal, unusual physical exertion, or a dose of insulin that is to large for immediate needs.

B) Skin related

Richardson and Kerr (2003:661) state that insulin therapy is associated with important cutaneous adverse effects, which can affect insulin absorption kinetics causing glycaemic excursions above and below target levels for blood glucose.

Common complications of subcutaneous insulin injection include lipoatrophy and lipohypertrophy.

Frequent use of the same injection site increases the risk of lipoatrophy, which decreases the absorption of insulin and leads to difficulties in achieving ideal blood glucose control. The likelihood of lipoatrophy can be reduced by regular rotation of injection sites (Richardson & Kerr, 2003:661).

Lipohypertrophy is the most common cutaneous complication of insulin therapy. Newer insulins have reduced its prevalence considerably, although its adverse effect on diabetic control is similar to lipoatrophy through impaired absorption of insulin into systemic circulation (Richardson & Kerr, 2003:661).

C) Allergic reactions

Local allergic reactions to insulin are usually erythema, pruritus and induration, which are normally short-lived and resolve spontaneously within a few weeks (Richardson & Kerr, 2003:662).

D) Cardiovascular effects

There is no evidence to support the hypothesis that insulin treatment in type 2 diabetes increases the risk of myocardial infarction even though the fasting insulin concentrations are higher in those treated with insulin compared to other groups (Patel, 2003:93).

2.9.5 Continuous subcutaneous insulin infusion (CSII)

Insulin pump therapy for the treatment of diabetes began to be utilized in the late 1970s and re-emerged in the 1990s due to technological advances in insulin delivery systems (Nabhan *et al.*, 2006:217).

According to Attali (2006:117) the advantages and disadvantages of insulin pump therapy encountered in patients with type 2 diabetes should be the same as those experienced by patients with type 1 diabetes. One of the greater advantages is that CSII therapy improve diabetes quality of life and treatment satisfaction, thus patients have more flexible lifestyles because of freedom from injection. One major disadvantage may be its cost.

Dl Bartolo *et al.* (2006:120) concluded that the use of a short-acting insulin analogue in CSII-therapy provides a small, but statistically significant improvement in glycaemic control compared to regular insulin. CSII has shown to provide additional flexibility in meal time and to better match the insulin requirements in different daily phases. For those reasons, today, CSII delivering fast-acting insulin analogues, is considered the best method to replace insulin in a physiological manner by mimicking meal and basal insulin requirements.

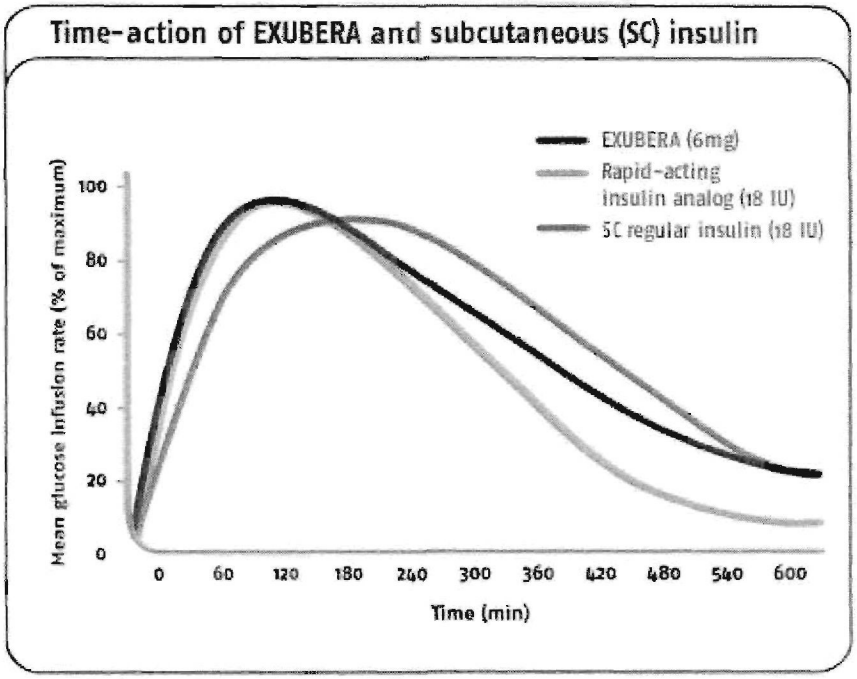
2.9.6 Inhaled insulin

Exubera is the first new insulin delivery option introduced since the finding of insulin in the 1920s (United States: FDA, 2006). It is an inhaled powder form of recombinant human insulin (rDNA) for the treatment of adult patients with type 1 and type 2 diabetes. It was approved by the FDA in 2006 in the U.S., but is not yet available in South Africa.

This inhalation insulin has an onset of action similar to rapid-acting analogs and should be dosed within 10 minutes before the start of a meal (Anon, 2007). According to the United States: FDA (2006) Exubera reaches peak insulin concentrations more quickly than regular insulin. In clinical studies, peak insulin levels were reached within 49 minutes after inhaling Exubera, where regular insulin peaked at 105 minutes.

The glucose-lowering effect of Exubera lasts approximately 6 hours. This is longer than insulin analogs and similar to subcutaneous regular insulin. This is illustrated in figure 5:

Figure 4 : Time-action of Exubera and subcutaneous insulin (Anon, 2007)



2.10 CONCLUSION

According to Harper *et al.* (2003:82) the detection and treatment of diabetes is an involved process and in developing countries with resource constraints, there are more undiagnosed than diagnosed cases. Diabetes care requires a multidisciplinary team with an active participation of the patient, clinician and health personnel.

Diabetes, together with HIV/AIDS and tuberculosis, is an important health priority, not only in South Africa, but also in the rest of the world. According to Ahmed and Goldstein (2006:237) an estimated 151 million people are affected by diabetes globally, and will rise to 324 million in 2025. Thus, by making people aware of the disease by promoting healthier living, for diabetic patients as well as non-patients, this estimated number may be lowered.

Chapter 3

Empirical investigation

3.1 INTRODUCTION

This chapter describes the general and specific objectives, study population, research design and methodology, measuring instruments and statistical analysis of the data obtained in the investigation.

3.2 RESEARCH OBJECTIVES

3.2.1 General objective

The aim of this dissertation is to study the treatment of diabetic patients on primary healthcare level, and which contributions can be made in the prevention of diabetic complications.

3.2.2 Specific objectives

- To determine how age, lifestyle, socio-economic status and education influence diabetes.
- To determine ethnic and cultural barriers in the diabetes education.
- To determine from members of the community how accessible healthcare providers are to them.
- To determine whether members of the community receive sufficient information on diabetes from healthcare providers.
- To determine the knowledge of the community about diabetes.
- To investigate methods and techniques in the public healthcare sector to ensure access to quality healthcare.
- To formulate recommendations regarding the management of *diabetes mellitus* on primary healthcare level.

3.3 STUDY POPULATION

103 diabetic patients, located in Promosa and Potchefstroom primary health clinics, were studied. These patients were interviewed, in order to get the correct information about them and their living with the disease.

Table 3.1: Frequency of gender in the study population

Gender	Total
Male	30
Female	73
Total	**103**

Table 3.2: Frequency of race in the study population

Race	Total
Black	66
White	19
Colored	18
Total	**103**

3.4 RESEARCH DESIGN AND METHODOLOGY

A non-experimental retrospective drug utilisation study was done in two primary healthcare clinics in a semi rural area.

According to Waning and Montagne (2001:45) there are general rules that must be followed for each epidemiological investigation:

Step 1: The research questions were stated. This included dependent variables, the outcomes, and the independent variables (the causes associated with diabetes).

Step 2: The study population was defined.

Step 3: All relevant data and information were identified and collected.

Step 4: The data were analysed according to the research questions. The analysis included subdividing the population according to certain risk factors and comparing rates for each group.

Step 5: Interpretation of the results.

3.5 MEASURING INSTRUMENTS

3.5.1 Frequency

According to Kirkwood (1998:5) frequency can be defined as the number of observations made in the study, with a sample size *n*. In the case of this dissertation the frequency was 103 questionnaires (Appendix F).

3.5.2 Percentages

According to the Bay Mills Community College (2006) percentages can be determined by an amount, which is equal to 100%, designated as representing the whole amount. Percent can also be defined as parts per hundred.

$$X\% = \left(\frac{x}{X}\right)100$$

3.5.3 Cumulative frequency

The cumulative frequency for a value *X* is the total count of all the data values that are equal in or less than the value to *X* (Wikibooks: 2007).

Cumulative frequency is used to determine the number of observations that lie above (or below) a particular value. The cumulative frequency is found from a stem and leaf table or a frequency distribution table by adding each frequency to the sum of its predecessor.
The last value will always equal the total for all observations, as all frequencies will have been added (Australian Bureau of Statistics: 2004).

3.5.4 Cumulative percent

The main advantage of using cumulative percentage rather than cumulative frequency is that it provides an easier way to compare different sets of data. Cumulative percentage is calculated by dividing the cumulative frequency by the number of observations, *n*, then multiplying by 100 (the last value will always be equal to 100%) (Australian Bureau of Statistics: 2004).

Mathematical

$$CP = \left(\frac{CF}{n}\right)100$$

3.6 STATISTICAL ANALYSES

3.6.1 Range

According to Jaisingh (2000:45) the range can be defined as the difference between the maximum and minimum values in a data set.

3.6.2 Mean

The mean is defined as the sum of all values making up the set of observations divided by the total number of observations in the set (Banerjee, 2003:3).

$$\text{Mean} = \frac{\text{sum of all entries}}{\text{number of entries}}$$

3.6.3 Standard deviation

According to Niles (2005:2) the standard deviation shows how tightly a set of values is clustered around the mean in a set of data.

Mathematically

Variance

$$S_x^2 = \frac{\sum (x_i - x)^2}{n-1}$$

Standard deviation

$$S_x = \sqrt{S_x^2}$$

3.6.4 Minimum and maximum

The minimum is the smallest value and the maximum is the largest value in the data set.

3.6.5 Chi-Square

Chi-Square gives probability values for the relationship between two dichotomous variables (SISA: 1994).

3.6.6 Likelihood Ratio Chi-Square (LRX)

The LRX is directly related to log-linear analysis and logistic regression (SISA: 1994).

3.6.7 Mantel-Haenszel Chi-Square

This type is not often used, but is thought to be closer to the 'true' Chi-Square if small numbers of cases are involved (SISA: 1994).

3.6.8 Effect size

The effect size is given by $w=\sqrt{\frac{X^2}{n}}$, where X^2 is the usual Chi-Square statistic for the contingency table and *n* is the sample size. In the special case of a 2x2 table, the effect size is given by the Phi Coefficient. Note that the effect size is independent of sample size.

Cohen (1988) gives the following guidelines for the interpretation of the effect size in the current case:

- Small effect: $W = 0.1$
- Medium effect: $W = 0.3$
- Large effect: $W = 0.5$

A relationship with $W \geq 0.5$ is considered as practically significant, $W \geq 0.3$ is considered as significant, and $W \geq 0.1$ as non-significant.

3.6.9 The Contingency Coefficient

The contingency coefficient is an adjustment to phi, intended to adapt it to tables larger than 2x2. C is equal to the square root of chi-square divided by chi-square plus *n* (sample size) (Garson, 2007).

Mathematical

$$C=\sqrt{\frac{X^2}{X^2+n}}$$

3.3.10 Cramer's V

Cramer's V is the most popular of the Chi-Square-based measures of nominal association because it gives good norming from 0 to 1 regardless of table size, when the row marginal equals the column marginal. *V* equals the square root of Chi-Square divided by sample size, *n*, times *m*, which is the smaller of (rows - 1) or (columns - 1) (Garson, 2007).

Mathematical

$$V = \sqrt{\frac{X^2}{nm}}$$

3.7 SUMMARY

The empirical investigation is discussed in this chapter. The research objectives, which consist out of the general and specific objectives, are described, as well as the study population, steps in research design and methodology, measuring instruments and the statistical analyses.

The results of the empirical investigation will be discussed in Chapter 4.

Chapter 4

Results and discussions

4.1 INTRODUCTION

The results of the empirical investigation will be discussed in this chapter. In this discussion the possible reasons why 80% of the study population are overweight and obese, will be investigated. An association between weight status and diabetes will be investigated. The questionnaires (Appendix F) are statistically analysed, and are numbered according to the numbers in the questionnaire.

4.2 SECTION A: DEMOGRAPHIC INFORMATION

The study was performed in two primary health care clinics, namely Potchefstroom Clinic and Promosa Clinic. Primary health care clinics are funded by the government to deliver a service free of charge to the public. Patients attending these clinics generally are people who cannot afford membership of a medical aid scheme, or pay for their own medication. 103 Patients were interviewed, of which 78 were at Potchefstroom Clinic and 25 at Promosa Clinic.

4.2.1 Number of patients at each clinic

Table 4.1: Patient frequency and percentage at each clinic (Appendix A)

Clinic	Frequency	Percent %
Potch	78	75.73
Prom	25	24.27
Total	103	100

There was no way of deciding which patients would be interviewed. As the patients arrived for their appointments, the nurses informed the interviewer about their status. Each patient had the option of being interviewed or not. After they agreed to the interview, they signed a release form (Appendix G) to discharge the University of any liability that may occur and to give their consent for the interview.

The patients studied are not the only diabetic patients in these two clinics. There are some whose blood glucose levels are properly controlled and who visit the clinic only once every two months. Therefore, it is possible that the study was done in a month that the patients did not visit the clinic. The operating hours of these clinics vary from 08:00 in the morning until 21:00 in the evening. Thus, it is also possible that some patients came for their monthly

visit, when the investigator was not there. Of the 103 patients interviewed, 30 were male and 73 were female.

4.2.2 Study population

Table 4.2: Study population compared to South Africa's population

	Study population		South African population	
Gender	**Frequency**	**Percentage %**	**Frequency**	**Percentage %**
Male	30	29.13	23,327,600	49.22
Female	73	70.87	24,063,300	50.78
Total	103	100	47,390,900	100

According to Statistics South Africa, in 2006, mid-year population was estimated at approximately 47.4 million of which 49.22% are male and 50.78% female. According to this population survey, the male to female ratio is almost 1:1, with slightly more females than males. The results of the study show that more females than males with diabetes were interviewed in these specific clinics. This may show that females are more prone to developing diabetes than males, and not because the female population is bigger. The other possibility may be that females are more likely to be obese than males, with obesity being one of the main causes of diabetes development (refer to section 2.6.3).

4.2.3 Different races in the study population

A) Race

Table 4.3: Race frequencies in the studied population (Appendix A)

Race	Frequency	Percent %
Black	66	64.08
White	19	18.45
Coloured	18	17.48
Total	103	100

64.08% of the study population are of black origin, where 18.45% and 17.48% are white and coloured respectively. According to the findings in this research, black people are more prone to diabetes, but the results may represent the fact that the study was performed in primary health care clinics, where mostly black and coloured patients receive their medication. All the coloured people attend Promosa Clinic, because this clinic is situated in an area where these people live. Most of the blacks, and all of the whites, attend

Potchefstroom Clinic, which is located in the central business district of Potchefstroom.

B) Correlation between diabetes groups and race

Table 4.4: Correlation between diabetes groups and races in studied population (Appendix C)

	GROUP A	GROUP B	GROUP C	TOTAL
Black	1	38	27	66
Row %	1.52	57.58	40.91	100
White	3	11	5	19
Row %	15.79	57.89	26.32	100
Coloured	0	15	3	18
Row %	0	83.33	16.67	100
Total	4	64	35	103

Group A: Type 1 diabetes requiring only insulin

Group B: Type 2 diabetes requiring only oral hypoglycemic medication

Group C: Type 2 diabetes requiring both oral hypoglycemic drugs and insulin

1.52% of the black patients and 15.79% of the white patients were classified as group A diabetics. 57.58% of the black patients, 57.89% of the white patients and 83.33% of the coloured patients were classified as Group B diabetics. 40.91% of the black patients, 26.32% of the white patients and 16.67% of the coloured patients were classified as Group C patients.

Table 4.5: Statistical parameters for correlation between different diabetes groups and races in the studied population (Appendix C)

STATISTIC	DF	VALUE	PROB
Chi-square	4	13.02	0.01
Likelihood Ratio Chi-square	4	11.18	0.03
Mantel-Haenszel Chi-square	1	4.08	0.04
Phi coefficient		**0.36**	
Contingency coefficient		0.34	
Cramer's V		0.25	

These statistic equations are explained in Chapter 3. The *Phi* coefficient is the only equation that is of relevance in this dissertation. As described in Chapter 3, the effect size is given by the *Phi* coefficient (W).

- Small effect: $W = 0.1$

- Medium effect: $W = 0.3$
- Large effect: $W = 0.5$

A relationship with $W \geq 0.5$ is considered as practically significant, $W \geq 0.3$ is considered as substantial and $W \geq 0.1$ as non-significant.

According to the statistics of the correlation between diabetes and race the *Phi* coefficient of 0.36 means that it has a substantial meaning. This means that in this studied population; race might be a factor in the development of diabetes. These results show that the majority of black and coloured patients are divided between Groups B and C diabetes and that mostly white patients suffer from Group B diabetes.

4.2.4 Language preference

Table 4.6: Language preference of the studied population (Appendix A)

Lang	Frequency	Percent %
Afr	100	97.09
Eng	3	2.91

Because each patient was individually interviewed, the language preference of each patient could be determined. Almost everyone spoke Afrikaans, and only three were English speaking.

4.3 SECTION B: DIAGNOSTIC DATA

The diagnostic data describe the diabetes classification, and the probability of genetic inheritance. The next table describes the prevalence of the different types of diabetes in these two clinics.

4.3.1 Classification of diabetes

A) Prevalence of diabetes groups

Table 4.7: Diabetes groups frequencies (Appendix A)

B1	Frequency	Percent %
Group A (Type 1 diabetes)	4	3.88
Group B (Type 2 diabetes)	64	62.14
Group C (Type 2 diabetes, requiring insulin)	35	33.98

Type 1 diabetes was formerly known as insulin-dependant or juvenile-onset diabetes, and generally develops as a result from immune-mediated destruction of pancreatic β-cell, resulting in an absolute deficiency of insulin, and develops in childhood or early adulthood (refer to section 2.4.1). There were only four patients with this type, three white and one black patient. This type of diabetes is usually inherited, thus this may show that type 1 is not a disease that habitually occurs in black Africans.

Type 2 diabetes is characterised by disorders of insulin action and insulin secretion, either of which may be the predominant feature. This type of diabetes was previously called non-insulin-dependent diabetes mellitus. In this type, the mass of pancreatic β-cell and their function are preserved to some extent, and insulin injection is seldom needed to sustain life. However, the deterioration in β cell function occurs both in patients controlled by diet and in those treated with sulphonylureas and metformin, thus suggesting that neither of these agents slows the rate of decline (refer to section 2.6). It is, therefore, reasonable to conclude that most patients with type 2 diabetes will eventually need exogenous insulin. Of the patients interviewed, 99 patients were type 2 diabetics, meaning that diabetes developed later in their lives. The major causes of diabetes are obesity (BMI > 30kg/m^2) and being overweight (BMI > 25 kg/m^2), unhealthy eating habits, and limited physical activity (refer to section 2.7.1). The number of South Africans with diabetes, has significantly increased, and is still rising. This is predominantly a result of their adopting a Western diet (Lehohla, 2006). Later in this chapter the eating habits and lifestyles of these patients will be discussed (refer to section C).

Gestational diabetes is any state of glucose intolerance occurring or detected for the first time during pregnancy, but usually disappears after delivery and may reappear with the next pregnancy. These patients have a higher risk of developing diabetes later in their lives. None of the patients interviewed suffered from this type. There was one white female who had this condition during her first pregnancy. When gestational diabetes was diagnosed, the physician prescribed the necessary medications. But, after delivery, the diabetes did not disappear as was expected and her treatment was eventually transformed from oral glucose lowering drugs to insulin injections, because the oral medication did not have the desired effect. This patient was at the time obese. When she started using insulin, she saw that if she didn't give herself the injections, she lost weight. She totally stopped giving herself insulin, and went from a size 44 dress to a number 34. This is a very common problem with overweight patients, especially if they have struggled with their weight for a long time. The primary goal of insulin is to promote glucose absorption into the cells. When there is not enough insulin, the body cannot absorb glucose, and the glucose is secreted into the

urine. This way of weight loss is very dangerous because it will lead to keto-acidosis and may contribute to the development of chronic complication development (O'Connell & Hieronymous: 2006).

There is no agreed definition for diabetic keto-acidosis, but in practice it refers to patients who have hyperglycaemia, acidosis and ketosis (Smith, 2006:111). According to Nattrass (2006:104) it can be defined as metabolic acidosis with plasma bicarbonate less than 15mmol/Litre and total ketone body concentration more than 5mmol/Litre. Keto-acidosis must be treated as a medical emergency, requiring hospitalisation for rehydration and insulin administration.

B) Correlation between gender and different diabetes groups

Table 4.8: Correlation between gender and different diabetes groups in the studied population (Appendix C)

	GROUP A	GROUP B	GROUP C	TOTAL
Male	0	14	16	30
Row %	0	46.67	53.33	100
Female	4	50	19	73
Row %	5.48	68.49	26.03	100
Total	4	64	35	103

None of the male patients were classified as group A diabetics, while 5.48% of the female population fell into this group. 46.67% of the male patients were classified as group B diabetics, and the remaining 53.33% of the studied male population were classified as group C. Of the studied female patients, 68.49% were classified as group B patients and 26.03% of the female population was group C diabetics.

This may indicate that females are more likely to develop diabetes than males, but there might be a number of reasons for these results as discussed previously.

Table 4.9: Statistical parameters for the correlation between different diabetes groups and gender in the studied population (Appendix C)

STATISTIC	DF	VALUE	PROB
Chi-square	2	7.94	0.02
Likelihood Ratio Chi-square	2	8.77	0.01
Mantel-Haenszel Chi-square	1	7.86	0.01
Phi coefficient		**0.28**	
Contingency coefficient		0.27	
Cramer's V		0.28	

According to the statistics of the correlation between diabetes and gender, the *Phi* coefficient is 0.28, which means that gender plays a substantial role in the development of diabetes in these specific patients. The reason for the *Phi* coefficient being significant may be because the study population is not large enough, or that the reason for these patients developing diabetes is because of wrong eating habits and lifestyle. The female patients in this specific population mostly suffered from Group B diabetes and the males studied were almost equally divided between groups B and C.

4.3.2 Genetic probability

A) Probability of inheritance tendency

Table 4.10: Family history of diabetes (Appendix A)

Number	Answer	Frequency	Percent %
B3N1 (Brother / Sister)	1 (Yes)	23	22.33
	2 (No)	80	77.67
B3N2 (Mother / Father)	1 (Yes)	29	28.16
	2 (No)	74	71.84
B3N3 (Grandparents)	1 (Yes)	19	18.45
	2 (No)	84	81.55
B3N4 (Aunt / Uncle)	1 (Yes)	22	21.36
	2 (No)	81	78.64

This section is about the genetic transfer possibilities of diabetes in these specific patients. When a person's direct family, meaning mother or father, brother or sister, suffers from diabetes, that person runs a greater risk to be born with diabetes or to develop it later in life.

There is not a great occurrence of diabetes in the families of these patients. An explanation might be that some of these patients do not know their families. This is a great possibility, because many of these people may have several brothers and sisters, all of the same mother, but not the same father, or vice versa. The other possibility may be that although diabetes was prevalent in their families, they might never have known about it, because these people did not previously have the resources to go to, e.g. doctors, clinics and hospitals. Those facilities which were available might not have met the expected standard. This situation has only changed during the past twenty years. Thus, it is possible that their parents lived with diabetes and never knew about it.

B) Correlation between different groups of diabetes and inheritance tendency

Table 4.11: Correlation between different groups of diabetes and inheritance tendency, where one or more family member suffered from the disease (Appendix C)

	GROUP A	GROUP B	GROUP C	TOTAL
Yes	3	27	13	43
Row %	6.98	62.79	30.23	100
No	1	37	22	60
Row %	1.67	61.69	36.67	100
Total	4	64	35	103
Total % of patients with family members with diabetes	75	42.19	37.14	

In table 4.11 the probability of only one member of the patient's family having diabetes is indicated, thus only brother/sister, or only mother/father, or only one grandparent, or only aunt/uncle. Forty-three patients said that some of their family members had diabetes. 75% of the patients, who were classified as group A, said that diabetes occurred in their families. 42.2% of the sixty-four patients who fell into group B said that diabetes occurred in their families and 37.1% of the thirty-five patients who were classified in group C had family members with diabetes.

Table 4.12: Statistical parameters for the correlation between different diabetes groups and inheritance tendency, where one or more family member suffered from the disease (Appendix C)

STATISTIC	DF	VALUE	PROB
Chi-square	2	2.13	0.35
Likelihood Ratio Chi-square	2	2.14	0.34
Mantel-Haenszel Chi-square	1	1.19	0.28
Phi coefficient		**0.14**	
Contingency coefficient		0.14	
Cramer's V		0.14	

According to the statistics of the correlation between the different diabetes groups and family inheritance, the *Phi* coefficient of 0.14 is non-significant. According to the results, 75% of the group A patients had diabetes in their families, 40% of the patients classified into group B and C had family members with diabetes. Thus, overall 42% of the patients interviewed had diabetes in their families. This may show that the probability of developing diabetes if it occurs in one or more family members is not great. But then again, maybe the study population could have been too small.

Table 4.13: Correlation between different diabetes groups and close family members with diabetes (Appendix C)

	GROUP A	GROUP B	GROUP C	TOTAL
Yes	3	35	21	59
Row %	5.08	59.32	35.59	
No	1	29	14	44
Row %	2.27	65.91	31.82	
Total	4	64	35	103
Total % of patients with close family with diabetes	75	54.70	60	

Table 4.13 describes where only the siblings and parents of the patients suffered from diabetes. Again 75% of group A diabetics said that diabetes occurred in their close family, where 57% of the patients in group B and C had diabetic relatives.

Table 4.14: Statistical parameters for the correlation between different diabetes groups and close family members with diabetes (Appendix C)

STATISTIC	DF	VALUE	PROB
Chi-square	2	0.8	0.67
Likelihood Ratio Chi-square	2	0.83	0.66
Mantel-Haenszel Chi-square	1	0.01	0.93
Phi coefficient		**0.09**	
Contingency coefficient		0.09	
Cramer's V		0.09	

According to the statistics of the correlation between diabetes and close family, the *Phi* coefficient of 0.09 means that this correlation is definitely not significant, but as shown in tables 4.11 to 4.13, 75% of insulin dependent diabetics interviewed had some one in their close family that had diabetes. Of the type 2 patients, 42% had some family members that were living with diabetes, and 57% said either their siblings or parents had diabetes.

Although the population was relatively small, according to this study type 1 has a three in four chance of being inherited, and there is more than a 50% chance that you will develop diabetes if some one in your family suffers from it. This percentage of inheritance cannot be lowered by lifestyle modifications, but by altering one's lifestyle the progression to the disease might be inhibited.

4.4 SECTION C: LIFESTYLE

Africa has always been regarded as a continent where starvation and malnutrition are the most pressing problems. However, new research indicates that as African populations become westernised and urbanised, the incidence of overweight and obesity increases exponentially. In South Africa, 40-50% of the population are obese (van Heerden, 2007). This can also be seen in the population studied.

BMI is calculated as follows:

BMI = weight (kg) / height²

Table 4.15: BMI explained

BMI	WEIGHT STATUS
<18.5 kg/m²	Underweight
18.5-24.9 kg/m²	Normal weight
25-29.9 kg/m²	Overweight
>30 kg/m²	Obese

Table 4.16: Weight frequencies in the total study population (Appendix B)

GROUP	FREQUENCY	PERCENT %
Normal	21	20.39
Overweight	41	39.81
Obese	41	39.81

Table 4.17: Means procedure of the total weight frequencies (Appendix A)

VARIABLE	N	MEAN	STD DEV	MIN	MAX
Weight	103	79.9	18.2	39.08	140
Height	103	1.63	0.08	1.47	1.87
BMI	103	30.13	6.56	13.52	53.91

There was only one patient who was severely underweight, weighing 39.08 kg. There are a number of reasons for this. One is her being unemployed, and therefore not able to buy nutritious foods that her body needs. The other reason may be that her glucose levels are not under control.

The mean is 30.12 kg/m². This indicates, according to the BMI conversion, that the average patient interviewed was obese. This is reason for concern because this may eventually lead to all the major complications of diabetes. These patients are at increased risk for developing heart disease, neuropathy and nephropathy (refer to section 2.6.4).

The maximum BMI of 53.90 kg/m² is alarming! This patient weighed 140 kg and was 1.61 m tall. The fundamental cause of obesity is an energy imbalance between calories consumed and calories expended. Adopting a Western diet indicates that there is a shift towards

increased intake of energy-dense foods that are high in fat and sugars, but low in vitamins, minerals and other micronutrients (WHO,2006). The other reason may be decreased physical activity due to the increasingly deskbound nature of many forms of work, altering modes of transportation, and increasing urbanisation.

On the other hand, most of the people interviewed are unemployed. This suggests that they don't have enough money to buy nutritious foods. Thus, when buying a 50 kg pack of maize, they can feed the whole family for the rest of the month. Evidently, this will not give them proper nutrition.

4.4.2 Exercise

Table 4.18: Total frequency of studied population who exercise (Appendix A)

C2N1	FREQUENCY	PERCENT %
1 (Yes)	30	29.13
2 (No)	73	70.87

Exercise has the potential to control diabetes by non-medical means, reduce the severity of the disease and significantly reduce the risk of long-term complications (Mullen, 2006). Of the patients interviewed, 70.87% said that they did not exercise, and 29.13% said that they did do some kind of exercise. This included walking to work, walking or running for exercise, or going to the gym. Only three patients held gym memberships.

Table 4.19: Total frequency of exercise types done by the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %
C2N2N1 (walk to work)	1 (Yes)	82	79.61
	2 (No)	21	20.39
C2N2N2 (walk or run for exercise)	1 (Yes)	18	17.48
	2 (No)	85	82.52
C2N2N3 (gym)	1 (Yes)	3	3.03
	2 (No)	96	96.97

Some of the patients said that they did not do extra exercises, but did work at home, e.g. cleaning or gardening. This was considered as some kind of exercise and they were classified under '"Walking to work", which explains why the frequencies in table 4.18 are much higher than those in table 4.17.

Table 4.20: Total frequency of exercise compared to weight status in the studied population (Appendix B)

	1 (YES)	2 (NO)	TOTAL
Normal weight	6	15	21
Row %	28.57	71.43	100
Overweight	10	31	41
Row %	24.39	75.61	100
Obese	10	31	41
Row %	24.39	75.61	100
Total	30	73	103

28.57% of the patients who are of normal weight, said that they do some kind of exercise. 24.39% of both the overweight and obese patients said that they do exercise. This is less than half the patients interviewed. Being physically inactive contributes to development of insulin insensitivity (refer to section 2.9.2.2). The exact types of exercise done by the patients can be seen in Appendix B.

Table 4.21: Statistical parameters for the correlation between exercise and weight status in the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	2	0.95	0.62
Likelihood Ratio Chi-square	2	0.95	0.62
Mantel-Haenszel Chi-square	1	0.28	0.6
Phi coefficient		**0.1**	
Contingency coefficient		0.1	
Cramer's V		0.1	

Table 4.20 describes the statistics for the patients who tend to work out, and those who do not. According to the statistics of the correlation between exercise and weight status the *Phi* coefficient of 0.1 shows that they do not exercise whether they are obese or normal or overweight.

Table 4.22: Frequency of exercise done in a week (Appendix A)

C2N3	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (less than once a week)	5	4.85	5	4.85
2 (2-3 times a week)	34	33.01	39	37.86
3 (5 times a week)	64	62.14	103	100

The patients who exercise less than once a week are a mere 4.85%. The patients that do some exercise two to three times a week are 33.01% and 62.14% say that they work out five

times a week.

Table 4.23: Correlation between frequencies of exercise done in a week compared to weight status of the studied population (Appendix B)

	1 (LESS THAN ONCE A WEEK)	2 (2-3 TIMES A WEEK)	3 (FIVE TIMES A WEEK)	TOTAL
Normal	1	6	14	21
Row %	4.76	28.57	66.67	100
Overweight	2	10	29	41
Row %	4.88	24.39	70.73	100
Obese	2	18	21	41
Row %	4.88	43.9	51.22	100
Total	5	34	64	103

Of the twenty-one patients who are of normal weight, 4.76% said they exercised less than once a week, 28.57% said they exercised two to three times a week and, 66.67% said they train five times a week.

Of the forty-one overweight patients, 4.88% said they were physically active less than once a week, whereas 24.39% said they were active two to three times a week and, 70.73% said they exercised five times a week.

4.88% of the forty-one obese patients said they were active less than once a week, 43.9% said they trained two to three times a week and, 51.22% said they do extra exercise five times a week.

Table 4.24: Statistical parameters for the correlation between frequencies of exercise done in a week and weight status of the studied population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	4	3.87	0.43
Likelihood Ratio Chi-square	4	3.85	0.43
Mantel-Haenszel Chi-square	1	0.32	0.57
Phi coefficient		**0.19**	
Contingency coefficient		0.19	
Cramer's V		0.14	

The meaning of the *Phi* coefficient, 0.19, is non significant. This means that being physically inactive has nothing to do with BMI.

The reason for this may be that the exercise that most of these patients do are classified

under 'Walk to work' (Table 4.18), thus they do additional exercise. The little activity that they do is inadequate to keep their blood sugar levels under control, thus they need to be much more active throughout the day to see what difference exercise can make to their current health status.

There may be another possibility for these people being inactive: it may be that they are not able to do any exercise, especially these patients who have diabetic neuropathy. These patients have difficulty walking, because of damage to the nerves in the lower extremities. Also, a lot of these patients complained about swelling in the lower limbs which makes it difficult to walk.

4.4.3 Smoking

Smoking is one of the contributing factors for ischemic heart attack and it contributes to elevated blood pressure (refer to section 2.8.4.2). Both of these are risk factors for developing chronic complications of diabetes, thus smoking increases one's risk.

Table 4.25: Frequency of smokers in the studied population (Appendix A)

C3N1	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	17	16.5	17	16.5
2 (No)	86	83.5	103	100

Only 16.5% of the total study population smoke.

Table 4.26: Frequency of cigarettes smoked by the study population (Appendix A)

C3N2	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (1-10 per day)	15	93.75	15	93.75
2 (11-20 per day)	1	6.25	16	100

Most of these people can not afford packets of cigarettes, thus they smoke rolled tobacco, without filters. 93.75% of the seventeen smokers, smoke up to ten of these rolled cigarettes a day, and one smokes up to twenty of these per day. According to table 4.25 there is one frequency missing. This is because one patient does not smoke these rolled tobacco cigarettes, he smokes Marijuana.

Table 4.27: Frequency of smokers who considered quitting smoking in the study population (Appendix A)

C3N4	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	15	88.24	15	88.24
2 (No)	2	11.76	17	100

88.24% of the patients who smoke said they were considering or had thought about quitting. The problem is that it is not that easy to quit. This is an addiction, when they smoke, it makes them feel good. These people are neglected and live in poverty, they do not have much and they are not willing to part from the one thing that gives them pleasure, even if it might cause harm to their health in the end.

4.4.4 Alcohol

Table 4.28: Frequency of total beer consumption per week by the study population (Appendix A)

C4N1N1	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (1-2 per week)	4	33.3	4	33.33
2 (3-4 per week)	6	50	10	83.33
3 (5-6 per week)	1	8.33	11	91.67
4 (more)	1	8.33	12	100

A total of twelve patients drink beer weekly, 33.30% drink one to two beers a week, 50% drink up to four beers a week, 8.33% drink more than five beers a week.

Table 4.29: Frequency of total wine consumption per week by the study population (Appendix A)

C4N1N2	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (1-2 per week)	4	80	4	80
2 (3-4 per week)	1	20	5	100

Only five patients admitted to drinking wine. 80% drink one to two glasses per week and 20% drink up to four glasses a week. This may be faulty information because people tend to tell the investigator what they think he/she wants to hear.

Table 4.30: Frequency and percentage of liquor consumption (Appendix A)

C4N1N3	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (1-2 per week)	2	100	2	100

Two patients admitted to drinking one to two shots of alcohol per week. Again, this information may be fabricated.

4.4.5 Diet

Evidence shows that nutritional modification has played a key role in the managing of diabetes for over 200 years. Before the widespread use of insulin therapy in the 1920's, a starvation diet was in general prescribed to alleviate the symptoms of diabetes (refer to section 2.9.2).

A well-balanced, healthy diet remains an essential component of therapy. Dietary requirements differ from obese diabetes patients to non-obese diabetics. Weight reduction by calorie limitation is the main goal for obese diabetics. The diet that a person with diabetes follows to help manage his or her blood glucose levels, is based on the same nutrition principles that any healthy person, with or without diabetes, should follow for good health (refer to section 2.9.2).

Table 4.31: Frequency of reasons for eating given by the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
C5N1N1 (Hunger)	1 (Yes)	82	79.61	82	79.61
	2 (No)	21	20.39	103	100
C5N1N2 – 4 (Stress) (Frustration) (Depression)	2 (No)	103	100	103	100
C5N1N5 (Energy)	1 (Yes)	30	29.13	30	29.13
	2 (No)	73	70.87	103	100
C5N1N6 (Stay healthy)	1 (Yes)	54	52.43	54	52.43
	2 (No)	49	47.57	103	100
C5N1N7 (Dietician / Prescribed)	1 (Yes)	39	37.86	39	37.86
	2 (No)	64	62.14	103	100

The majority of patients, 79.61% said that they only ate when they felt hungry. All the patients interviewed said that stress, frustration and depression did not play a role in their eating habits. 29.13% said that they ate when they felt that they needed some energy, and 52.43% said their motivation for eating was to stay healthy. Only 37.86% said they ate because a dietician recommended specific mealtimes.

Table 4.32: Comparison between being hungry for a reason for eating and weight status of the study population (Appendix B)

	1 (YES)	2 (NO)	TOTAL
Normal	17	4	21
Row %	80.95	19.05	100
Overweight	36	5	41
Row %	87.8	12.2	100
Obese	29	12	41
Row %	70.73	29.27	100
Total	82	21	103

Of the twenty-one patients who were of normal weight, 80.95% said they only ate when they were hungry. 87.80% and 70.73% of the overweight and obese patients respectively said they only ate when they were hungry.

Table 4.33: Statistical parameters for the comparison between being hungry for a reason for eating and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	2	3.71	0.17
Likelihood Ratio Chi-square	2	3.76	0.15
Mantel-Haenszel Chi-square	1	0.99	0.32
Phi coefficient		**0.19**	
Contingency coefficient		0.19	
Cramer's V		0.19	

According to the statistics of the correlation between hunger the reason for eating and weight status the *Phi* coefficient of 0.19 is practically non- significant, thus meaning that only eating when hungry does not have an impact on weight (BMI). This is in contrast with the literature, which says that by eating five to six small meals a day, one's glucose levels remain constant (refer to section 2.9.2). These patients are suffering poverty, thus they do not have the finances to buy large amounts of food.

Table 4.34: Comparison between the reason for eating being prescribed by a dietician and weight status of the study population (Appendix B)

	1 (YES)	2 (NO)	TOTAL
Normal	6	15	21
Row %	28.57	71.43	100
Overweight	20	21	41
Row %	48.78	51.22	100
Obese	13	28	41
Row %	31.71	68.29	100
Total	39	64	103

28.57% of the normal weight patients said that they ate according to the prescription of a dietician or other healthcare professional, 48.78% of the overweight patients and 31.71% of the obese patients claimed that they did the same as well.

Table 4.35: Statistical parameters for comparison between reason for eating being prescribed by a dietician and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	2	3.51	0.17
Likelihood Ratio Chi-square	2	3.5	0.17
Mantel-Haenszel Chi-square	1	2.99	0.08
Phi coefficient		**0.19**	
Contingency coefficient		0.18	
Cramer's V		0.19	

According to the statistics of the correlation between the reasons for eating because it was prescribed by a dietician and weight status the *Phi* coefficient of 0.19 shows that this is not significant. The reason for this may be that these people know that this is the healthy way of living, but cannot eat like that because of poverty. The other possibility may be that they only eat meat and maize, and not enough fruit and vegetables. This will be discussed later in this section.

Table 4.36: Frequency of meals consumed a day by the study population (Appendix A)

C5N2	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (2 meals)	8	7.77	8	7.77
2 (3 meals)	27	26.21	35	33.98
3 (3 meals, 2-3 snacks)	54	52.43	89	86.41
4 (5-6 meals)	14	13.59	103	100

52.43% of the patients said that they ate regularly, meaning three main courses with two to three snacks a day, which is the recommended way to eat. 13.59% eat more than five meals a day, where 26.21% eat three meals a day, and 7.77% eat only one meal a day.

Table 4.37: Comparison between meals consumed a day and weight status of the study population (Appendix B)

	1 (2 MEALS)	2 (3 MEALS)	3 (3 MEALS, 2-3 SNACKS)	4 (5-6 MEALS)	TOTAL
Normal	3	5	10	3	21
Row %	14.29	23.81	47.62	14.29	100
Overweight	3	7	23	8	41
Row %	7.32	17.07	56.1	19.51	100
Obese	2	15	21	3	41
Row %	4.88	36.59	51.22	7.32	100
Total	8	27	54	14	103

Of the normal weight patients, 14.29% said they ate once a day, 23.81% said that they ate twice daily, 47.62% said they ate three times a day with two to three snacks in-between, and 14.29% said that they ate more than five times a day. Of the overweight patients 7.32% said they only ate once a day, 17.07% said they ate two meals a day, 56.1% said they ate three times a day with two to three snacks and 19.51% said they eat more than five times a day. Of the obese patients, 4.88% said they ate once a day, 36.59% said they ate twice a day, 51.22% said they ate three main meals with two to three snacks during the day and only 7.32% said they ate more than five times a day.

Table 4.38: Statistical parameters for comparison between meals consumed a day and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	6	7.1	0.31
Likelihood Ratio Chi-square	6	7.1	0.32
Mantel-Haenszel Chi-square	1	2.02	0.16
Phi coefficient		**0.26**	
Contingency coefficient		0.25	
Cramer's V		0.19	

According to the statistics of the correlation between the numbers of meals eaten a day and weight status the *Phi* coefficient of 0.26 means that this has almost a substantial effect, thus meaning that weight status relates with how many meals are eaten throughout the day. A healthy person's diet consists of regular meals, small portions at a time, with lots of fresh

fruits and vegetables (refer to section 2.9.2.2).

The probable reason for these people being overweight and obese may be that they were previously disadvantaged and malnourished. As African populations become westernised and urbanised, the incidence of overweight and obesity increases exponentially (van Heerden, 2007).

Table 4.39: Frequency of fruits, vegetables and meat consumed a day by the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
C5N3N1 (Fruit)	1 (Yes)	78	75.73	78	75.73
	2 (No)	25	24.27	103	100
C5N3N2 (Vegetables)	1 (Yes)	94	91.26	94	91.26
	2 (No)	9	8.74	103	100
C5N3N3 (Chicken)	1 (Yes)	94	91.26	94	91.26
	2 (No)	9	8.74	103	100
C5N3N4 (Fish)	1 (Yes)	54	52.43	54	52.43
	2 (No)	49	47.57	103	100
C5n3N5 (Mutton)	1 (Yes)	27	26.21	27	26.21
	2 (No)	76	73.79	103	100
C5N3N6 (Beef)	1 (Yes)	52	50.49	52	50.49
	2 (No)	51	49.51	103	100
C5N3N7 (Pork)	1 (Yes)	16	15.53	16	15.53
	2 (No)	87	84.47	103	100

75.73% and 91.26% of all the patients said they regularly ate fruit and vegetables respectively, three to four servings per day. 91.26% said they ate chicken; this may be because chicken is the least expensive of the meat types. About half of the patients, 52.43% do eat fish, and only 26.21% said they ate mutton. This may be because mutton is the most expensive of all meat. The average patient, 50.49% do eat beef and a mere 15.53% of them eat pork. This may be because of cultural or religious issues.

Table 4.40: Comparison between daily vegetable consumption and weight status of the study population (Appendix B)

C5N3N2	1 (YES)	2 (NO)	TOTAL
Normal	16	5	21
Row %	76.19	23.81	100
Overweight	38	3	41
Row %	92.68	7.32	100
Obese	40	1	41
Row %	97.56	2.44	100
Total	94	9	103

Of the normal weight patients, 76.19% said they ate between three and four servings of vegetables everyday, 92.68% and 97.56% of the overweight and obese patients respectively claimed to eat three to four servings of vegetables each day.

Table 4.41: Statistical parameters for comparison between daily vegetable consumption and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	2	8.13	0.02
Likelihood Ratio Chi-square	2	7.15	0.03
Mantel-Haenszel Chi-square	1	3.01	0.08
Phi coefficient		**0.28**	
Contingency coefficient		0.27	
Cramer's V		0.28	

The only *Phi* coefficient that was of relative importance in question 5.3 was that of C5N3N2. The rest of this question's statistical analyses can be viewed in Appendix B. According to the statistics of the correlation between daily vegetable consumption and weight status the *Phi* coefficient of 0.28 means that it has a substantial effect, thus weight status might be related to the amount of vegetables eaten everyday. What this actually means is that eating lots of vegetables is one of the reasons for these people being overweight which is not possible. Maybe they do eat plenty of vegetables, but of the wrong kind e.g. potatoes and maize.

Table 4.42: Frequency of daily carbohydrate and plant proteins consumed (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
C5N4N1 (Bread)	1 (Yes)	100	97.09	100	97.09
	2 (No)	3	2.91	103	100
C5N4N2 (Porridge)	1 (Yes)	92	89.32	92	89.32
	2 (No)	11	10.68	103	100
C5N4N3 (Potatoes)	1 (Yes)	88	85.44	88	85.44
	2 (No)	15	14.56	103	100
C5N4N4 (Rice)	1 (Yes)	78	75.73	78	75.73
	2 (No)	25	24.27	103	100
C5N4N5 (Dried beans)	1 (Yes)	40	38.83	40	38.83
	2 (No)	63	61.17	103	100
C5N4N6 (Soya beans)	1 (Yes)	8	7.77	8	7.77
	2 (No)	95	92.23	103	100
C5N4N7 (Split peas)	1 (Yes)	50	48.54	50	48.54
	2 (No)	53	51.46	103	100
C5N4N8 (Lentils)	1 (Yes)	32	31.07	32	31.07
	2 (No)	71	68.93	103	100

The carbohydrates referred to in this question were bread, especially white bread, and porridge. 97.09% of the patients said that they ate bread and 89.32% said they ate porridge. The other carbohydrates in question were potatoes and rice. The percentages of patients who admitted to eating these on a regular basis were 85.44% and 75.73% respectively.

The plant proteins the patients were questioned about were bean types, peas and lentils. 38.83% said they ate dried beans and only 7.77% ate soya beans. 48.54% said they ate peas and 31.07% of them admitted to eating lentils.

Table 4.43: Comparison between weekly consumption of beans and weight status of the study population (Appendix B)

	1 (YES)	2 (NO)	TOTAL
Normal	11	10	21
Row %	52.38	47.62	100
Overweight	11	30	41
Row %	26.83	73.17	100
Obese	18	23	41
Row %	43.9	56.1	100
Total	40	63	103

More than half of the normal weight patients, 52.38% said they ate dried beans more than three times a week. Of the overweight patients, 26.83% said that they ate dried beans often and 43.9% of the obese patients admitted to eating dried beans more than three times a week.

Table 4.44: Statistical parameters for comparison between weekly bean consumption and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	2	4.55	0.1
Likelihood Ratio Chi-square	2	4.63	0.1
Mantel-Haenszel Chi-square	1	4.33	0.04
Phi coefficient		**0.21**	
Contingency coefficient		0.21	
Cramer's V		0.21	

The *Phi* coefficient of 0.21 is almost substantial, thus indicating that eating dried beans more than three times a week, does not have effect on weight status. The rest of question 5.4's *Phi* coefficients are not worth mentioning, because all of them are non-significant and can be viewed in Appendix B.

Table 4.45: Frequency of daily fat consumption in the study population (Appendix A)

C5N5	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (1-2 tsp)	89	87.25	89	87.25
2 (3-4 tsp)	11	10.78	100	98.04
3 (more)	2	1.96	102	100

The cumulative frequency of 102 means that there is one frequency missing. This is because there was one person who said that that he had never eaten any fat. This includes margarine, butter, oil and any animal fat products. 87.25% said they ate one to two teaspoons of fat per day, 10.78% said they ate up to four teaspoons per day and only 1.96%

said they ate more than four teaspoons of fat per day.

Table 4.46: Correlation between daily fat consumption and weight status in the study population (Appendix B)

	1 (1-2 TSP)	2 (3-4 TSP)	3 (MORE)	TOTAL
Normal	15	5	1	21
Row %	71.43	23.81	4.76	100
Overweight	37	3	0	40
Row %	92.5	7.5	0	100
Obese	37	3	1	41
Row %	90.24	7.32	2.44	100
Total	89	11	2	102

Of the twenty-one patients of normal weight, 71.43% said they ate one to two teaspoons of fat per day, 23.81% said they ate up to four a day, and 4.76% said they ate more than four teaspoons per day. Of the overweight patients, 92.5% said they ate one to two teaspoons of fat per day, 7.5% said they ate three to four teaspoons, whilst none consumed more than four teaspoons a day. Of the obese patients, 90.24% said they ate one to two teaspoons of fat per day, 7.32% said they ate up to four a day and only 2.44% said they ate more than four teaspoons of fat per day.

Table 4.47: Statistical parameters for correlation between daily fat consumption and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	4	6.6	0.16
Likelihood Ratio Chi-square	4	6.43	0.17
Mantel-Haenszel Chi-square	1	4.83	0.03
Phi coefficient		**0.26**	
Contingency coefficient		0.25	
Cramer's V		0.18	

According to the statistics of the correlation between daily fat consumption and weight status the *Phi* coefficient of 0.26 indicates an almost a substantial effect, indicating that weight status is related to the daily fat consumption of these patients.

Table 4.48: Frequency of daily salt consumption in the study population (Appendix A)

C5N6	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (1-2 tsp)	91	90.1	91	90.1
2 (3-4 tsp)	8	7.92	99	98.02

3 (more)	2	1.98	101	100

The cumulative frequency adds up to 101, thus meaning there are two frequencies missing. This is because there were two patients who said they did not eat any salt. 90.1% said they ate one to two teaspoons of salt per day, 7.92% said they ate up to four a day, and only 1.98% said they ate more than four teaspoons of salt a day.

Table 4.49: Comparison between daily salt consumption and weight status of the study population (Appendix B)

	1 (1-2 TSP)	2 (3-4 TSP)	3 (MORE)	TOTAL
Normal	20	1	0	21
Row %	95.24	4.76	0	100
Overweight	36	3	1	40
Row %	90	7.5	2.5	100
Obese	35	4	1	40
Row %	87.5	10	2.5	100
Total	91	8	2	101

Of the normal weight patients, 95.24% said they ate one to two teaspoons of salt per day, where 4.76% said they ate up to four a day and none of them eat more than four teaspoons of salt per day. Of the overweight patients, 90% eat one to two teaspoons of salt a day, 7.5% said they ate three to four a day, and 2.5% said they ate more than four a day. Of the obese patients, 87.5% eat one to two teaspoons of salt per day, 10% eat up to four a day, and 2.5% eat more than four teaspoons of salt per day.

Table 4.50: Statistical parameters for the comparison between daily salt consumption and weight status in the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	4	1.11	0.89
Likelihood Ratio Chi-square	4	1.54	0.82
Mantel-Haenszel Chi-square	1	0.36	0.55
Phi coefficient		**0.11**	
Contingency coefficient		0.1	
Cramer's V		0.07	

The *Phi* coefficient of 0.11 is non-significant, thus meaning that the amount of salt eaten a day has nothing to do with weight status. Salt has a direct elevating effect on blood pressure, and people with diabetes, have a higher risk to develop hypertension because of insulin resistance (refer to section 2.8.4.1). Thus, this increases their risk for developing

arteriosclerosis and heart diseases.

Table 4.51: Frequency of daily water consumption in the study population (Appendix A)

C5N7	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	82	79.61	82	79.61
2 (No)	21	20.39	103	100

79.61% of the patients interviewed said they drank six to eight glasses of water a day, and 20.39% said they drank less.

Table 4.52: Comparison between daily water consumption and weight status of the study population (Appendix B)

	1 (YES)	2 (NO)	TOTAL
Normal	16	5	21
Row %	76.19	23.81	100
Overweight	33	8	41
Row %	80.49	19.51	100
Obese	33	8	41
Row %	80.49	19.51	100
Total	82	21	103

76.19% of the twenty-one normal weight patients said they drank six to eight glasses of water a day, 80.49% of the overweight patients said that they did as well, and 80.49% of the obese patients said they drank six to eight glasses as well.

Table 4.53: Statistical parameters for the comparison between daily water consumption and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	2	0.19	0.91
Likelihood Ratio Chi-square	2	0.19	0.91
Mantel-Haenszel Chi-square	1	0.12	0.73
Phi coefficient		**0.04**	
Contingency coefficient		0.04	
Cramer's V		0.04	

The *Phi* coefficient of 0.04 is practically non-significant, thus meaning that to drink six to eight glasses of water a day is not the cause of being overweight and obese, but this is obvious.

Table 4.54: Frequency of patients finding it difficult to obtain the right food in the study population (Appendix A)

C5N8	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	52	50.49	52	50.49
2 (No)	51	49.51	103	100

Half of the patients said they found some difficulty to get the right food to cater for their specific needs, and half said that there was no problem getting the right food.

Table 4.55: Comparison between the frequency of patients finding it difficult to obtain the right food and weight status of the study population (Appendix B)

	1 (YES)	2 (NO)	TOTAL
Normal	14	7	21
Row %	66.67	33.33	100
Overweight	17	24	41
Row %	41.46	58.54	100
Obese	21	20	41
Row %	51.22	48.78	100
Total	52	51	103

Of the normal weight patients, 66.67% said they found it hard to find specific food, where 41.46% of the overweight patients said it was difficult to get the right food and 51.22% of the overweight patients said they had some difficulty.

Table 4.56: Statistical parameters for the comparison between the frequency of patients finding it difficult to obtain the right food and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	2	3.54	0.17
Likelihood Ratio Chi-square	2	3.59	0.17
Mantel-Haenszel Chi-square	1	3.43	0.06
Phi coefficient		**0.19**	
Contingency coefficient		0.18	
Cramer's V		0.19	

According to the statistics of the correlation between weight status and difficulty finding the correct food the *Phi* coefficient of 0.19 means that it has a non-significant effect.

Table 4.57: Frequency of patients' finding it difficult to follow a specific diet in the

study population (Appendix A)

C5N9	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	3	2.91	3	2.91
2 (No)	100	97.09	103	100

Only 2.91% of the patients interviewed said they found it difficult to eat the correct food, and 97.09% they had no difficulty following the specific diet.

Table 4.58: Correlation between frequency of patients finding it difficult to follow a specific diet and weight status of the study population (Appendix B)

	1 (YES)	2 (NO)	TOTAL
Normal	0	21	21
Row %	0	100	100
Overweight	1	40	41
Row %	2.44	97.56	100
Obese	2	39	41
Row %	4.88	95.12	100
Total	3	100	103

Of the patients of normal weight, 21% said they had no difficulty following the diet, where 2.44% of the overweight patients said they found it problematic to follow the diet and 97.56% said it was no problem to eat the specific foods. 4.88% of the obese patients said it was difficult for them to follow the diet and 95.12% said that it was not.

Table 4.59: Statistical parameters for the correlation between the frequency of patients finding it difficult to follow a specific diet and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	2	1.22	0.54
Likelihood Ratio Chi-square	2	1.74	0.42
Mantel-Haenszel Chi-square	1	0.11	0.75
Phi coefficient		**0.11**	
Contingency coefficient		0.11	
Cramer's V		0.11	

According to the statistics of the correlation between weight status and difficulty of following a correct diet the Phi coefficient of 0.1 has no significant effect. Thus, it means that difficulty to follow a specific diet regime has no specific impact on weight status in the study population.

This is in contrast with the literature, because there it is clearly stated that by following a healthy, nutritious diet and moderate activity, one can lose the extra weight and maintain a normal weight (Homeier, 2005).

Table 4.60: Frequency of patients' last session attended with a registered dietician (Appendix A)

C5N10	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (0-6 months)	12	11.65	12	11.65
2 (7-12 months)	12	11.65	24	23.3
3 (> year)	79	76.7	103	100

11.65% of all the patients interviewed said they had been to a registered dietician in the previous six months, and 11.65% said they had been to one in the previous twelve months. 76.7% of the patients had seen a dietician more than a year before, and most of these patients were visiting one when they were first diagnosed with diabetes.

Table 4.61: Comparison between last sessions attended with dietician and weight status of the study population (Appendix B)

	1 (0-6 MONTHS)	2 (7-12 MONTHS)	3 (> YEAR)	TOTAL
Normal	2	4	15	21
Row %	9.52	19.05	71.43	100
Overweight	5	7	29	41
Row %	12.2	17.07	70.73	100
Obese	5	1	35	41
Row %	12.2	2.44	85.37	100
Total	12	12	79	103

9.52% of the normal weight patients said they had been to a registered dietician in the previous six months, 19.05% said they had seen a dietician in the previous twelve months and 71.43% said it had been more than a year before. Of the overweight patients, 12.2% said they had had a session with one in the previous six months, 17.07% said it had been during the previous year and 70.73% said it had been more than a year before. 12.2% of the obese patients had been to a dietician in the previous six months, 2.44% said they had been to one the previous twelve months and 85.37% of them said it had been more than a year before.

Table 4.62: Statistical parameters for the comparison between last sessions attended with dietician and weight status of the study population (Appendix B)

STATISTIC	DF	VALUE	PROB
Chi-square	4	5.78	0.22
Likelihood Ratio Chi-square	4	6.92	0.14
Mantel-Haenszel Chi-square	1	0.15	0.7
Phi coefficient		**0.24**	
Contingency coefficient		0.23	
Cramer's V		0.17	

The *Phi* coefficient of 0.24 means that it has almost a substantial effect, thus not attending a dietician for a specific eating regime, has an effect on weight status. It is critical for diabetic patients to attend a dietician or consult some one with dietetic knowledge to inform them of what to eat and what not, at least once a year. The nutritious needs of these patients change as their diabetic status progresses, thus by eating the correct foods at the correct intervals each day, there is a better chance to control their condition.

Table 4.63: Frequency of patients in the study population who visited a dentist, podiatrist and ophthalmologist in the past year (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
C5N11N1	1 (Yes)	26	25.24	26	25.24
(Dentist)	2 (No)	77	74.76	103	100
C5N11N2	1 (Yes)	21	20.39	21	20.39
(Podiatrist)	2 (No)	82	79.61	103	100
C5N11N3	1 (Yes)	51	49.51	51	49.51
(Ophthalmologist)	2 (No)	52	50.49	103	100

25.24% of the total number of patients interviewed said they had been to a dentist, 20.39% said they had been to a podiatrist and 49.51% said that they had been to an ophthalmologist in the previous year. Attending one of these does not have an impact on being overweight or obese, but these *Phi* coefficients can be viewed in Appendix B.

The major complications of diabetes are retinopathy and neuropathy and these are the leading causes of blindness and gangrene leading to amputation in diabetic patients (refer to sections 2.8.1.3 and 2.8.3). It is of vital importance that people with diabetes see each of these professionals at least once a year to prevent these complications from progressing.

4.5 SECTION D: WELL-BEING

This section is about the emotional aspect of having diabetes. It is very common to have strong feelings about diabetes. When being diagnosed with diabetes, the most common

emotions are feelings of shock, despair and anxiety (Peel *et al.* 2004:269).

The problem in primary health care facilities is time. As previously stated the staff in these clinics are pressured for time, and are not spending sufficient time with each patient explaining exactly the impact that having diabetes will have on their lives.

The next table describes the most frequent reactions towards being diagnosed with diabetes.

Table 4.64: Frequency of emotions towards diabetes in the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
D1N1 (Angry)	1 (Yes)	21	20.39	21	20.39
	2 (No)	82	79.61	103	100
D1N2 (Sad)	1 (Yes)	41	39.81	41	39.81
	2 (No)	62	60.19	103	100
D1N3 (Afraid)	1 (Yes)	38	36.89	38	36.89
	2 (No)	65	63.11	103	100
D1N4 (Alone)	1 (Yes)	4	3.88	4	3.88
	2 (No)	99	96.12	103	100
D1N5 (Guilty)	1 (Yes)	3	2.91	3	2.91
	2 (No)	100	97.09	103	100
D1N6 (Uninformed)	1 (Yes)	40	38.83	40	38.83
	2 (No)	63	61.17	103	100
D1N7 (Depressed)	1 (Yes)	12	11.65	12	11.65
	2 (No)	91	88.35	103	100

20.39% of the patients said they felt angry when they were diagnosed, 39.81% said they felt sad and 36.89% said they felt afraid. Only 3.88% of them said they felt alone, this will be discussed further in table 4.64. 2.91% said they felt guilty, 38.83% said they felt uninformed about diabetes, and 11.65% said they felt depressed about being diagnosed with diabetes.

When the interviewer asked the patients who said that they were informed about the implications of having diabetes, what exactly diabetes is and how their life is going to change, most of them answered that it meant they have 'sugar', and could not eat sugary foods anymore. Thus, this clearly indicates that they had some idea of what diabetes is.

After explaining to them in uncomplicated terms what the disease implicates, many of them said it had not been explained to them and that they now understood it better.

Table 4.65: Frequency of patients feeling isolated because of diabetes in the study population (Appendix A)

D2	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	3	2.91	3	2.91
2 (No)	100	97.09	103	100

This question is about the patients feeling abandoned by their close friends and relatives when these found out that the specific person had been diagnosed with diabetes. Only 2.91% of all the patients interviewed said that they felt their families and friends pushed them away. This might be because of being uneducated and uniformed about the disease, thus thinking it might be contagious or that this person is terminally ill and will not live long.

Table 4.66: Frequency of patients with physical complaints in the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
D3N1 (Aches)	1 (Yes)	53	51.46	53	51.46
	2 (No)	50	48.57	103	103
D3N2 (Pains)	1 (Yes)	55	53.4	55	53.4
	2 (No)	48	46.6	103	100
D3N3 (Headaches)	1 (Yes)	58	56.31	58	56.31
	2 (No)	45	43.69	103	100
D3N4 (Lingering colds)	1 (Yes)	24	23.3	24	23.3
	2 (No)	79	76.7	103	100

51.46% and 53.4% of the patients interviewed complained of aches and pains respectively, where 56.31% complained about frequent headaches and only 23.3% said they suffered from lingering colds. Most of the aches and pains are of the lower limbs and this may be because of poor blood circulation and swelling of the lower limbs, or even limited activity. People suffering from diabetes normally suffer from colds and flu longer than the average person not living with diabetes, but this was only true in 23.3% of the interviewed patients.

4.6 SECTION E: COMPLIANCE

This section is about patient compliance: what types of diabetic medication the patients use, do they use it regularly and if not, what the reasons may be.

Table 4.67: Frequency of patients in the study population taking medication as prescribed (Appendix A)

E1	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
3 (Most of the time)	3	2.91	3	2.91
4 (Always)	100	97.09	103	100

Almost every patient, 97.09% confirmed that they took the medication as prescribed by the doctor or nurse and, only 2.91% said they took it as prescribed most of the time.

Table 4.68: Frequency of reasons given by the patients in the study population for not taking the prescribed medication (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
E2N1 (Side effects)	1 (Yes)	0	0	0	0
	2 (No)	103	100	103	100
E2N2 (Forgot)	1 (Yes)	26	25.24	26	25.24
	2 (No)	77	74.76	103	100
E2N3 (Felt too ill)	1 (Yes)	1	0.97	1	0.97
	2 (No)	102	99.03	103	100
E2N4 (Not important)	1 (Yes)	1	0.97	1	0.97
	2 (No)	102	99.03	103	100

All of the patients said that side effects of the prescribed medicine were not the reason for them not to take their medication. 25.24% of them said that sometimes they forgot to drink the oral glucose lowering drugs; only one patient said that occasionally he felt too sick to dose himself and one other patient said that sometimes he felt that it was not important to take the medication as prescribed.

Table 4.69: Frequency of patients in the study population whose prescription have been adjusted (Appendix A)

E3N1	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	79	76.7	79	76.7

2 (No)	24	23.3	103	100

76.7% of the patients that were interviewed said that their prescription had been altered in the past. There can be numerous reasons for this. The next table outlines possible reasons.

Table 4.70: Frequency of the main reason for prescription alteration given by patients in the study population (Appendix A)

E3N2	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Symptoms)	3	3.85	3	3.85
2 (Blood glucose)	75	96.15	78	100

3.85% of the patients whose prescription had been previously changed said it was because of adverse effects that they had experienced with a specific type of oral glucose lowering drug. Some of the main adverse effects of these agents are (refer to section 2.9.3):

- Nausea
- Vomiting
- Abdominal distension
- Diarrhoea
- Constipation

96.15% of the patients whose medicine had been altered said it was because of their blood glucose levels that fluctuated and could not be kept under control, thus the dosage was elevated and those who had already been on the highest dose were converted to subcutaneous insulin.

Table 4.71: Frequency of glucose lowering agents used in the study population (Appendix A)

E4	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Insulin)	10	9.71	10	9.71

2 (Tablets)	63	61.17	73	70.87
3 (Combination of tablets and insulin)	60	29.13	103	100

Only 9.71% of the patients are using subcutaneous insulin, 61.17% of them are using oral glucose lowering agents, and 29.13% of the patients are using both insulin and oral medication.

This next section deals with the patients administrating subcutaneous insulin injections.

Table 4.72: Frequency of insulin types used in the study population (Appendix A)

E5	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Actraphane)	39	97.5	39	97.5
3 (Protophane)	1	2.5	40	100

97.5% of the insulin users are using Actraphane®, which is a biphasic insulin preparation. These are ready mixed preparations containing short-acting and intermediate-acting insulin. This may be useful in many patients and are administered subcutaneously once or usually twice daily (refer to section 2.9.4.2).

Protophane® is intermediate-to-long-acting insulin. These are suspensions and are bound to protamine or zinc as retarding agents to prolong their duration of action. They can only be administered subcutaneously. They are usually administered once, or more commonly twice daily, and may be combined with short-acting insulin (refer to section 2.9.4.2).

The other insulin used in Primary healthcare clinics is Actrapid®. None of the patients interviewed were using this type. Actrapid® is fast-acting insulin and may be administered intravenously, intramuscularly or subcutaneously. It is administered subcutaneously for everyday control of diabetes, usually in combination with longer-acting insulin. In diabetic keto-acidosis and during surgery it may be given intravenously (refer to section 2.9.4.2).

It is essential to rotate injection sites because adverse reactions may occur if not. The next table describes the most frequent injection sites used.

Table 4.73: Frequency of injection sites used by group A and C diabetics in the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %

E5N1N1 (Stomach)	1 (Yes)	33	82.5	33	82.5
	2 (No)	7	17.5	40	100
E5N1N2 (Back of upper arms)	1 (Yes)	5	12.5	5	12.5
	2 (No)	35	87.5	40	100
E5N1N3 (Upper buttocks)	1 (Yes)	4	10	4	10
	2 (No)	36	90	40	100
E5N1N4 (Outer sides of thighs)	1 (Yes)	18	45	18	45
	2 (No)	22	55	40	100

There are four main sites where one can inject oneself. The most frequently used is the stomach area, and 82.5% of the patients use this site. The second most common site for injection is the outer sides of the thighs; 45% of patients usually inject themselves there. 12.5% of the patients use the back of their upper arms to administer the injections and only 10% use the upper buttocks. When the injection sites are not rotated, there are several adverse effects that may be presented such as bleeding, pitting, lumping and skin infections. This makes it difficult for the insulin to be readily absorbed because of the hardened connective tissue.

The following table describes the most common side effects occurring in these patients.

Table 4.74: Frequency of injection sites problems reported by the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
E5N2N1 (Bleeding)	1 (Yes)	6	15	6	15
	2 (No)	34	85	40	100
E5N2N2 (Pitting)	1 (Yes)	13	32.5	13	32.5
	2 (No)	27	67.5	40	100
E5N2N3 (Lumping)	1 (Yes)	15	37.5	15	37.5
	2 (No)	25	62.5	40	100
E5N2N4 (Skin infections)	1 (Yes)	1	2.5	1	2.5
	2 (No)	39	97.5	40	100

According to these statistics, the side effects that occurred in the interviewed population are minimal. 15% complained about bleeding at the site of injection, 32.5% and 37.5% respectively said they experienced occasional pitting and lumping. Only one patient said that

he developed a skin infection at the injection site.

The following section deals with the type and dosage of oral glucose lowering agents being used. It is possible that there were patients using both metformin and gliclazide, explaining why the frequencies do not add up.

Table 4.75: Frequency of patients in the study population using metformin (Appendix A)

E6N1N1	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	83	100	83	100

In both clinics studied, eighty-three patients are using metformin which is a biguanide. Metformin is used for the management of type 2 diabetes when dietary management alone has failed. The biguanides are agents of first choice in the management of obese type 2 diabetics because they induce a mild anorexia and so help to control weight gain (refer to section 2.9.3.1). Because of their insulin-sparing properties, they do not increase weight or provoke hypoglycaemia.

Table 4.76: Frequency of metformin dosages administered by the patients in the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
E6N1N2A (500mg three times daily)	1 (Yes)	14	100	14	100
E6N1N2B (850mg twice daily)	1 (Yes)	69	100	69	100

Of the eighty-three patients using Metformin, fourteen of them were on a 500mg every eight hourly dose and sixty-nine were administering 850mg twelve hourly. This is the initial dosage for Metformin. This dosage can be gradually increased if necessary up to 3000mg per day.

Table 4.77: Frequency of patients in the study population administering metformin with meals (Appendix A)

E6N1N3	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	76	91.57	76	91.57
2 (No)	7	8.43	83	100

Metformin should be taken with meals to lower abdominal disturbances such as nausea and diarrhea. The majority of patients, 91.57%, stated that they do take their daily dosage with meals, whilst the other 8.43% said that they take it on an empty stomach. The interviewer advised these patients to start taking their medication with meals.

Table 4.78: Frequency of patients in the study population using gliclazide (Appendix A)

E6N2N1	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	59	100	59	100

There were fifty-nine patients in total who use gliclazide which is classified as sulphonylamides and urea derivates. These drugs may provide good control of blood glucose and have been shown to reduce the micro-vascular complications of diabetes. They are used in management of type 2 diabetes when dietary management alone has failed and, may be used as monotherapy or in combination with metformin or insulin (refer to section 2.9.3.2).

Table 4.79: Frequency of gliclazide dosages administered by the patients in the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
E6N2N2A (40-80mg daily)	1 (Yes)	10	100	10	100
E6N2N2B (160mg daily)	1 (Yes)	28	100	28	100
E6N2N2C (320 mg daily)	1 (Yes)	21	100	21	100

Of the fifty-nine patients using gliclazide, ten are using 40-80mg per day, twenty eight are using 160mg per day and twenty-one are using up to 320mg per day. Initial therapy starts with 80mg daily and can be increased to up to 320mg a day, which is the maximum recommended dosage.

Table 4.80: Frequency of patients in the study population administering gliclazide with meals (Appendix A)

E6N2N3	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	56	94.92	56	94.92
2 (No)	3	5.08	59	100

The majority (94.92%) of the patients using gliclazide confirmed that they took their medication with meals. It is indicated that this drug must be taken with meals to prevent abdominal disturbances such as nausea, vomiting and diarrhoea.

4.7 SECTION F: MONITORING

This section deals with how well the individual patient monitors himself. It describes how many patients own a blood sugar monitor, what each patient's average reading is, the symptoms experienced when one's blood glucose levels are low or high and if there are any concerns about the long-term complications of having diabetes.

Table 4.81: Frequency of patients in the study population owning a blood glucose instrument (Appendix A)

F1N1	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	20	19.42	20	19.42
2 (No)	83	80.58	103	100

One of the single most important pieces of equipment that a diabetic patient needs is an easy to use, well-functioning blood glucose meter. According to the American Diabetic Association a diabetic patient is supposed to measure his blood glucose at least three times a day to ensure optimum control. Only 19.42% of the studied patients said they had their own monitor, thus 80.58% of them do not have access to a glucose monitor when they need it, only when they have an appointment at the clinic.

Table 4.82: Frequency of the study population's frequency of blood glucose measurement (Appendix A)

F2	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (once weekly)	15	14.56	15	14.56
2 (twice weekly)	1	0.97	16	15.53
3 (three times a week)	3	2.91	19	18.45
5 (once daily)	6	5.83	25	24.27
6 (twice daily)	4	3.88	29	28.16
9 (once monthly)	74	71.84	103	100

Table 4.81 describes how many times a day, week or month these patients' blood glucose is measured. 5.83% of the studied patients said that they measured their blood sugar once a day and 3.88% said they measured it twice daily. 14.56% of the studied population said their blood sugar was measured once a week, 0.97% said that it was measured twice a week and 2.91% said it was measured three times a week. The remaining 71.84% said that their blood sugar was only measured once a month when they had their appointment at the clinic.

The next section describes the correlation between the different patients of normal weight in the study population, the different diabetic groups and the frequency of blood glucose level measurement.

Table 4.83: Correlation between the frequency of normal weight patients in the study and the frequency of blood glucose measurement (Appendix D)

	1 (Once Weekly)	5 (Once daily)	6 (Twice daily)	9 (Once monthly)	Total
Group A (Insulin)	1	0	0	0	1
Row %	100	0	0	0	100
Group B (Oral hypoglycaemic tablets)	2	1	1	6	10
Row %	20	10	10	60	100
Group C (Oral hypoglycaemic tablets and insulin	2	0	0	8	10
Row %	20	0	0	80	100
Total	5	1	1	14	21

There was only one patient of normal weight who was classified as a Group A diabetic. This patient said he measured his blood glucose levels once a week. There were ten normal weight patients who were classified as Group B diabetics, two of whom said they measured their blood glucose levels once a week. One patient of normal weight claimed to measure it once a day, another patient said he measured it twice a day, and the remaining six patients of normal weight said it was only measured once a month at the clinic. There were ten patients in the study population who were of normal weight who were classified as group C

diabetics. Two of these patients said they measured their blood glucose levels once a week and the remaining eight said it was only measured when they attended the clinic for their monthly visit.

Table 4.84: Statistical parameters for the correlation between the frequency of normal weight patients in the study and the frequency of blood glucose measurement (Appendix D)

Statistic	DF	Value	Prob
Chi-square	6	5.76	0.45
Likelihood Ratio Chi-square	6	6.1	0.41
Mantel-Haenszel Chi-square	1	1.72	0.19
Phi coefficient		**0.52**	
Contingency coefficient		0.46	
Cramer's V		0.37	

According to the statistics for the correlation between the frequency of the total normal weight patients in the study population and the frequency of blood glucose measurement, the *Phi* coefficient of 0.52 means that it has a practically significant effect. Thus, this shows that Group A patients measure their blood glucose every week, where group B and C patients mostly measure once a month. The next section describes the correlation between the different patients who are overweight in the study population, the different diabetic groups and the frequency of blood glucose level measurement.

Table 4.85: Correlation between the frequency of overweight patients in the study and the frequency of blood glucose measurement (Appendix D)

	1 (Once weekly)	3 (Three times a week)	5 (Once daily)	6 (Twice daily)	9 (once monthly)	Total
Group A (Insulin)	1	1	1	0	0	3
Row %	33.33	33.33	33.33	0	0	100
Group B (Oral hypoglycaemic drugs)	2	0	1	0	23	26
Row %	7.69	0	3.85	0	88.46	100
Group C (Oral hypoglycaemic drugs and insulin)	1	0	1	2	8	12
Row %	8.33	0	8.33	16.67	66.67	100
Total	4	1	3	2	31	41

There were forty-one overweight patients in the study population. One of the overweight patients in group A said they measured their blood glucose levels once a week, another one said they measured it three times a week and the other one of the overweight patients in

group A said they measured their blood glucose levels once a day.

There were twenty-six overweight patients that fell into group B. 7.69% of these patients said they measured their blood glucose levels once a week and only 3.85% of them said they measured it once a day. A staggering 88.46% of the overweight patients in group B said their blood glucose levels were measured once a month only, when they attended the clinic for their monthly visit.

Of the twelve overweight patients that were classified into group C, 8.33% said they measured their blood glucose levels once a week and another 8.33% said they measured it once a day. Only 16.67% admitted to measuring their blood glucose levels twice daily and 66.67% said it was only measured once a month during their monthly clinic visit.

Table 4.86: Statistical parameters for the correlation between the frequency of overweight patients in the study and the frequency of blood glucose measurement (Appendix D)

Statistic	DF	Value	Prob
Chi-square	8	25.53	0.001
Likelihood Ratio Chi-square	8	18.55	0.02
Mantel-Haenszel Chi-square	1	1.65	0.2
Phi coefficient		**0.79**	
Contingency coefficient		0.62	
Cramer's V		0.56	

According to the statistics for the correlation between the frequency of overweight patients in the study and the frequency of blood glucose measurement the *Phi* coefficient of 0.79 has a practically significant meaning. Thus, group A patients measure their blood glucose more frequently than Group B and C patients.

Table 4.87: Correlation between the frequency of obese patients in the study and the frequency of blood glucose measurement (Appendix D)

	1 (Once weekly)	2 (Twice weekly)	3 (Three times a week)	5 (once daily)	6 (Twice daily)	9 (Once monthly)	Total
Group B (Oral hypoglycaemic drugs)	3	1	0	2	1	21	28
Row %	10.71	3.57	0	7.14	3.57	75	100
Group C (Oral hypoglycaemic drugs and insulin)	3	0	2	0	0	8	13
Row %	23.08	0	15.38	0	0	61.54	100
Total	6	1	2	2	1	29	41

There were forty-one obese patients in the study population. Twenty-eight of these patients were classified as group B patients. 10.71% of them said they measured their blood glucose levels once a week, 3.57% said they measured them twice a week, 7.14% said they measured them once a day, and 3.57% said they measured them twice a day. An overwhelming 75% of these obese patients in group B said they measured their blood glucose levels only once a month when the attended their appointments at the clinics.

Thirteen obese patients were classified as group C diabetics, and 23.08% of them said they measured their blood glucose levels once a week, 15.38% said they measure them three times a week and 61.54% of them said they measured their levels once a month.

Table 4.88: Statistical parameters for the correlation between the frequency of obese patients in the study and the frequency of blood glucose measurement (Appendix D)

Statistic	DF	Value	Prob
Chi-square	5	7.32	0.2
Likelihood Ratio Chi-square	5	8.74	0.12
Mantel-Haenszel Chi-square	1	1.44	0.23
Phi coefficient		**0.42**	
Contingency coefficient		0.39	
Cramer's V		0.42	

According to the statistics for the correlation between the frequency of obese patients in the study population and the frequency of blood glucose measurement the *Phi* coefficient of 0.42 has a substantial effect. Thus, group C patients measure their blood glucose levels more

frequently than group B patients.

Table 4.89: Frequency of the patients' average blood glucose readings in the study population (Appendix A)

F3	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
2 (3-5 mmol/L)	15	14.56	15	14.56
3 (6-9 mmol/L)	55	53.4	70	67.96
4 (>10mmol/L)	33	32.04	103	100

Every patient in the clinics has a book where all relevant information is stated; including what medications are taken, blood glucose readings and when the next appointment will be. Thus, the average readings were calculated over the past year as stated in these patients' books. 14.56% of the patients' average blood glucose was between 3 and 5 mmol/L, 53.4% had an average reading of 6-9 mmol/L and 32.04% had an above normal reading of more than 10mmol/L. This means that in an estimated 53% of the patients interviewed, their diabetes is controlled, and in the rest, an alarming 47%, their diabetes is not under control.

Table 4.90: Correlation between the frequency of normal weight patients in the study and their average blood glucose levels (Appendix D)

	2 (3-5 mmol/L)	3 (6-9 mmol/L)	4 (≥ 10 mmol/L)	Total
Group A (Insulin)	0	1	0	1
Row %	0	100	0	100
Group B (Oral hypoglycaemic drugs)	2	5	3	10
Row %	20	50	30	100
Group C (Oral hypoglycaemic drugs and insulin)	4	3	3	10
Row %	40	30	30	100
Total	6	9	6	21

Of the Group A patients, only one patient was of normal weight and this patient's average blood glucose was between 6-9 mmol/L. There were two normal weight patients in group B who said their average blood glucose readings were between 3-5 mmol/L, five patients said that their average readings were between 6- 9 mmol/L and the remaining three patients in group B claimed their average blood glucose levels were 10 mmol/L or more. In group C four normal weight patients said their average blood glucose levels were between 3-5 mmol/L, three patients said their average reading were between 6-9 mmol/L and the remaining three

patients in group C said their average blood glucose levels were 10 mmol/L and more.

Table 4.91: Statistical parameters for the correlation between the frequency of normal weight patients in the study and their average blood glucose levels (Appendix D)

Statistic	DF	Value	Prob
Chi-square	4	2.57	0.63
Likelihood Ratio Chi-square	4	2.95	0.57
Mantel-Haenszel Chi-square	1	0.23	0.63
Phi coefficient		**0.35**	
Contingency coefficient		0.33	
Cramer's V		0.25	

According to the statistics of the correlation between the frequency of normal weight patients in the study and their average blood glucose levels, the *Phi* coefficient of 0.35 means that it has a substantial effect. Thus, the blood glucose levels of the majority of the normal weight patients who use both oral hypoglycaemic lowering drugs and insulin are lower than those using only insulin or hypoglycaemic drugs.

Table 4.92: Correlation between the frequency of overweight patients in the study and their average blood glucose levels (Appendix D)

	2 (3-5mmol/L)	3 (6-9mmol/L)	4 (≥10mmol/l)	Total
Group A (Insulin)	0	3	0	3
Row %	0	100	0	100
Group B(Oral hypoglycaemic drugs)	2	17	7	26
Row %	7.69	65.38	26.92	100
Group C (Oral hypoglycaemic drugs and insulin)	0	6	6	12
Row %	0	50	50	100
Total	2	26	13	41

All three of the overweight patients that were classified as group A said their average blood glucose was between 6-9 mmol/L. 7.69% of the overweight patients who fell into group B said their average blood glucose levels were between 3-5 mmol/L, 65.38% of them said their average readings were between 6-9 mmol/L and the remaining 26.92% of the overweight patients in group B said their average blood glucose readings were 10 mmol/L or more. The twelve patients who were overweight and classified as group C patients, half (50%) said their average readings were between 6-9 mmol/L and the other 50% of these patients said their

average readings were 10 mmol/L or more.

Table 4.93: Statistical parameters for the correlation between the frequency of overweight patients in the study and their average blood glucose levels (Appendix D)

Statistic	DF	Value	Prob
Chi-square	4	4.55	0.34
Likelihood Ratio Chi-square	4	5.92	0.21
Mantel-Haenszel Chi-square	1	3.28	0.07
Phi coefficient		**0.33**	
Contingency coefficient		0.32	
Cramer's V		0.24	

According to the statistics for the correlation between the frequency of overweight patients in the study and their average blood glucose levels the *Phi* coefficient of 0.33 means that it has a substantial effect. This may indicate that the average blood glucose levels of the overweight patients in this study population are lower.

Table 4.94: Correlation between the frequency of obese patients in the study and their average blood glucose levels (Appendix D)

	2 (3-5 mmol/L)	3 (6-9 mmol/l)	4 (≥ 10 mmol/l)	Total
Group B (Oral hypoglycaemic drugs)	6	12	10	28
Row %	21.43	42.86	35.71	100
Group C (Oral hypoglycaemic drugs and insulin)	1	8	4	13
Row %	7.69	61.54	30.77	100
Total	7	20	14	41

21.43% of the twenty-eight obese patients classified as group B said their average blood glucose levels were between 3-5 mmol/L, 42.86% of them were controlled with blood glucose levels being between 6-9 mmol/L and 35.71% of them were 10 mmol/L or more. Only 7.69% of the obese patients in group C said their blood glucose levels were between 3-5 mmol/L, 61.54% of these patients blood glucose levels ranged between 6-9 mmol/L and 30.77% of them were 10 mmol/L or more.

Table 4.95: Statistical parameters for the correlation between the frequency of obese patients in the study and their average blood glucose levels (Appendix D)

Statistic	DF	Value	Prob
Chi-square	2	1.68	0.43
Likelihood Ratio Chi-square	2	1.81	0.41
Mantel-Haenszel Chi-square	1	0.14	0.71
Phi coefficient		**0.20**	
Contingency coefficient		0.2	
Cramer's V		0.2	

According to the statistics for the correlation between the frequency of obese patients in the study and their average blood glucose levels the *Phi* coefficient of 0.2 has an almost substantial meaning. This shows that the blood glucose levels of overweight patients in this study population, who use only oral hypoglycaemic drugs, are lower.

The following section deals with low and high blood glucose levels. Because the majority of these patients do not have their own blood sugar monitors, they could not exactly say how often their blood sugar plunged beneath 3 mmol/L and rose above 10 mmol/ L. Thus, they were asked how often they felt the symptoms generally associated with high and low blood sugar. According to this it was assumed that it was when the glucose levels plunged beneath or rose above the normal range.

Table 4.96: Frequency of patients in the study population experiencing low blood glucose levels (≤ 3 mmol/L) (Appendix A)

F4	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Never)	74	71.84	74	71.84
2 (Once per month)	22	21.36	96	93.2
3 (Once in two weeks)	5	4.85	101	98.06
4 (Once a week or more)	2	1.94	103	100

Of all the patients interviewed, 71.84% of them said they never felt the symptoms associated with low blood glucose, 21.36% said they felt them once a month, 4.85% said they felt them once in two weeks and only 1.94% said they felt the symptoms once a week or more. The following table describes the symptoms that these people feel when their blood glucose levels are low.

Table 4.97: Correlation between frequency of normal weight patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L) (Appendix D)

	1 (Never)	2 (Once monthly)	3 (Once in 2 weeks)	4 (Once weekly)	Total
Group A (Insulin)	0	1	0	0	1
Row %	0	100	0	0	100
Group B (Oral hypoglycaemic drugs)	7	1	1	1	10
Row %	70	10	10	10	100
Group C (Oral hypoglycaemic drugs and insulin)	6	4	0	0	10
Row %	60	40	0	0	100
Total	13	6	1	1	21

The only normal weight patient in group A said that he experienced low blood glucose levels (3 mmol/L or less) only once a month. Seven of the normal weight patients in group B said that they never experienced low blood glucose levels, one said that he experienced it once a month, the other patient said once in two weeks and the last normal weight patient of group B said he experienced low blood glucose levels once a week. Six of the ten normal weight patients that fell into group C said they never experienced low blood glucose levels while the remaining four patients in this group said they experienced it once a month.

Table 4.98: Statistical parameters for the correlation between frequency of normal weight patients in the study population and patients experiencing low blood glucose levels (≤ 3mmol/L) (Appendix D)

Statistic	DF	Value	Prob
Chi-square	6	6.38	0.38
Likelihood Ratio Chi-square	6	7.41	0.29
Mantel-Haenszel Chi-square	1	0.62	0.43
Phi coefficient		**0.55**	
Contingency coefficient		0.48	
Cramer's V		0.39	

According to the statistics for the correlation between the frequency of the normal weight patients in the study population and the patients experiencing blood glucose levels of 3 mmol/L or less the *Phi* coefficient of 0.55 means that it has a significant effect. Thus, the majority of the normal weight patients in the study population who use hypoglycaemic drugs are less likely to experience low blood glucose levels.

Table 4.99: Correlation between frequency of overweight patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L) (Appendix D)

	1 (Never)	2 (Once monthly)	3 (once in 2 weeks)	Total
Group A (Insulin)	1	1	1	3
Row %	33.33	33.33	33.33	100
Group B (Oral hypoglycaemic drugs)	21	4	1	26
Row %	80.77	15.38	3.85	100
Group C (Oral hypoglycaemic drugs and insulin)	7	5	0	12
Row %	58.33	41.67	0	100
Total	29	10	2	41

33.33% of the overweight patients that were classified as group A said they never experienced blood glucose levels lower than 3 mmol/L, another 33.33% said that they did experience it once a month and the remaining 33.33% said they experienced it once in two weeks.

80.77% of the overweight patients that fell into group B said they had never experienced low blood glucose levels, 15.38% said they experienced low blood glucose levels once a month and only 3.85% of these patients said they experienced it once in two weeks.

Of the overweight patients who were classified as group C patients, 58.33% of patients said that they had never experienced blood glucose levels of 3 mmol/L or less and the remaining 41.67% said they experienced it once a month.

Table 4.100: Statistical parameters for the correlation between frequency of overweight patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L) (Appendix D)

Statistic	DF	Value	Prob
Chi-square	4	9.28	0.06
Likelihood Ratio Chi-square	4	7.03	0.13
Mantel-Haenszel Chi-square	1	0.27	0.61
Phi coefficient		**0.48**	
Contingency coefficient		0.43	
Cramer's V		0.34	

According to the statistics for the correlation between the frequency of overweight patients in the study population and patients experiencing low blood glucose levels (≤ 3mmol/L) the *Phi*

coefficient of 0.48 means that it almost has a practically significant effect. Thus blood glucose levels of the majority of the overweight patients in this study population who use oral hypoglycaemic drugs never dropped beneath 3 mmol/L.

Table 4.101: Correlation between frequency of obese patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L) (Appendix D)

	1 (Never)	2 (Once monthly)	3 (Once in 2 weeks)	4 (Once weekly)	Total
Group B (Oral hypoglycaemic drugs)	24	4	0	0	28
Row %	85.71	14.29	0	0	100
Group C (Oral hypoglycaemic drugs and insulin)	8	2	2	1	13
Row %	61.54	15.38	15.38	7.69	100
Total	32	6	2	1	41

The majority (85.71%) of the obese patients in group C said their blood glucose levels never plunged beneath 3 mmol/L and 14.29% of these patients said their levels sank below 3 mmol/L only once a month. 61.54% of the obese patients that fell into group C said they never experienced low blood glucose levels, 15.38% said they experienced it once a month and a further 15.38% said they experienced it once in two weeks. Only 7.69% of these obese patients in group C said that they experienced low blood glucose levels once a week.

Table 4.102: Statistical parameters for the correlation between frequency of obese patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L) (Appendix D)

Statistic	DF	Value	Prob
Chi-square	3	7.13	0.07
Likelihood Ratio Chi-square	3	7.59	0.06
Mantel-Haenszel Chi-square	1	5.68	0.02
Phi coefficient		**0.42**	
Contingency coefficient		0.39	
Cramer's V		0.42	

According to the statistics of the correlation between the frequency of obese patients in the study population and patients experiencing low blood glucose levels of 3 mmol/L or less, the *Phi* coefficient of 0.42 almost has practically significant effect. This shows that the blood glucose levels of the majority of the obese patients in this study population, who use oral

hypoglycaemic drugs, never dropped beneath 3 mmol/L.

Table 4.103: Frequency of patients in the study population experiencing symptoms associated with low blood glucose levels (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F5N1 (Trembling)	1 (Yes)	75	72.82	75	72.82
	2 (No)	28	27.18	103	100
F5N2 (Clamminess)	1 (Yes)	7	6.8	7	6.8
	2 (No)	96	93.2	103	100
F5N3 (Palpitations)	1 (Yes)	31	30.1	31	30.1
	2 (No)	72	69.9	103	100
F5N4 (Anxiety)	1 (Yes)	6	5.83	6	5.83
	2 (No)	97	94.17	103	100
F5N5 (Sweating)	1 (Yes)	35	33.98	35	33.98
	2 (No)	68	66.02	103	100
F5N6 (Hunger)	1 (Yes)	43	41.75	43	41.75
	2 (No)	60	58.25	103	100

The majority (72.82%) of the patients said that trembling was one of the first warning signs they felt when blood sugar was low. 6.8% said that their hands felt clammy, 30.10% claimed they got heart palpitations and 5.83% said they felt anxious when blood glucose levels dropped. 33.98% of the patients claimed to feel sweaty and 41.75% said that they felt hungry when their glucose levels plunged.

Table 4.104: Frequency of patients in the study population experiencing elevated blood glucose levels (≥ 10 mmol/L) (Appendix A)

F6	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Never)	29	28.16	29	28.16
2 (Once a month)	22	21.36	51	49.51
3 (Once in two weeks)	25	24.27	76	73.79
4 (Once a week or more)	27	26.21	103	100

As previously stated these values are assumed according to the known symptoms of high blood glucose, because of patients not owning blood glucose meters. 28.16% of the patients interviewed claimed that their blood glucose levels never rose above the normal range as far as they knew, 21.36% said that it rose once a month, 24.27% stated that it rose once in two

weeks and 23.21% said that it rose at least once a week.

Table 4.105: Correlation between normal weight patients in the study population and patients experiencing elevated blood glucose levels (≥ 10mmol/L) (Appendix D)

	1 (Never)	2 (Once monthly)	3 (Once in 2 weeks)	4 (Once weekly)	Total
Group A (Insulin)	0	1	0	0	1
Row %	0	100	0	0	100
Group B (Oral hypoglycemic drugs)	4	1	1	4	10
Row %	40	10	10	40	100
Group C (Oral hypoglycemic drugs and insulin)	2	3	4	1	10
Row %	20	30	40	10	100
Total	6	5	5	5	21

The one normal weight patient in group A said he experienced elevated blood glucose levels (≥ 10 mmol/L) once a month. Four normal weight patients in Group B said they had never experienced elevated blood glucose levels, one patient admitted to experiencing elevated levels once a month, one other patient said he experienced it once in two weeks and the remaining four patients in group B said they experienced it once a week. Of the ten normal weight patients in group C two said that they had never experienced elevated blood glucose levels, three patients said they experienced it once a month, four said they experienced it once in two weeks and only one patient admitted to experiencing elevated blood glucose levels once a week.

Table 4.106: Statistical parameters for the correlation between normal weight patients in the study population and patients experiencing elevated blood glucose levels (≥ 10mmol/L) (Appendix D)

Statistic	DF	Value	Prob
Chi-square	6	8.68	0.2
Likelihood Ratio Chi-square	6	8.62	0.2
Mantel-Haenszel Chi-square	1	0.01	0.96
Phi coefficient		**0.64**	
Contingency coefficient		0.54	
Cramer's V		0.46	

According to the statistics for the correlation between the normal weight patients in the study

population and the patients experiencing blood glucose levels of 10 mmol/L or more, the *Phi* coefficient of 0.64 means that it has a significant effect. Thus, elevated blood glucose levels of more than 10 mmol/ occur more in the normal weight patients in this study, who use oral hypoglycaemic drugs.

Table 4.107: Correlation between overweight patients in the study population and patients experiencing elevated blood glucose levels (≥ 10mmol/L) (Appendix D)

	1 (Never)	2 (once monthly)	3 (once in 2 weeks)	4 (Once weekly)	Total
Group A (Insulin)	0	0	2	1	3
Row %	0	0	66.67	33.33	100
Group B (Oral hypoglycaemic drugs)	5	5	9	7	26
Row %	19.23	19.23	34.62	26.92	100
Group C (Oral hypoglycaemic drugs and insulin)	3	5	2	2	12
Row %	25.00	41.67	16.67	16.67	100
Total	8	10	13	10	41

There were only three overweight patients in this study population who were classified as group A patients. Of these, 66.67% said they experienced elevated blood glucose levels once in two weeks and the remaining 33.33% said they experienced it once a week.

There were twenty-six overweight patients who were classified as group B. Of these patients, 19.23% said they never experienced elevated blood glucose levels, and another 19.23% said they experienced it once a month. 34.62% of these patients in group B said they experienced it once in two weeks and 26.92% said that they experienced elevated blood glucose levels once a week.

Of the overweight patients who were classified as group C, 25% said they had never experienced elevated blood glucose levels. 41.67% of these patients said they experienced it once a month, 16.67% said that they experienced it once in two weeks and the remaining 16.67% said they experienced elevated blood glucose levels once a week.

Table 4.108: Statistical parameters for the correlation between overweight patients in the study population and patients experiencing elevated blood glucose levels (≥ 10mmol/L) (Appendix D)

Statistic	DF	Value	Prob
Chi-square	6	5.8	0.45
Likelihood Ratio Chi-square	6	6.8	0.34
Mantel-Haenszel Chi-square	1	2.83	0.09
Phi coefficient		**0.38**	
Contingency coefficient		0.35	
Cramer's V		0.27	

According to the statistics for the correlation between overweight patients in the study population and the patients who experienced elevated blood glucose levels the *Phi* coefficient of 0.38 has a substantial effect. This shows that the majority of overweight patients in this study who use oral hypoglycaemic drugs, experience elevated blood glucose levels more often.

Table 4.109: Correlation between obese patients in the study population and patients experiencing elevated blood glucose levels (≥ 10mmol/L) (Appendix D)

	1 (Never)	2 (Once monthly)	3 (Once in 2 weeks)	4 (once weekly)	Total
Group B (Oral hypoglycaemic drugs)	11	4	4	9	28
Row %	39.29	14.29	14.29	32.14	100
Group C (Oral hypoglycaemic drugs and insulin)	4	3	3	3	13
Row %	30.77	23.08	23.08	23.08	100
Total	15	7	7	12	41

Of the obese patients in group B, 39.29% said they never experienced blood glucose levels of 10 mmol/L or more, 14.29% said they experienced it once a month and another 14.29% said they experienced it once in two weeks. 32.14% of these obese patients in group B said they experienced elevated blood glucose levels once a week. 30.77% of the obese group C patients said they never experienced elevated blood glucose levels, 23.08% said they experienced it once a month, another 23.08% said they experienced it once in two weeks and the remaining 23.08% of the obese patients in group C said they experienced blood glucose levels of 10 mmol/L or more once a week.

Table 4.110: Correlation between obese patients in the study population and patients experiencing elevated blood glucose levels (≥ 10mmol/L) (Appendix D)

Statistic	DF	Value	Prob
Chi-square	3	1.23	0.75
Likelihood Ratio Chi-square	3	1.21	0.75
Mantel-Haenszel Chi-square	1	0.0004	0.98
Phi coefficient		**0.17**	
Contingency coefficient		0.17	
Cramer's V		0.17	

According to the statistics of the correlation between obese patients in the study population and the patients experiencing elevated blood glucose levels the *Phi* coefficient of 0.17 has a non-substantial effect. This shows that overweight patients in this study population who use oral hypoglycaemic drugs and the combination of insulin and oral hypoglycaemic drugs, experience more or less the same frequency of elevated blood glucose levels.

Table 4.111: Frequency of patients in the study population experiencing symptoms associated with elevated glucose levels (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F7N1 (Fatigue)	1 (Yes)	68	66.02	68	66.02
	2 (No)	35	33.98	103	100
F7N2 (Hunger)	1 (Yes)	19	18.45	19	18.45
	2 (No)	84	81.55	103	100
F7N3 (Thirst)	1 (Yes)	67	65.05	67	65.05
	2 (No)	36	34.95	103	100
F7N4 (Increased urination)	1 (Yes)	26	25.24	26	25.24
	2 (No)	77	74.76	103	100
F7N5 (Change in vision)	1 (Yes)	68	66.02	68	66.02
	2 (No)	35	33.98	103	100
F7N6 (Decreased concentration)	1 (Yes)	20	19.42	20	19.42
	2 (No)	83	80.58	103	100

Of all the patients interviewed, 66.02% of them stated that they experienced fatigue when glucose levels were high, 65.05% said they felt thirsty and 66.02% said their vision changed. These three symptoms are the main warning signs of elevated blood glucose levels (refer to section 2.5.2). The other symptoms included feeling hungry (18.45%), 25.24% said they experienced increase in urination and 19.42% said their concentration decreased.

The next section deals with the associated diseases that occur with diabetes.

Table 4.112: Frequency and percentage of patients in the study population that previously went into a diabetic coma and insulin shock (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F8N1 (Diabetic coma)	1 (Yes)	7	6.8	7	6.8
	2 (No)	96	93.2	103	100
F8N2 (Insulin shock)	1 (Yes)	11	10.78	11	10.78
	2 (No)	91	89.22	102	100

Very few of these patients had been in a diabetic coma and insulin shock in the past. 6.8% said they had been in a coma and 10.78% said they had had insulin shock.

Table 4.113: Frequency of patients in the study population experiencing recurrent diseases (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F8N3N1 (Tonsillitis)	1 (Yes)	21	20.39	21	20.39
	2 (No)	82	79.61	103	100
F8N3N2 (Boils)	1 (Yes)	13	12.62	13	12.62
	2 (No)	90	87.38	103	100
F8N3N3 (Abscessed teeth)	1 (Yes)	27	26.21	27	26.21
	2 (No)	76	73.79	103	100
F8N3N4 (Bladder infection)	1 (Yes)	48	46.6	48	46.6
	2 (No)	55	53.4	103	100
F8N3N5 (Kidney infection)	1 (Yes)	26	25.24	26	25.24
	2 (no)	77	74.76	103	100

People with diabetes may suffer from frequent infections. The most frequent of these in the study population was bladder infection from which 46.6% of the patients suffered. 20.39% said they regularly suffer from tonsillitis, only 12.62% suffered from boils, 26.21% complained about tooth abscesses and 25.24% said they suffered from kidney infections.

Table 4.114: Frequency of patients in the study population who suffered from vision disturbances (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F8N4N1 (Blurred vision)	1 (Yes)	85	82.52	85	82.52
	2 (No)	18	17.48	103	100
F8N4N2 (Double vision)	1 (Yes)	31	30.1	31	30.1
	2 (No)	72	69.9	103	100
F8N4N3 (Visual halo)	1 (Yes)	1	0.97	1	0.97
	2 (No)	102	99.03	103	100
F8N4N4 (Floaters)	1 (Yes)	41	39.81	41	39.81
	2 (No)	62	60.19	103	100

A change in vision is a sure symptom of high blood glucose (refer to section 2.6.2), and as previously mentioned, 66.02% of the study population suffered from this when their glucose levels were elevated. The most common vision disorder was blurred vision, with 82.52% of the patients suffering from it. Then one gets floaters, which are tiny black or silver dots floating in one's eyesight: 39.81% complained of this disorder. Double vision was also a frequent manifestation and 30.1% of patients said it occurred regularly. Visual halos were the least common, where a light ring is seen around objects or lights. Only 0.97% of the patients complained about this disturbance.

Table 4.115: Frequency of patients in the study population with possible heart problems (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F8N5N1 (Angina)	1 (Yes)	9	8.74	9	8.74
	2 (No)	94	91.26	103	100
F8N5N2 (Ischemic heart disease)	1 (Yes)	8	7.77	8	7.77
	2 (No)	95	92.23	103	100
F8N5N3 (Heart failure)	1 (Yes)	1	0.97	1	0.97
	2 (No)	102	99.03	103	100

Individuals with *diabetes mellitus* are at increased risk for cardiovascular morbidity and mortality compared to the general population. Cardiovascular risk appears to be

associated with both the level of hyperglycaemia and the duration of diabetes (refer to section 2.8.4).

Both angina and heart failure are precursors for ischemic heart disease or stroke (refer to section 2.8.4.2). Heart diseases do not appear to be of relevant significance in this specific population, but these data were obtained from the patients themselves. It is possible that the data may thus not be accurate. According to the questionnaire only 8.74% suffered from angina, 7.77% suffered from ischemic heart disease and only one patient had heart failure.

Late clinical manifestations of *diabetes mellitus* include a number of pathological changes that involve small and large blood vessels, cranial and peripheral nerves, the skin, and the lens of the eye. These lesions lead to hypertension, renal failure, blindness, autonomic and peripheral neuropathy, amputations of the lower extremities, myocardial infarction and cerebrovascular incidents (refer to section 2.8).

As previously stated the majority of patients in the study were uninformed about what the implications of having diabetes are. They did not know how to handle it; they did not know that lifestyle plays a major role in the treatment and most of all they did not know about the long-term complications. Thus, because they did not know, they were not concerned. This can clearly be observed in the results. This is described in the next table:

Table 4.116: Frequency of patients in the study population with possible diabetic complications (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
F9N1 (Nephropathy)	1 (Yes)	8	7.77	8	7.77
	2 (No)	95	92.23	103	100
F9N2 (Neuropathy)	1 (Yes)	14	13.59	14	13.59
	2 (No)	89	66.41	103	100
F9N3 (Retinopathy)	1 (Yes)	34	33.01	34	33.01
	2 (No)	69	66.99	103	100
F9N4 (Heart disease)	1 (Yes)	5	4.85	5	4.85
	2 (No)	98	95.15	103	100

The biggest concern of these patients was the possibility of their developing retinopathy, because the symptoms experienced were sudden and clear. Even so, a mere 33.01% of the studied patients were concerned about it. Only 13.59% of them were concerned about neuropathy, because many of them suffered from cold hands and feet, pins-and-needles and swelling of the lower limbs. These symptoms are a sign of poor blood circulation, all

contributing to neuropathy. 7.77% of the patients were concerned about nephropathy and only 4.85% were concerned about possible heart diseases.

4.8 SECTION G: CONSULTATION

This section is about how often the patients visit the clinics, what the reasons are for the visits and whether they have been hospitalised before.

Table 4.117: Frequency of patients in the study population who attended doctor consultations in the past twelve months (Appendix A)

G1	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (1-2 times)	7	6.8	7	6.8
2 (3-5 times)	13	12.62	20	19.42
3 (6-8 times)	83	80.58	103	100

The majority of patients had appointments once a month at these clinics. The study was done in August and September, the eighth and ninth months of the year. 80.58% of the studied patients said they had consultations once a month, 12.62% said they consulted a doctor three to five times in the year and 6.8% said they had been to a doctor once or twice in the year.

Table 4.118: Frequency of given reasons for the consultations by the patients in the study population (Appendix A)

NUMBER	ANSWER	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
G2N1 (Check-up)	1 (Yes)	103	100	103	100
G2N2 (Repeat prescription)	1 (No)	80	77.67	80	77.67
	2 (No)	23	22.33	103	100
G2N3 (Changing medication)	1 (Yes)	13	12.62	13	12.62
	2 (No)	90	87.38	103	100
G2N4 (Infections)	1 (Yes)	5	4.85	5	4.85
	2 (No)	98	95.15	103	100
G2N5 (Not feeling well)	1 (Yes)	19	18.45	19	18.45
	2 (No)	84	81.55	103	100
G2N6 (High glucose)	1 (Yes)	2	1.94	2	1.94
	2 (No)	101	98.06	103	100
G2N7 (Low glucose)	2 (No)	103	100	103	100
G2N8 (Complications)	1 (Yes)	2	1.94	2	1.94
	2 (No)	101	98.06	103	100

According to the results the main reasons for these patients' clinic visits were for diabetes control and routine check-ups, and to repeat their prescriptions. All of the patients confirmed that they visited the clinic for check-ups and 77.67% said they came to repeat their medication. Only 4.85% said it was because of infections and 18.45% said it was because they were feeling ill. A mere 1.94% said they came because of their blood glucose levels being high and because of complications, and none of them said they came because of low blood glucose.

Table 4.119: Frequency of patients in the study population being previously hospitalised for diabetes (Appendix A)

G3	FREQUENCY	PERCENT %	CUMULATIVE FREQUENCY	CUMULATIVE PERCENT %
1 (Yes)	49	47.57	49	47.57
2 (No)	54	52.43	103	100

An estimated 50% of all the patients interviewed said they had been previously hospitalised for diabetes, but most of them said it was only at the beginning, when diabetes had just been diagnosed.

4.9 SUMMARY

This section presents the results of the study. From these, certain conclusions can be drawn, recommendations made and restrictions can be deduced. This will be concluded in Chapter 5.

Chapter 5

Conclusions, recommendations and restrictions

5.1 INTRODUCTION

The conclusion and specific restrictions in this study will be discussed in this chapter, as well as certain recommendations.

5.2 CONCLUSIONS

The aim of this study was to evaluate diabetic patients on primary health care level and to determine how they manage their disease.

In this particular study population, the majority of patients were classified as type 2 diabetics. This can be viewed in table 4.8 where 62.14% of the total study population was classified as group B, which means that these patients use oral glucose lowering drugs to control their disease. A further 33.98% of the population was classified as group C diabetics, which means that these patients need oral glucose lowering drugs as well as exogenous insulin to maintain a healthy life. The latter group obviously consists of patients whose diabetic status was not under control in the past, thus the need for the insulin. This clearly shows that these patients have not been informed about how they can manage the disease by dietary modification and lifestyle interventions.

The ***first specific objectives*** were to determine how age, lifestyle, socio-economic and education influence diabetic management. The ages of the patients were not specified, but it is safe to conclude that the majority of them were above twenty years of age, because only 3.88% of the study population was classified as group A patients, meaning type 1 diabetes, which can be viewed in table 4.8.

Lifestyle, socio-economic and education played a major role in the development of this disease in these patients. The weight status of the study population was determined and can be viewed in table 4.15. Only 20.39% of them were of normal weight with a body mass index (BMI) ranging between 18.5 – 24.9 kg/m^2. 39.81% of them were overweight with their BMI ranging between 25 – 29.9 kg/m^2 and the remaining 39.81% of the study population were classified as obese with their BMI's above 30 kg/m^2. The majority (an estimated 80%) of the study population were above optimal weight. This may cause the development of chronic complications, such as retinopathy, neuropathy and nephropathy.

Being physically inactive may contribute to the development of insulin resistance (refer to

section 2.9.2.2). This might cause group B patients to eventually need exogenous insulin, such as happened to the group C patients. This may contribute to the development of chronic complications, especially nephropathy and neuropathy leading to amputation of the lower limbs. Only 29.13% of the total study population admitted to doing some kind of exercise, this may be viewed in table 4.17.

These patients think of exercise as an activity which involves physical effort. This is to a certain extent true, because any activity that increases one's heart rate, counts as being active. According to the American Diabetes Association it is best to aim for a total of 30 minutes a day, at least five days a week. It must be taken into account that the majority of these patients are unemployed, thus cannot afford a gym membership. The interviewer informed the patients that there are alternative ways to increase physical activity such as climbing the stairs instead of using the elevator, doing regular chores in and around the house and walking from one place to another. When the patients were asked about walking, an estimated 80% of them said that they did walk regularly (table 4.18).

Smoking was not a major cause of concern because a mere 16.5% of the studied patients smoked (table 4.24) and an estimated 90% of the smokers were considering quitting (table 4.26). Smoking is a major contributive factor to ischemic heart disease and hypertension, with both of these being risk factors for chronic complication development in diabetes. These facts were stipulated to the patients, and the majority of them agreed to know it. Whether they really considered quitting is debatable, because nicotine is highly addictive and it takes a strong will to part from it.

Alcohol consumption in the study population was minimal, with a total of 19 patients admitting to drinking beer, wine or spirits. This was a mere estimated 20% of the total study population. It is questionable whether these patients interviewed were telling the truth.

Nutritional modification plays a major role in managing diabetes. It is recommended that regular meals be eaten throughout the day, with plenty of vegetables and fruits, lean meat and whole wheat products. Fat, salt, sugar and refined carbohydrates must be used sparingly. The diet that a person with diabetes follows to help manage his or her blood glucose levels, is based on the same nutrition principles that any healthy person, with or without diabetes, should follow for good health (refer to section 2.9.2).

The questionnaire was formulated with many questions about eating habits to determine whether their diets contributed to diabetes development. The majority of patients (an estimated 80%) said that the main reason for eating was hunger and only 37.86% of the studied patients admitted to eating because they were advised by a dietician or prescriber (table 4.30). This shows that an estimated 60% of the patients were not informed about

correct eating habits which is concerning because type 2 diabetes could in most of the cases be controlled by diet and exercise modifications only. Thus, it is possible that these patients are wrongly treated with oral drugs and insulin, when lifestyle modifications would have been sufficient. This might have been prevented by proper education about diabetes at the time of diagnosis.

Daily fat and salt intake by the study population was more or less the same. An estimated 90% of them admitting to consuming one to two teaspoons of fat and salt respectively a day (table 4.44 and 4.47). This information might be faulty, because fat and salt consumption might be more than they were aware of because of food manufacturing and animal fats present in meat.

One of the main symptoms of high blood glucose is thirst; this is because excess glucose in the body draws water from the surrounding tissues, thus making one feel dehydrated. The majority (79.61%) of the interviewed patients said they frequently drank fluids, at least six to eight glasses of water a day.

The socio-economic status of the study population was relatively poor because of unemployment. Although 90.07% of them said they had no difficulty to follow their diet (table 4.56) almost half of the patients said they had some difficulty to get the correct food for their specific needs (table 4.53). The first may be because they are still eating they way they used to with no modifications and the latter may be because of their financial status. Not being able to find work has a major effect on their lives. They cannot afford to buy foods suitable for their needs.

As previously stated, patient education is fundamental in the managing and controlling diabetes. When these patients were asked whether they know what diabetes is, and what the complications of the disease might hold, most of them answered that it means they have 'sugar', and cannot eat sugary foods any more. This clearly indicates that they have some idea of what diabetes is. After having explained to them in uncomplicated terms what the disease implicates, many of them said it had not been not explained to them previously and that they now understood it better.

The ***second specific objectives*** were to determine whether there were any ethnic and cultural barriers in the education about diabetes. According to the findings in this study there were none. Each patient interviewed was using the medicine as prescribed, and none of them admitted to using alternative medication such as remedies received from their traditional healers.

The ***third*** and ***fourth specific objectives*** were to determine how accessible health care providers are to the community and whether they receive sufficient information from

these providers. There are numerous primary health care clinics in the Potchefstroom area meaning that the facilities are accessible to the public. Even though the clinics are readily available for public use, they have staff shortages which result in patient overcrowding, and these health care providers only have limited resources which they receive from the government. Having staff shortages contributes to being pressed for time, thus these personnel cannot spend sufficient time with each patient. This results in a lack of patient education.

The ***fifth specific objective*** was to determine the knowledge of the community about diabetes. It was concluded that the majority of the studied population were under a false impression of what diabetes implied. This is partly due to the lack of time the clinic staffs have to spend with each patient, educating them about the disease.

The ***sixth specific objective*** was to investigate methods and techniques in the public health care sector to ensure access to quality health care. One aspect that was most obvious during this study was the fact that an estimated 20% of all patients studied had their own blood glucose monitor (table 4.80). This is somewhat concerning because to have optimal control over one's blood glucose levels, one needs to has a blood glucose monitor for regular monitoring. An estimated 70% of the studied population measures their blood glucose only once a month when they attend the clinic for their monthly visit (table 4.81). This is not nearly enough to ensure optimal control.

The average blood glucose levels were calculated as described in section 4.7. Even with the minimal measurement, about 50% of these patients' blood glucose levels were fairly under control with an average of 6-9mmol/L (table 4.88). But the other estimated 50% of the population were not controlled with averages of either below 5mmol/L or above 9mmol/L. This is concerning because the possibility that these uncontrolled cases may develop chronic complications, might be unavoidable unless they start taking control of their lives. And for this to happen, these patients need all the possible education from qualified health care providers and the support of their families.

5.3 RECOMMENDATIONS

The ***seventh specific objective*** was to formulate recommendations regarding the management of *diabetes mellitus* on primary health care level.

Health care personnel must be fully informed about *diabetes mellitus* and how the disease must be treated and managed.

This includes:

- The health care providers must be fully informed about the possible chronic complications that may occur. They must inform the patients about the prevention of such complications and why it is necessary to visit a dentist, ophthalmologist and podiatrist at least once a year.

- These providers must be informed about dietary modifications that are an absolute necessity to manage the disease. It might be advisable that each cubicle in every clinic has one food pyramid guideline and pamphlets to hand out to each patient.

- The importance of increased physical activity must be made clear to each patient. This is not only necessary to lose weight, but to lower blood glucose levels, decrease blood pressure and improve blood circulation.

- Counselors may be appointed to look after the patients' well-being, because when diagnosed with diabetes it is possible to feel depressed and isolated. When there is a support group with people having the same emotions and feelings, it might assist with the emotional aspect of living with diabetes.

- It is important to consult with the patient's family, to inform them about what the patient is going through so that this might help them to understand the situation better. This will help the patient as well because then he has the support and understanding of his family.

- Blood glucose monitors are an absolute necessity and an estimated 70% of the study population does not have their own. Some form of intervention must take place, either by government supplying these monitors and strips each month for every diabetic patient, or by manufacturing companies donating these devices.

5.4 RESTRICTIONS

Certain restrictions were identified which may limit the capacity of this study.

- It is debatable whether the information supplied by the interviewed patients was absolutely truthful.
- It is plausible that not all diabetic patients in the two clinics involved were interviewed.
- The questionnaire was formulated around aspects of diabetes, and did not involve possible hypertension levels. This might have been helpful information in establishing more uncontrolled cases.
- In one case language was a definite barrier, because the patient only spoke Zulu and there was no interpreter to translate, thus the patient was not interviewed.

5.5 SUMMARY

In this chapter the conclusion, recommendations and restrictions are discussed.

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APPENDIX A

Frequency procedure

Table 4.1: Patient frequency and percentage at each clinic

Clinic	Frequency	Percent	Cumulative frequency	Cumulative percent
Potch	78	75.73	78	75.73
Prom	25	24.27	103	100

Table 4.2: Gender frequencies in the studied population

Gender	Frequency	Percent	Cumulative frequency	Cumulative percent
Male	30	29.13	30	29.13
Female	73	70.87	103	100

Table 4.3: Race frequencies in the studied population

Race	Frequency	Percent	Cumulative frequency	Cumulative percent
Black	66	64.08	66	64.08
White	19	18.45	85	82.52
Colored	18	17.48	103	100

Table 4.6: Preference language of the studied population

Lang	Frequency	Percent	Cumulative frequency	Cumulative percent
Afr	100	97.09	100	97.09
Eng	3	2.91	103	100

Table 4.7: Diabetes group frequencies

B1	Frequency	Percent	Cumulative frequency	Cumulative percent
1	4	3.88	4	3.88
2	64	62.14	68	66.02
3	35	33.98	103	100

Table 4.10: Family history of diabetes

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
B3N1	1	23	22.33	23	22.3
	2	80	77.67	103	100
B3N2	1	29	28.16	29	28.16
	2	74	71.84	103	100
B3N4	1	19	18.45	19	18.45
	2	84	81.55	103	100
B3N5	1	22	21.36	22	21.36
	2	81	78.64	103	100

Table 4.17: Means procedure of the total weight frequencies

Variable	N	Mean	Std Dev	Min	Max
Weight	103	79.9	18.2	39.08	140
Height	103	1.63	0.08	1.47	1.87
BMI	103	30.13	6.56	13.52	53.91

Table 4.18: Total frequency of studied population who exercise

C2N1	Frequency	Percent	Cumulative frequency	Cumulative percent
1	30	29.13	30	29.13
2	73	70.87	103	100

Table 4.19: Total frequency of exercise types done by the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
C2N2N1	1	82	79.61	82	79.61
	2	21	20.39	103	100
C2N2N2	1	18	17.48	18	17.48
	2	85	82.52	103	100
C2N2N3	1	3	3.03	3	3.03
	2	96	96.97	99	100

Table 4.22: Frequency of exercise done in a week

C2N3	Frequency	Percent	Cumulative frequency	Cumulative percent
1	5	4.85	5	4.85
2	34	33.01	39	37.86
3	64	62.14	103	100

Table 4.25: Frequency of smokers in the studied population

C3N1	Frequency	Percent	Cumulative frequency	Cumulative percent
1	17	16.5	17	16.5
2	86	83.5	103	100

Table 4.26: Frequency of cigarettes smoked by the study population

C3N2	Frequency	Percent	Cumulative frequency	Cumulative percent
1	15	93.75	15	93.75
2	1	6.25	16	100

Table 4.27: Frequency of smokers who considered quitting smoking in the study population

C3N4	Frequency	Percent	Cumulative frequency	Cumulative percent
1	15	88.24	15	88.24
2	2	11.76	17	100

Table 4.28: Frequency of total beer consumption per week by the study population

C4N1N1	Frequency	Percent	Cumulative frequency	Cumulative percent
1	4	33.3	4	33.33
2	6	50	10	83.33
3	1	8.33	11	91.67
4	1	8.33	12	100

Table 4.29: Frequency of total wine consumption per week by the study population

C4N1N2	Frequency	Percent	Cumulative frequency	Cumulative percent
1	4	80	4	80
2	1	20	5	100

Table 4.30: Frequency and percentage of spirit consumption

C4N1N3	Frequency	Percent	Cumulative frequency	Cumulative percent
1	2	100	2	100

Table 4.31: Frequency of reasons for eating given by the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
C5N1N1	1	82	79.61	82	79.61
	2	21	20.39	103	100
C5N1N2-N4	1	0	0	0	0
	2	103	100	103	100
C5N1N5	1	30	29.13	30	29.13
	2	73	70.87	103	100
C5N1N6	1	54	52.43	54	52.43
	2	49	47.57	103	100
C5N1N7	1	39	37.86	39	37.86
	2	64	62.14	103	100

Table 4.36: Frequency of meals consumed a day by the study population

C5N2	Frequency	Percent	Cumulative frequency	Cumulative percent
1	8	7.77	8	7.77
2	27	26.21	35	33.98
3	54	52.43	89	86.41
4	14	13.59	103	100

Table 4.39: Frequency of fruits, vegetables and meat consumed a day by the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
C5N3N1	1	78	75.73	78	75.73
	2	25	24.27	103	100
C5N3N2	1	94	91.26	94	91.26
	2	9	8.74	103	100
C5N3N3	1	94	91.26	94	91.26
	2	9	8.74	103	100
C5N3N4	1	54	52.43	54	52.43
	2	49	47.57	103	100
C5N3N5	1	27	26.21	27	26.21
	2	76	73.79	103	100
C5N3N6	1	52	50.49	52	50.49
	2	51	49.51	103	100
C5N3N7	1	16	15.53	16	15.53
	2	87	84.47	103	100

Table 4.42: Frequency of daily carbohydrate and plant proteins consumed

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
C5N4N1	1	100	97.09	100	97.09
	2	3	2.91	103	100
C5N4N2	1	92	89.32	92	89.32
	2	11	10.68	103	100
C5N4N3	1	88	85.44	88	85.44
	2	15	14.56	103	100
C5N4N4	1	78	75.73	78	75.73
	2	25	24.27	103	100
C5N4N5	1	40	38.83	40	38.83
	2	63	61.17	103	100
C5N4N6	1	8	7.77	8	7.77
	2	95	92.23	103	100
C5N4N7	1	50	48.54	50	48.54
	2	53	51.46	103	100
C5N4N8	1	32	31.07	32	31.07
	2	71	68.93	103	100

Table 4.45: Frequency of daily fat consumption in the study population

C5N5	Frequency	Percent	Cumulative frequency	Cumulative percent
1	89	87.25	89	87.25
2	11	10.78	100	98.04
3	2	1.96	102	100
Frequency missing = 1				

Table 4.48: Frequency of daily salt consumption in the study population

C5N6	Frequency	Percent	Cumulative frequency	Cumulative percent
1	91	90.1	91	90.1
2	8	7.92	99	98.02
3	2	1.98	101	100
Frequency missing = 2				

Table 4.51: Frequency of daily water consumption in the study population

C5N7	Frequency	Percent	Cumulative frequency	Cumulative percent
1	82	79.61	82	79.61
2	21	20.39	103	100

Table 4.54: Frequency of patients finding it difficult to obtain the right food in the study population

C5N8	Frequency	Percent	Cumulative frequency	Cumulative percent
1	52	50.49	52	50.49
2	51	49.51	103	100

Table 4.57: Frequency of patients finding it difficult to follow a specific diet in the study population

C5N9	Frequency	Percent	Cumulative frequency	Cumulative percent
1	3	2.91	3	2.91
2	100	97.09	103	100

Table 4.60: Frequency of patients' last session attended with a registered dietician

C5N10	Frequency	Percent	Cumulative frequency	Cumulative percent
1	12	11.65	12	11.65
2	12	11.65	24	23.3
3	79	76.7	103	100

Table 4.63: Frequency of patients in the study population who visited a dentist, podiatrist and ophthalmologist in the past year

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
C5N11N1	1	26	25.24	26	25.24
	2	77	74.76	103	100
C5N11N2	1	21	20.39	21	20.39
	2	82	79.61	103	100
C5N11N3	1	51	49.51	51	49.51
	2	52	50.49	103	100

Table 4.64: Frequency of emotions towards diabetes in the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
D1N1	1	21	20.39	21	20.39
	2	82	79.61	103	100
D1N2	1	41	39.81	41	39.81
	2	62	60.19	103	100
D1N3	1	38	36.89	38	36.89
	2	65	63.11	103	100
D1N4	1	4	3.88	4	3.88
	2	99	96.12	103	100
D1N5	1	3	2.91	3	2.91
	2	100	97.09	103	100
D1N6	1	40	38.83	40	38.83
	2	63	61.17	103	100
D1N7	1	12	11.65	12	11.65
	2	91	88.35	103	100

Table 4.65: Frequency of patients feeling isolated because of diabetes in the study population

D2	Frequency	Percent	Cumulative frequency	Cumulative percent
1	3	2.91	3	2.91
2	100	97.09	103	100

Table 4.66: Frequency of patients with physical complaints in the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
D3N1	1	53	51.46	53	51.46
	2	50	48.57	103	103
D3N2	1	55	53.4	55	53.4
	2	48	46.6	103	100
D3N3	1	58	56.31	58	56.31
	2	45	43.69	103	100
D3N4	1	24	23.3	24	23.3
	2	79	76.7	103	100

Table 4.67: Frequency of patients in the study population taking medication as prescribed

E1	Frequency	Percent	Cumulative frequency	Cumulative percent
3	3	2.91	3	2.91
4	100	97.09	103	100

Table 4.68: Frequency of reasons given by the patients in the study population for not taking the prescribed medication

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
E2N1	2	103	100	103	100
E2N2	1	26	25.24	26	25.24
	2	77	74.76	103	100
E2N3	1	1	0.97	1	0.97
	2	102	99.03	103	100
E2N4	1	1	0.97	1	0.97
	2	102	99.03	103	100

Table 4.69: Frequency of patients in the study population whose prescription have been adjusted

E3N1	Frequency	Percent	Cumulative frequency	Cumulative percent
1	79	76.7	79	76.7
2	24	23.3	103	100

Table 4.70: Frequency of the main reasons for prescription alteration given by the patients in the study population

E3N2	Frequency	Percent	Cumulative frequency	Cumulative percent
1	3	3.85	3	3.85
2	75	96.15	78	100

Table 4.71: Frequency of glucose lowering agents used in the study population

E4	Frequency	Percent	Cumulative frequency	Cumulative percent
1	10	9.71	10	9.71
2	63	61.17	73	70.87
3	60	29.13	103	100

Table 4.72: Frequency of insulin types used in the study population

E5	Frequency	Percent	Cumulative frequency	Cumulative percent
1	39	97.5	39	97.5
3	1	2.5	40	100

Table 4.73: Frequency of injection sites used by group A and C diabetics in the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
E5N1N1	1	33	82.5	33	82.5
	2	7	17.5	40	100
E5N1N2	1	5	12.5	5	12.5
	2	35	87.5	40	100
E5N1N3	1	4	10	4	10
	2	36	90	40	100
E5N1N4	1	18	45	18	45
	2	22	55	40	100

Table 4.74: Frequency of injection sites problems reported by the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
E5N2N1	1	6	15	6	15
	2	34	85	40	100
E5N2N2	1	13	32.5	13	32.5
	2	27	67.5	40	100
E5N2N3	1	15	37.5	15	37.5
	2	25	62.5	40	100
E5N2N4	1	1	2.5	1	2.5
	2	39	97.5	40	100

Table 4.75: Frequency of patients in the study population using metformin

E6N1N1	Frequency	Percent	Cumulative frequency	Cumulative percent
1	83	100	83	100

Table 4.76: Frequency of metformin dosages administered by the patients in the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
E6N1N2A	1	14	100	14	100
E6N1N2B	1	69	100	69	100

Table 4.77: Frequency of patients in the study population administering metformin with meals

E6N1N3	Frequency	Percent	Cumulative frequency	Cumulative percent
1	76	91.57	76	91.57
2	7	8.43	83	100

Table 4.78: Frequency of patients in the study population using gliclazide

E6N2N1	Frequency	Percent	Cumulative frequency	Cumulative percent
1	59	100	59	100

Table 4.79: Frequency of gliclazide dosages administered by the patients in the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
E6N2N2A	1	10	100	10	100
E6N2N2B	1	28	100	28	100
E6N2N2C	1	21	100	21	100

Table 4.80: Frequency of patients in the study population administering gliclazide with meals

E6N2N3	Frequency	Percent	Cumulative frequency	Cumulative percent
1	56	94.92	56	94.92
2	3	5.08	59	100

Table 4.81: Frequency of patients in the study population owning a blood glucose instrument

F1N1	Frequency	Percent	Cumulative frequency	Cumulative percent
1	20	19.42	20	19.42
2	83	80.58	103	100

Table 4.82: Frequency of the study population's frequency of blood glucose measurement

F2	Frequency	Percent	Cumulative frequency	Cumulative percent
1	15	14.56	15	14.56
2	1	0.97	16	15.53
3	3	2.91	19	18.45
5	6	5.83	25	24.27
6	4	3.88	29	28.16
9	74	71.84	103	100

Table 4.89: Frequency of patients' average blood glucose readings in the study population

F3	Frequency	Percent	Cumulative frequency	Cumulative percent
2	15	14.56	15	14.56
3	55	53.4	70	67.96
4	33	32.04	103	100

Table 4.96: Frequency of patients in the study population experiencing low blood glucose levels (≤ 3 mmol/L)

F4	Frequency	Percent	Cumulative frequency	Cumulative percent
1	74	71.84	74	71.84
2	22	21.36	96	93.2
3	5	4.85	101	98.06
4	2	1.94	103	100

Table 4.103: Frequency of patients in the study population experiencing symptoms associated with low blood glucose levels

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
F5N1	1	75	72.82	75	72.82
	2	28	27.18	103	100
F5N2	1	7	6.8	7	6.8
	2	96	93.2	103	100
F5N3	1	31	30.1	31	30.1
	2	72	69.9	103	100
F5N4	1	6	5.83	6	5.83
	2	97	94.17	103	100
F5N5	1	35	33.98	35	33.98
	2	68	66.02	103	100
F5N6	1	43	41.75	43	41.75
	2	60	58.25	103	100

Table 4.104: Frequency of patients in the study population experiencing elevated blood glucose levels (≥ 10 mmol/L)

F6	Frequency	Percent	Cumulative frequency	Cumulative percent
1	29	28.16	29	28.16
2	22	21.36	51	49.51
3	25	24.27	76	73.79
4	27	26.21	103	100

Table 4.111: Frequency of patients in the study population experiencing symptoms associated with elevated glucose levels

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
F7N1	1	68	66.02	68	66.02
	2	35	33.98	103	100
F7N2	1	19	18.45	19	18.45
	2	84	81.55	103	100
F7N3	1	67	65.05	67	65.05
	2	36	34.95	103	100
F7N4	1	26	25.24	26	25.24
	2	77	74.76	103	100
F7N5	1	68	66.02	68	66.02
	2	35	33.98	103	100
F7N6	1	20	19.42	20	19.42
	2	83	80.58	103	100

Table 4.112: Frequency and percentage of patients in the study population that previously went into a diabetic coma and insulin shock

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
F8N1	1	7	6.8	7	6.8
	2	96	93.2	103	100
F8N2	1	11	10.78	11	10.78
	2	91	89.22	102	100

Table 4.113: Frequency of patients in the study population experiencing recurrent disease

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
F8N3N1	1	21	20.39	21	20.39
	2	82	79.61	103	100
F8N3N2	1	13	12.62	13	12.62
	2	90	87.38	103	100
F8N3N3	1	27	26.21	27	26.21
	2	76	73.79	103	100
F8N3N4	1	48	46.6	48	46.6
	2	55	53.4	103	100
F8N3N5	1	26	25.24	26	25.24
	2	77	74.76	103	100

Table 4.114: Frequency of patients in the study population who suffered from vision disturbances

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
F8N4N1	1	85	82.52	85	82.52
	2	18	17.48	103	100
F8N4N2	1	31	30.1	31	30.1
	2	72	69.9	103	100
F8N4N3	1	1	0.97	1	0.97
	2	102	99.03	103	100
F8N4N4	1	41	39.81	41	39.81
	2	62	60.19	103	100

Table 4.115: Frequency of patients in the study population with possible heart problems

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
F8N5N1	1	9	8.74	9	8.74
	2	94	91.26	103	100
F8N5N2	1	8	7.77	8	7.77
	2	95	92.23	103	100
F8N5N3	1	1	0.97	1	0.97
	2	102	99.03	103	100

Table 4.116: Frequency of patients in the study population with possible diabetic complications

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
F9N1	1	8	7.77	8	7.77
	2	95	92.23	103	100
F9N2	1	14	13.59	14	13.59
	2	89	66.41	103	100
F9N3	1	34	33.01	34	33.01
	2	69	66.99	103	100
F9N4	1	5	4.85	5	4.85
	2	98	95.15	103	100

Table 4.117: Frequency of patients in the study population who attended doctor consultations in the past twelve months

G1	Frequency	Percent	Cumulative frequency	Cumulative percent
1	7	6.8	7	6.8
2	13	12.62	20	19.42
3	83	80.58	103	100

Table 4.118: Frequency of given reasons for the consultations by the patients in the study population

Number	Answer	Frequency	Percent	Cumulative frequency	Cumulative percent
G2N1	1	103	100	103	100
	2	0	0	0	0
G2N2	1	80	77.67	80	77.67
	2	23	22.33	103	100
G2N3	1	13	12.62	13	12.62
	2	90	87.38	103	100
G2N4	1	5	4.85	5	4.85
	2	98	95.15	103	100
G2N5	1	19	18.45	19	18.45
	2	84	81.55	103	100
G2N6	1	2	1.94	2	1.94
	2	101	98.06	103	100
G2N7	1	0	0	0	0
	2	103	100	103	100
G2N8	1	2	1.94	2	1.94
	2	101	98.06	103	100

Table 4.119: Frequency of patients in the study population being previously hospitalised for diabetes

G3	Frequency	Percent	Cumulative frequency	Cumulative percent
1	49	47.57	49	47.57
2	54	52.43	103	100

APPENDIX B

Correlation between weight status and diabetes

Table 4.16: Weight frequencies in the total study population

Group	Frequency	Percent	Cumulative frequency	Cumulative percent
Normal	21	20.39	21	20.39
Overweight	41	39.81	62	60.19
Obese	41	39.81	103	100

1 Section C: Lifestyle

1.1 Exercise

Table 4.20: Total frequency of exercise compared to weight status in the study population

C2N1		1	2	Total
Normal	Frequency	6	15	21
	Percent	5.83	14.56	20.39
	Row Pct	28.57	71.43	
	Col Pct	20	20.55	
Overweight	Frequency	10	31	41
	Percent	9.71	30.1	39.81
	Row Pct	24.39	75.61	
	Col Pct	33.33	42.47	
Obese	Frequency	10	31	41
	Percent	9.71	30.1	39.81
	Row Pct	24.39	75.61	
	Col Pct	33.33	42.47	
Total	Frequency	30	73	103
	Percent	29.13	70.87	100

Table 4.21: Statistics for the correlation between exercise and weight status in the study population

Statistic	DF	Value	Prob
Chi-square	2	0.95	0.62
Likelihood Ratio Chi-square	2	0.95	0.62
Mantel-Haenszel Chi-square	1	0.28	0.6
Phi coefficient		**0.1**	
Contingency coefficient		0.1	
Cramer's V		0.1	

Exact exercising types of the patients in the study population:

a) Walk to work:

C2N2N1		1	2	Total
Normal	Frequency	18	3	21
	Percent	17.48	2.91	20.39
	Row Pct	85.71	14.29	
	Col Pct	21.95	14.29	
Overweight	Frequency	30	11	41
	Percent	29.13	10.68	39.81
	Row Pct	73.17	26.83	
	Col Pct	36.59	52.38	
Obese	Frequency	34	7	41
	Percent	33.01	6.8	39.81
	Row Pct	82.93	17.07	
	Col Pct	41.46	33.33	
Total	Frequency	82	21	103
	Percent	79.61	20.39	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	1.81	0.41
Likelihood Ratio Chi-square	2	1.8	0.41
Mantel-Haenszel Chi-square	1	1.62	0.2
Phi coefficient		**0.13**	
Contingency coefficient		0.13	
Cramer's V		0.13	

b) Walk/run for exercise:

C2N2N2		1	2	Total
Normal	Frequency	3	18	21
	Percent	2.91	17.48	20.39
	Row Pct	14.29	85.71	
	Col Pct	16.67	21.12	
Overweight	Frequency	8	33	41
	Percent	7.77	32.04	39.81
	Row Pct	19.51	80.49	
	Col Pct	44.44	38.82	
Obese	Frequency	7	34	41
	Percent	6.8	33.01	39.81
	Row Pct	17.07	82.93	
	Col Pct	38.89	40	
Total	Frequency	18	85	103
	Percent	17.48	82.52	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	0.27	0.87
Likelihood Ratio Chi-square	2	0.28	0.87
Mantel-Haenszel Chi-square	1	0.27	0.61
Phi coefficient		**0.05**	
Contingency coefficient		0.05	
Cramer's V		0.05	

c) Gym:

C2N2N3		1	2	Total:
Normal	Frequency	0	20	20
	Percent	0	20.2	20.2
	Row Pct	0	100	
	Col Pct	0	20.83	
Overweight	Frequency	2	37	39
	Percent	2.02	37.37	39.39
	Row Pct	5.13	94.87	
	Col Pct	66.67	38.54	
Obese	Frequency	1	39	40
	Percent	1.01	39.39	40.4
	Row Pct	2.5	97.5	
	Col Pct	33.33	40.63	
Total	Frequency	3	96	99
	Percent	3.03	96.97	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	1.25	0.54
Likelihood Ratio Chi-square	2	1.76	0.42
Mantel-Haenszel Chi-square	1	1.24	0.27
Phi coefficient		**0.11**	
Contingency coefficient		0.11	
Cramer's V		0.11	

Table 4.23: Correlation between frequencies of exercise done in a week compared to weight status of the study population

C2N3		1	2	3	Total
Normal	Frequency	1	6	14	21
	Percent	0.97	5.83	13.59	20.39
	Row Pct	4.76	28.57	66.67	
	Col Pct	20	17.65	21.88	
Overweight	Frequency	2	10	29	41
	Percent	1.94	9.71	28.16	39.81
	Row Pct	4.88	24.39	70.73	
	Col Pct	40	29.41	45.31	
Obese	Frequency	2	18	21	41
	Percent	1.94	17.48	20.39	39.81
	Row Pct	4.88	43.9	51.22	
	Col Pct	40	52.94	32.81	
Total	Frequency	5	34	64	103
	Percent	4.85	33.01	62.14	100

Table 4.24: Statistics for the correlation between frequencies of exercise done in a week and weight status of the studied population

Statistic	DF	Value	Prob
Chi-square	4	3.87	0.43
Likelihood Ratio Chi-square	4	3.85	0.43
Mantel-Haenszel Chi-square	1	0.32	0.57
Phi coefficient		**0.19**	
Contingency coefficient		0.19	
Cramer's V		0.14	

1.2 Diet:

Table 4.32: Comparison between being hungry for a reason for eating and weight status of the study population

C5N1N1		1	2	Total
Normal	Frequency	17	4	21
	Percent	16.5	3.88	20.39
	Row Pct	80.95	19.05	
	Col Pct	20.73	19.05	
Overweight	Frequency	36	5	41
	Percent	34.95	4.85	39.81
	Row Pct	87.8	12.2	
	Col Pct	43.9	23.81	
Obese	Frequency	29	12	41
	Percent	28.16	11.65	39.81
	Row Pct	70.73	29.27	
	Col Pct	35.37	57.14	
Total	Frequency	82	21	103
	Percent	79.61	20.39	100

Table 4.33: Statistics for the comparison between being hungry for a reason for eating and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	2	3.71	0.17
Likelihood Ratio Chi-square	2	3.76	0.15
Mantel-Haenszel Chi-square	1	0.99	0.32
Phi coefficient		**0.19**	
Contingency coefficient		0.19	
Cramer's V		0.19	

Other reason for eating: Stress, frustration and depression:

C5N1N2-N4		2	Total
Normal	Frequency	21	21
	Percent	20.39	20.39
	Row Pct	100	
	Col Pct	20.39	
Overweight	Frequency	41	41
	Percent	39.81	39.81
	Row Pct	100	
	Col Pct	39.81	
Obese	Frequency	41	41
	Percent	39.81	39.81
	Row Pct	100	
	Col Pct	39.81	
Total	Frequency	103	103
	Percent	100	100

Energy:

C5N1N5		1	2	Total
Normal	Frequency	7	14	21
	Percent	6.8	13.59	20.39
	Row Pct	33.33	66.67	
	Col Pct	23.33	19.18	
Overweight	Frequency	12	29	41
	Percent	11.65	28.16	39.81
	Row Pct	29.27	70.73	
	Col Pct	40	39.73	
Obese	Frequency	11	30	41
	Percent	10.68	29.13	39.81
	Row Pct	26.83	73.17	
	Col Pct	36.67	41.1	
Total	Frequency	30	73	103
	Percent	29.13	70.87	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	0.29	0.87
Likelihood Ratio Chi-square	2	0.28	0.87
Mantel-Haenszel Chi-square	1	0.056	0.81
Phi coefficient		**0.05**	
Contingency coefficient		0.05	
Cramer's V		0.05	

To stay healthy:

C5N1N6		1	2	Total
Normal	Frequency	10	11	21
	Percent	9.71	10.68	20.39
	Row Pct	47.62	52.38	
	Col Pct	18.52	22.45	
Overweight	Frequency	22	19	41
	Percent	21.36	18.45	39.81
	Row Pct	53.66	46.34	
	Col Pct	40.74	38.78	
Obese	Frequency	22	19	41
	Percent	21.36	18.45	39.81
	Row Pct	53.66	46.34	
	Col Pct	40.74	38.78	
Total	Frequency	54	49	103
	Percent	52.43	47.57	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	0.25	0.89
Likelihood Ratio Chi-square	2	0.24	0.89
Mantel-Haenszel Chi-square	1	0.16	0.69
Phi coefficient		**0.05**	
Contingency coefficient		0.05	
Cramer's V		0.05	

Table.34: Comparison between the reason for eating being prescribed by a dietician and weight status of the study population

C5N1N7		1	2	Total
Normal	Frequency	6	15	21
	Percent	5.83	14.56	20.39
	Row Pct	28.57	71.43	
	Col Pct	15.38	23.44	
Overweight	Frequency	20	21	41
	Percent	19.42	20.39	39.81
	Row Pct	48.78	51.22	
	Col Pct	51.28	32.81	
Obese	Frequency	13	28	41
	Percent	12.62	27.18	39.81
	Row Pct	31.71	68.29	
	Col Pct	33.33	43.75	
Total	Frequency	39	64	103
	Percent	37.86	62.14	100

Table 4.35: Statistics for the comparison between reason for eating being prescribed by a dietician and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	2	3.51	0.17
Likelihood Ratio Chi-square	2	3.5	0.17
Mantel-Haenszel Chi-square	1	2.99	0.08
Phi coefficient		**0.19**	
Contingency coefficient		0.18	
Cramer's V		0.19	

Table 4.37: Comparison between meals consumed a day and weight status of the study population

C5N2		1	2	3	4	Total
Normal	Frequency	3	5	10	3	21
	Percent	2.91	4.85	9.71	2.91	20.39
	Row Pct	14.29	23.81	47.62	14.29	
	Col Pct	37.5	18.52	18.52	21.43	
Overweight	Frequency	3	7	23	8	41
	Percent	2.91	6.8	22.33	7.77	39.81
	Row Pct	7.32	17.07	56.1	19.51	
	Col Pct	37.5	25.93	42.59	57.14	
Obese	Frequency	2	15	21	3	41
	Percent	1.94	14.56	20.39	2.91	39.81
	Row Pct	4.88	36.59	51.22	7.32	
	Col Pct	25	55.56	38.89	21.43	
Total	Frequency	8	27	54	14	103
	Percent	7.77	26.21	52.43	13.59	100

Table 4.38: Statistics for the comparison between meals consumed a day and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	6	7.1	0.31
Likelihood Ratio Chi-square	6	7.1	0.32
Mantel-Haenszel Chi-square	1	2.02	0.16
Phi coefficient		**0.26**	
Contingency coefficient		0.25	
Cramer's V		0.19	

Daily fruit consumption:

C5N3N1		1	2	Total
Normal	Frequency	16	5	21
	Percent	15.53	4.85	20.39
	Row Pct	76.19	23.81	
	Col Pct	20.51	20	
Overweight	Frequency	34	7	41
	Percent	33.01	6.8	39.81
	Row Pct	82.93	17.07	
	Col Pct	43.59	28	
Obese	Frequency	28	13	41
	Percent	27.18	12.62	39.81
	Row Pct	68.29	31.71	
	Col Pct	35.9	52	
Total	Frequency	78	25	103
	Percent	75.73	24.27	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	2.39	0.3
Likelihood Ratio Chi-square	2	2.41	0.3
Mantel-Haenszel Chi-square	1	0.76	0.39
Phi coefficient		**0.15**	
Contingency coefficient		0.15	
Cramer's V		0.15	

Table 4.40: Comparison between daily vegetable consumption and weight status of the study population

C5N3N2		1	2	Total
Normal	Frequency	16	5	21
	Percent	15.53	4.85	20.39
	Row Pct	76.19	23.81	
	Col Pct	17.02	55.56	
Overweight	Frequency	38	3	41
	Percent	36.89	2.91	39.81
	Row Pct	92.68	7.32	
	Col Pct	40.43	33.33	
Obese	Frequency	40	1	41
	Percent	38.83	0.97	39.81
	Row Pct	97.56	2.44	
	Col Pct	42.55	11.11	
Total	Frequency	94	9	103
	Percent	91.26	8.47	100

Table 4.41: Statistics for the comparison between daily vegetable consumption and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	2	8.13	0.02
Likelihood Ratio Chi-square	2	7.15	0.03
Mantel-Haenszel Chi-square	1	3.01	0.08
Phi coefficient		**0.28**	
Contingency coefficient		0.27	
Cramer's V		0.28	

Daily chicken consumption:

C5N3N3		1	2	Total
Normal	Frequency	20	1	21
	Percent	19.42	0.97	20.39
	Row Pct	95.24	4.76	
	Col Pct	21.28	11.11	
Overweight	Frequency	37	4	41
	Percent	35.92	3.88	39.81
	Row Pct	90.24	9.76	
	Col Pct	39.36	44.44	
Obese	Frequency	37	4	41
	Percent	35.92	3.88	39.81
	Row Pct	90.24	9.76	
	Col Pct	39.36	44.44	
Total	Frequency	97	9	103
	Percent	91.26	8.74	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	0.52	0.77
Likelihood Ratio Chi-square	2	0.6	0.74
Mantel-Haenszel Chi-square	1	0.34	0.56
Phi coefficient		**0.07**	
Contingency coefficient		0.07	
Cramer's V			

Daily fish consumption:

C5N3N4		1	2	Total
Normal	Frequency	11	10	21
	Percent	10.68	9.71	20.39
	Row Pct	52.38	47.62	
	Col Pct	20.37	20.41	
Overweight	Frequency	24	17	41
	Percent	23.3	16.5	39.81
	Row Pct	58.54	41.46	
	Col Pct	44.44	34.69	
Obese	Frequency	19	22	41
	Percent	18.45	21.36	39.81
	Row Pct	46.34	43.66	
	Col Pct	35.19	44.9	
Total	Frequency	54	49	103
	Percent	52.43	47.57	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	1.22	0.54
Likelihood Ratio Chi-square	2	1.23	0.54
Mantel-Haenszel Chi-square	1	0.43	0.51
Phi coefficient		**0.11**	
Contingency coefficient		0.11	
Cramer's V		0.11	

Daily mutton consumption:

C5N3N5		1	2	Total
Normal	Frequency	4	17	21
	Percent	3.88	16.5	20.39
	Row Pct	19.05	80.95	
	Col Pct	14.81	22.37	
Overweight	Frequency	10	31	41
	Percent	9.71	30.1	39.81
	Row Pct	24.39	75.61	
	Col Pct	37.04	40.79	
Obese	Frequency	13	28	41
	Percent	12.62	27.18	39.81
	Row Pct	31.71	68.29	
	Col Pct	48.15	36.84	
Total	Frequency	27	76	103
	Percent	26.21	73.79	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	1.27	0.53
Likelihood Ratio Chi-square	2	1.28	0.53
Mantel-Haenszel Chi-square	1	0.05	0.82
Phi coefficient		**0.11**	
Contingency coefficient		0.11	
Cramer's V		0.11	

Daily beef consumption:

C5N3N6		1	2	Total
Normal	Frequency	9	12	21
	Percent	8.74	11.65	20.39
	Row Pct	42.86	57.14	
	Col Pct	17.31	23.53	
Overweight	Frequency	22	19	41
	Percent	21.36	18.45	39.81
	Row Pct	53.66	46.34	
	Col Pct	42.31	37.25	
Obese	Frequency	21	20	41
	Percent	20.39	19.42	39.81
	Row Pct	51.22	48.78	
	Col Pct	40.38	39.22	
Total	Frequency	52	51	103
	Percent	50.49	49.51	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	0.66	0.72
Likelihood Ratio Chi-square	2	0.66	0.72
Mantel-Haenszel Chi-square	1	0.57	0.45
Phi coefficient		**0.08**	
Contingency coefficient		0.08	
Cramer's V		0.08	

Daily pork consumption:

C5N3N7		1	2	Total
Normal	Frequency	2	19	21
	Percent	1.94	18.45	20.39
	Row Pct	9.52	90.48	
	Col Pct	12.5	21.84	
Overweight	Frequency	5	36	41
	Percent	4.85	34.95	39.81
	Row Pct	12.2	87.8	
	Col Pct	31.25	41.38	
Obese	Frequency	9	32	41
	Percent	8.74	31.07	39.81
	Row Pct	21.95	78.05	
	Col Pct	56.25	36.78	
Total	Frequency	16	87	103
	Percent	15.53	84.47	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	2.21	0.33
Likelihood Ratio Chi-square	2	2.19	0.33
Mantel-Haenszel Chi-square	1	0.01	0.97
Phi coefficient		**0.15**	
Contingency coefficient		0.15	
Cramer's V		0.15	

Bread consumption per week:

C5N4N1		1	2	Total
Normal	Frequency	21	0	21
	Percent	20.39	0	20.39
	Row Pct	100	0	
	Col Pct	21	0	
Overweight	Frequency	39	2	41
	Percent	37.86	1.94	39.81
	Row Pct	95.12	4.88	
	Col Pct	39	66.67	
Obese	Frequency	40	1	41
	Percent	38.83	0.97	39.81
	Row Pct	97.56	2.44	
	Col Pct	40	33.33	
Total	Frequency	100	3	103
	Percent	97.09	2.91	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	1.22	0.54
Likelihood Ratio Chi-square	2	1.74	0.42
Mantel-Haenszel Chi-square	1	1.21	0.27
Phi coefficient		**0.11**	
Contingency coefficient		0.11	
Cramer's V		0.11	

Porridge consumption per week:

C5N4N2		1	2	Total
Normal	Frequency	19	2	21
	Percent	18.45	1.94	20.39
	Row Pct	90.48	9.52	
	Col Pct	20.65	18.18	
Overweight	Frequency	38	3	41
	Percent	36.89	2.91	39.81
	Row Pct	92.68	7.32	
	Col Pct	41.3	27.27	
Obese	Frequency	35	6	41
	Percent	33.98	5.83	39.81
	Row Pct	85.37	14.63	
	Col Pct	38.04	54.55	
Total	Frequency	92	11	103
	Percent	89.32	10.68	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	1.19	0.55
Likelihood Ratio Chi-square	2	1.18	0.55
Mantel-Haenszel Chi-square	1	0.23	0.63
Phi coefficient		**0.11**	
Contingency coefficient		0.11	
Cramer's V		0.11	

Potatoes consumption per week:

C5N4N3		1	2	Total:
Normal	Frequency	19	2	21
	Percent	18.45	1.94	20.39
	Row Pct	90.48	9.52	
	Col Pct	21.59	13.33	
Overweight	Frequency	37	4	41
	Percent	35.92	3.88	39.81
	Row Pct	90.24	9.76	
	Col Pct	42.05	26.67	
Obese	Frequency	32	9	41
	Percent	31.07	8.74	39.81
	Row Pct	78.05	21.95	
	Col Pct	36.36	60	
Total	Frequency	88	15	103
	Percent	85.44	14.56	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	2.99	0.22
Likelihood Ratio Chi-square	2	2.92	0.23
Mantel-Haenszel Chi-square	1	0.11	0.74
Phi coefficient		**0.17**	
Contingency coefficient		0.17	
Cramer's V		0.17	

Rice consumption per week:

C5N4N4		1	2	Total
Normal	Frequency	17	4	21
	Percent	16.5	3.88	20.39
	Row Pct	80.95	19.05	
	Col Pct	21.79	16	
Overweight	Frequency	34	7	41
	Percent	33.01	6.8	39.81
	Row Pct	82.93	17.07	
	Col Pct	43.59	28	
Obese	Frequency	27	14	41
	Percent	26.21	13.59	39.81
	Row Pct	65.85	34.15	
	Col Pct	34.62	56	
Total	Frequency	78	25	103
	Percent	75.73	24.27	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	3.64	0.16
Likelihood Ratio Chi-square	2	3.59	0.16
Mantel-Haenszel Chi-square	1	0.32	0.57
Phi coefficient		**0.19**	
Contingency coefficient		0.19	
Cramer's V		0.19	

Table 4.43: Comparison between weekly consumption of beans and weight status of the study population

C5N4N5		1	2	Total
Normal	Frequency	11	10	21
	Percent	10.68	9.71	20.39
	Row Pct	52.38	47.62	
	Col Pct	27.5	15.87	
Overweight	Frequency	11	30	41
	Percent	10.68	29.13	39.81
	Row Pct	26.83	73.17	
	Col Pct	27.5	47.62	
Obese	Frequency	18	23	41
	Percent	17.48	22.33	39.81
	Row Pct	43.9	56.1	
	Col Pct	45	36.51	
Total	Frequency	40	63	103
	Percent	38.83	61.17	100

Table 4.44: Statistics for the comparison between weekly bean consumption and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	2	4.55	0.1
Likelihood Ratio Chi-square	2	4.63	0.1
Mantel-Haenszel Chi-square	1	4.33	0.04
Phi coefficient		**0.21**	
Contingency coefficient		0.21	
Cramer's V		0.21	

Soya beans consumption per week:

C5N4N6		1	2	Total
Normal	Frequency	3	18	21
	Percent	2.91	17.48	20.39
	Row Pct	14.29	85.71	
	Col Pct	37.5	18.95	
Overweight	Frequency	3	38	41
	Percent	2.91	36.89	39.81
	Row Pct	7.32	92.68	
	Col Pct	37.5	40	
Obese	Frequency	2	39	41
	Percent	1.94	37.86	39.81
	Row Pct	4.88	95.12	
	Col Pct	25	41.05	
Total	Frequency	8	95	103
	Percent	7.77	92.23	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	1.74	0.42
Likelihood Ratio Chi-square	2	1.57	0.46
Mantel-Haenszel Chi-square	1	0.57	0.45
Phi coefficient		**0.13**	
Contingency coefficient		0.13	
Cramer's V		0.13	

Split peas consumption per week:

C5N4N7		1	2	Total
Normal	Frequency	10	11	21
	Percent	9.71	10.68	20.39
	Row Pct	47.62	52.38	
	Col Pct	20	20.75	
Overweight	Frequency	19	22	41
	Percent	18.45	21.36	39.81
	Row Pct	46.34	53.66	
	Col Pct	38	41.51	
Obese	Frequency	21	20	41
	Percent	20.39	19.42	39.81
	Row Pct	51.22	48.78	
	Col Pct	42	37.74	
Total	Frequency	50	53	103
	Percent	48.54	51.46	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	0.2	0.9
Likelihood Ratio Chi-square	2	0.2	0.9
Mantel-Haenszel Chi-square	1	0.03	0.85
Phi coefficient		**0.05**	
Contingency coefficient		0.05	
Cramer's V		0.05	

Lentils consumption per week:

C5N4N8		1	2	Total
Normal	Frequency	10	11	21
	Percent	9.71	10.68	20.39
	Row Pct	47.62	52.38	
	Col Pct	31.25	15.49	
Overweight	Frequency	10	31	41
	Percent	9.71	30.1	39.81
	Row Pct	24.39	75.61	
	Col Pct	31.25	43.66	
Obese	Frequency	12	29	41
	Percent	11.65	28.16	39.81
	Row Pct	29.27	70.73	
	Col Pct	37.5	40.85	
Total	Frequency	32	71	103
	Percent	31.07	68.93	100

Statistics:

Statistic	DF	Value	Prob
Chi-square	2	3.6	0.17
Likelihood Ratio Chi-square	2	3.46	0.18
Mantel-Haenszel Chi-square	1	3.07	0.08
Phi coefficient		**0.19**	
Contingency coefficient		0.18	
Cramer's V		0.18	

Table 4.46: Correlation between daily fat consumption and weight status in the study population

C5N5		1	2	3	Total
Normal	Frequency	15	5	1	21
	Percent	14.71	4.9	0.98	20.59
	Row Pct	71.43	23.81	4.76	
	Col Pct	16.85	45.45	50	
Overweight	Frequency	37	3	0	40
	Percent	36.27	2.94	0	39.22
	Row Pct	92.5	7.5	0	
	Col Pct	41.57	27.27	0	
Obese	Frequency	37	3	1	41
	Percent	36.27	2.94	0.98	40.2
	Row Pct	90.24	7.32	2.44	
	Col Pct	41.57	27.27	50	
Total	Frequency	89	11	2	102
	Percent	87.25	10.78	1.96	100
Frequency missing = 1					

Table 4.47: Statistics for the correlation between daily fat consumption and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	4	6.6	0.16
Likelihood Ratio Chi-square	4	6.43	0.17
Mantel-Haenszel Chi-square	1	4.83	0.03
Phi coefficient		**0.26**	
Contingency coefficient		0.25	
Cramer's V		0.18	

Table 4.49: Comparison between daily salt consumption and weight status of the study population

C5N6		1	2	3	Total
Normal	Frequency	20	1	0	21
	Percent	19.8	0.99	0	20.79
	Row Pct	95.24	4.76	0	
	Col Pct	21.98	12.5	0	
Overweight	Frequency	36	3	1	40
	Percent	35.64	2.97	0.99	39.6
	Row Pct	90	7.5	2.5	
	Col Pct	39.56	37.5	50	
Obese	Frequency	35	4	1	40
	Percent	34.65	3.96	0.99	39.6
	Row Pct	87.5	10	2.5	
	Col Pct	38.46	50	50	
Total	Frequency	91	8	2	101
	Percent	90.1	7.92	1.98	100
Frequency missing = 2					

Table 4.50: Statistics for the comparison between daily salt consumption and weight status in the study population

Statistic	DF	Value	Prob
Chi-square	4	1.11	0.89
Likelihood Ratio Chi-square	4	1.54	0.82
Mantel-Haenszel Chi-square	1	0.36	0.55
Phi coefficient		**0.11**	
Contingency coefficient		0.1	
Cramer's V		0.07	

Table 4.52: Comparison between daily water consumption and weight status of the study population

C5N7		1	2	Total
Normal	Frequency	16	5	21
	Percent	15.53	4.85	20.39
	Row Pct	76.19	23.81	
	Col Pct	19.51	23.81	
Overweight	Frequency	33	8	41
	Percent	32.04	7.77	39.81
	Row Pct	80.49	19.51	
	Col Pct	40.24	38.1	
Obese	Frequency	33	8	41
	Percent	32.04	7.77	39.81
	Row Pct	80.49	19.51	
	Col Pct	40.24	38.1	
Total	Frequency	82	21	103
	Percent	79.61	20.39	100

Table 4.53: Statistics for the comparison between daily water consumption and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	2	0.19	0.91
Likelihood Ratio Chi-square	2	0.19	0.91
Mantel-Haenszel Chi-square	1	0.12	0.73
Phi coefficient		**0.04**	
Contingency coefficient		0.04	
Cramer's V		0.04	

Table 4.55: Comparison between the frequency of patients finding it difficult to obtain the right food and weight status of the study population

C5N8		1	2	Total
Normal	Frequency	14	7	21
	Percent	13.59	6.8	20.39
	Row Pct	66.67	33.33	
	Col Pct	26.92	13.73	
Overweight	Frequency	17	24	41
	Percent	16.5	23.3	39.81
	Row Pct	41.46	58.54	
	Col Pct	32.69	47.06	
Obese	Frequency	21	20	41
	Percent	20.39	19.42	39.81
	Row Pct	51.22	48.78	
	Col Pct	40.38	39.22	
Total	Frequency	52	51	103
	Percent	50.49	49.51	100

Table 4.56: Statistics for the comparison between the frequency of patients finding it difficult to obtain the right food and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	2	3.54	0.17
Likelihood Ratio Chi-square	2	3.59	0.17
Mantel-Haenszel Chi-square	1	3.43	0.06
Phi coefficient		**0.19**	
Contingency coefficient		0.18	
Cramer's V		0.19	

Table 4.58: Correlation between frequency of patients finding it difficult to follow a specific diet and weight status of the study population

C5N9		1	2	Total
Normal	Frequency	0	21	21
	Percent	0	20.39	20.39
	Row Pct	0	100	
	Col Pct	0	21	
Overweight	Frequency	1	40	41
	Percent	0.97	38.83	39.81
	Row Pct	2.44	97.56	
	Col Pct	33.33	40	
Obese	Frequency	2	39	41
	Percent	1.94	37.86	39.81
	Row Pct	4.88	95.12	
	Col Pct	66.67	39	
Total	Frequency	3	100	103
	Percent	2.91	97.09	100

Table 4.59: Statistics for the correlation between the frequency of patients finding it difficult to follow a specific diet and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	2	1.22	0.54
Likelihood Ratio Chi-square	2	1.74	0.42
Mantel-Haenszel Chi-square	1	0.11	0.75
Phi coefficient		**0.11**	
Contingency coefficient		0.11	
Cramer's V		0.11	

Table 4.61: Comparison between last sessions attended with dietician and weight status of the study population

C5N10		1	2	3	Total
Normal	Frequency	2	4	15	21
	Percent	1.94	3.88	14.56	20.39
	Row Pct	9.52	19.05	71.43	
	Col Pct	16.67	33.33	18.99	
Overweight	Frequency	5	7	29	41
	Percent	4.85	6.8	28.16	39.81
	Row Pct	12.2	17.07	70.73	
	Col Pct	41.67	58.33	36.71	
Obese	Frequency	5	1	35	41
	Percent	4.85	0.97	33.98	39.81
	Row Pct	12.2	2.44	85.37	
	Col Pct	41.67	8.33	44.3	
Total	Frequency	12	12	79	103
	Percent	11.65	11.65	76.7	100

Table 4.62: Statistics for the comparison between the last sessions attended with dietician and weight status of the study population

Statistic	DF	Value	Prob
Chi-square	4	5.78	0.22
Likelihood Ratio Chi-square	4	6.92	0.14
Mantel-Haenszel Chi-square	1	0.15	0.7
Phi coefficient		**0.24**	
Contingency coefficient		0.23	
Cramer's V		0.17	

APPENDIX C

Correlation between gender, race and family history with different diabetes groups

Table 4.4: Correlation between diabetes groups and races in studied population

A7		1	2	3	Total
Black	Frequency	1	38	27	66
	Percent	0.97	36.89	26.21	64.08
	Row Pct	1.52	57.58	40.91	
	Col Pct	25	59.38	77.14	
White	Frequency	3	11	5	19
	Percent	2.91	10.68	4.85	18.45
	Row Pct	15.79	57.89	26.32	
	Col Pct	75	17.19	14.29	
Colored	Frequency	0	15	3	18
	Percent	0	14.56	2.91	17.48
	Row Pct	0	83.33	16.67	
	Col Pct	0	23.44	8.57	
Total	Frequency	4	64	35	103
	Percent	3.88	62.14	33.98	100

Table 4.5: Statistics for the correlation between different diabetes groups and races in the studied population

Statistic	DF	Value	Prob
Chi-square	4	13.02	0.01
Likelihood Ratio Chi-square	4	11.18	0.03
Mantel-Haenszel Chi-square	1	4.08	0.04
Phi coefficient		**0.36**	
Contingency coefficient		0.34	
Cramer's V		0.25	

Table 4.8: Correlation between gender and different diabetes groups in the studied population

A3		1	2	3	Total
Male	Frequency	0	14	16	30
	Percent	0	13.59	15.53	29.16
	Row Pct	0	46.67	53.33	
	Col Pct	0	21.88	45.71	
Female	Frequency	4	50	19	73
	Percent	3.88	48.54	18.45	70.87
	Row Pct	5.48	68.49	26.03	
	Col Pct	100	78.13	54.29	
Total	Frequency	4	64	35	103
	Percent	3.88	62.14	33.98	100

Table 4.9: Statistics for the correlation between different diabetes groups and gender in the studied population

Statistic	DF	Value	Prob
Chi-square	2	7.94	0.02
Likelihood Ratio Chi-square	2	8.77	0.01
Mantel-Haenszel Chi-square	1	7.86	0.01
Phi coefficient		**0.28**	
Contingency coefficient		0.27	
Cramer's V		0.28	

Table 4.11: Correlation between different groups of diabetes and inheritance tendency, where one or more family member suffered from the disease

B3		1	2	3	Total
Yes	Frequency	3	27	13	43
	Percent	2.91	26.21	12.62	41.75
	Row Pct	6.98	62.79	30.23	
	Col Pct	75	42.19	37.14	
No	Frequency	1	37	22	60
	Percent	0.97	35.92	21.36	58.25
	Row Pct	1.67	61.67	36.67	
	Col Pct	25	57.81	62.86	
Total	Frequency	4	64	35	103
	Percent	3.88	62.14	33.98	100

Table 4.12: Statistics for the correlation between different diabetes groups and inheritance tendency, where one or more family member suffered from diabetes

Statistic	DF	Value	Prob
Chi-square	2	2.13	0.35
Likelihood Ratio Chi-square	2	2.14	0.34
Mantel-Haenszel Chi-square	1	1.19	0.28
Phi coefficient		**0.14**	
Contingency coefficient		0.14	
Cramer's V		0.14	

Table 4.13: Correlation between different diabetes groups and close family members with diabetes

B3		1	2	3	Total
Yes	Frequency	3	35	21	59
	Percent	2.91	33.98	20.39	57.28
	Row Pct	5.08	59.32	35.59	
	Col Pct	75	54.69	60	
No	Frequency	1	29	14	44
	Percent	0.97	28.16	13.59	42.72
	Row Pct	2.27	65.91	31.82	
	Col Pct	25	45.31	40	
Total	Frequency	4	64	35	103
	Percent	3.88	62.14	33.98	100

Table 4.14: Statistics for the correlation between different diabetes groups and close family members with diabetes

Statistic	DF	Value	Prob
Chi-square	2	0.8	0.67
Likelihood Ratio Chi-square	2	0.83	0.66
Mantel-Haenszel Chi-square	1	0.01	0.93
Phi coefficient		**0.09**	
Contingency coefficient		0.09	
Cramer's V		0.09	

APPENDIX D

Correlation between different diabetes groups, weight status and blood glucose control

1 Normal weight patients in the study population

Table 4.83: Correlation between the frequency of normal weight patients in the study and the frequency of blood glucose measurement

F2		1	5	6	9	Total
Group A	Frequency	1	0	0	0	1
	Percent	4.76	0	0	0	4.76
	Row Pct	100	0	0	0	
	Col Pct	20	0	0	0	
Group B	Frequency	2	1	1	6	10
	Percent	9.52	4.76	4.76	28.57	47.62
	Row Pct	20	10	10	60	
	Col Pct	40	100	100	42.86	
Group C	Frequency	2	0	0	8	10
	Percent	9.52	0	0	38.1	47.62
	Row Pct	20	0	0	80	
	Col Pct	40	0	0	57.14	
Total	Frequency	5	1	1	14	21
	Percent	23.81	4.76	4.76	66.67	100

Table 4.84: Statistics for the correlation between the frequency of normal weight patients in the study and the frequency of blood glucose measurement

Statistic	DF	Value	Prob
Chi-square	6	5.76	0.45
Likelihood Ratio Chi-square	6	6.1	0.41
Mantel-Haenszel Chi-square	1	1.72	0.19
Phi coefficient		**0.52**	
Contingency coefficient		0.46	
Cramer's V		0.37	

Table 4.90: Correlation between the frequency of normal weight patients in the study and their average blood glucose levels

F3		2	3	4	Total
Group A	Frequency	0	1	0	1
	Percent	0	4.76	0	4.76
	Row Pct	0	100	0	
	Col Pct	0	11.11	0	
Group B	Frequency	2	5	3	10
	Percent	9.52	23.81	14.29	4.62
	Row Pct	20	50	30	
	Col Pct	33.33	55.56	50	
Group C	Frequency	4	3	3	10
	Percent	19.05	14.29	14.29	47.62
	Row Pct	40	30	30	
	Col Pct	66.67	33.33	50	
Total	Frequency	6	9	6	21
	Percent	28.57	42.86	28.57	100

Table 4.91: Statistics for the correlation between the frequency of normal weight patients in the study and their average blood glucose levels

Statistic	DF	Value	Prob
Chi-square	4	2.57	0.63
Likelihood Ratio Chi-square	4	2.95	0.57
Mantel-Haenszel Chi-square	1	0.23	0.63
Phi coefficient		**0.35**	
Contingency coefficient		0.33	
Cramer's V		0.25	

Table 4.97: Correlation between frequency of normal weight patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L)

F4		1	2	3	4	Total
Group A	Frequency	0	1	0	0	1
	Percent	0	4.76	0	0	4.76
	Row Pct	0	100	0	0	
	Col Pct	0	16.67	0	0	
Group B	Frequency	7	1	1	1	10
	Percent	33.33	4.76	4.76	4.76	47.62
	Row Pct	70	10	10	10	
	Col Pct	53.85	16.67	100	100	
Group C	Frequency	6	4	0	0	10
	Percent	28.57	19.05	0	0	47.62
	Row Pct	60	40	0	0	
	Col Pct	46.15	66.67	0	0	
Total	Frequency	13	6	1	1	21
	Percent	61.9	28.57	4.76	4.76	100

Table 4.98: Statistics for the correlation between frequency of normal weight patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L)

Statistic	DF	Value	Prob
Chi-square	6	6.38	0.38
Likelihood Ratio Chi-square	6	7.41	0.29
Mantel-Haenszel Chi-square	1	0.62	0.43
Phi coefficient		**0.55**	
Contingency coefficient		0.48	
Cramer's V		0.39	

Table 4.105: Correlation between normal weight patients in the study population and patients experiencing elevated blood glucose levels (≥ 10 mmol/L)

F6		1	2	3	4	Total
Group A	Frequency	0	1	0	0	1
	Percent	0	4.76	0	0	4.76
	Row Pct	0	100	0	0	
	Col Pct	0	20	0	0	
Group B	Frequency	4	1	1	4	10
	Percent	19.05	4.76	4.76	19.05	47.62
	Row Pct	40	10	10	40	
	Col Pct	66.67	20	20	80	
Group C	Frequency	2	3	4	1	10
	Percent	9.52	14.29	19.05	4.76	47.62
	Row Pct	20	30	40	10	
	Col Pct	33.33	60	80	20	
Total	Frequency	6	5	5	5	21
	Percent	28.57	23.81	23.81	23.81	100

Table 4.106: Statistics for the correlation between normal weight patients in the study population and patients experiencing elevated blood glucose levels (≥ 10 mmol/L)

Statistic	DF	Value	Prob
Chi-square	6	8.68	0.2
Likelihood Ratio Chi-square	6	8.62	0.2
Mantel-Haenszel Chi-square	1	0.01	0.96
Phi coefficient		**0.64**	
Contingency coefficient		0.54	
Cramer's V		0.46	

2 Overweight patients in the study population

Table 4.85: Correlation between the frequency of overweight patients in the study and the frequency of blood glucose measurement

F2		1	3	5	6	9	Total
Group A	Frequency	1	1	1	0	0	3
	Percent	2.44	2.44	2.44	0	0	7.32
	Row Pct	33.33	33.33	33.33	0	0	
	Col Pct	25	100	33.33	0	0	
Group B	Frequency	2	0	1	0	23	26
	Percent	4.88	0	2.44	0	56.1	63.41
	Row Pct	7.69	0	3.85	0	88.46	
	Col Pct	50	0	33.33	0	74.19	
Group C	Frequency	1	0	1	2	8	12
	Percent	2.44	0	2.44	4.88	19.51	29.27
	Row Pct	8.33	0	8.33	16.67	66.67	
	Col Pct	25	0	33.33	100	25.81	
Total	Frequency	4	1	3	2	31	41
	Percent	9.76	2.44	7.32	4.88	75.61	100

Table 4.86: Statistics for the correlation between the frequency of overweight patients in the study and the frequency of blood glucose measurement

Statistic	DF	Value	Prob
Chi-square	8	25.53	0.001
Likelihood Ratio Chi-square	8	18.55	0.02
Mantel-Haenszel Chi-square	1	1.65	0.2
Phi coefficient		**0.79**	
Contingency coefficient		0.62	
Cramer's V		0.56	

Table 4.92: Correlation between the frequency of overweight patients in the study and their average blood glucose levels

F3		2	3	4	Total
Group A	Frequency	0	3	0	3
	Percent	0	7.32	0	7.32
	Row Pct	0	100	0	
	Col Pct	0	11.54	0	
Group B	Frequency	2	17	7	26
	Percent	4.88	41.46	17.07	63.41
	Row Pct	7.69	65.38	26.92	
	Col Pct	100	65.38	53.85	
Group C	Frequency	0	6	6	12
	Percent	0	14.63	14.63	29.27
	Row Pct	0	50	50	
	Col Pct	0	23.08	46.15	
Total	Frequency	2	26	13	41
	Percent	4.88	63.41	31.71	100

Table 4.93: Statistics for the correlation between the frequency of overweight patients in the study and their average blood glucose levels

Statistic	DF	Value	Prob
Chi-square	4	4.55	0.34
Likelihood Ratio Chi-square	4	5.92	0.21
Mantel-Haenszel Chi-square	1	3.28	0.07
Phi coefficient		**0.33**	
Contingency coefficient		0.32	
Cramer's V		0.24	

Table 4.99: Correlation between frequency of overweight patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L)

F4		1	2	3	Total
Group A	Frequency	1	1	1	3
	Percent	2.44	2.44	2.44	7.32
	Row Pct	33.33	33.33	33.33	
	Col Pct	3.45	10	50	
Group B	Frequency	21	4	1	26
	Percent	51.22	9.76	2.44	63.41
	Row Pct	80.77	15.38	3.85	
	Col Pct	72.41	40	50	
Group C	Frequency	7	5	0	12
	Percent	17.07	12.2	0	29.27
	Row Pct	58.33	41.67	0	
	Col Pct	24.14	50	0	
Total	Frequency	29	10	2	41
	Percent	70.73	24.39	4.88	100

Table 4.100: Statistics for the correlation between frequency of overweight patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L)

Statistic	DF	Value	Prob
Chi-square	4	9.28	0.06
Likelihood Ratio Chi-square	4	7.03	0.13
Mantel-Haenszel Chi-square	1	0.27	0.61
Phi coefficient		**0.48**	
Contingency coefficient		0.43	
Cramer's V		0.34	

Table 4.107: Correlation between overweight patients in the study population and patients experiencing elevated blood glucose levels (≥ 10 mmol/L)

F6		1	2	3	4	Total
Group A	Frequency	0	0	2	1	3
	Percent	0	0	4.88	2.44	7.32
	Row Pct	0	0	66.67	33.33	
	Col Pct	0	0	15.38	10	
Group B	Frequency	5	5	9	7	26
	Percent	12.2	12.2	21.95	17.07	63.41
	Row Pct	19.23	19.23	34.62	26.92	
	Col Pct	62.5	50	69.23	70	
Group C	Frequency	3	5	2	2	12
	Percent	7.32	12.2	4.88	4.88	29.27
	Row Pct	25	41.67	16.67	16.67	
	Col Pct	37.5	50	15.38	20	
Total	Frequency	8	10	13	10	41
	Percent	19.51	24.39	31.71	24.39	100

Table 4.108: Statistics for the correlation between overweight patients in the study population and patients experiencing elevated blood glucose levels (≥ 10 mmol/L)

Statistic	DF	Value	Prob
Chi-square	6	5.8	0.45
Likelihood Ratio Chi-square	6	6.8	0.34
Mantel-Haenszel Chi-square	1	2.83	0.09
Phi coefficient		**0.38**	
Contingency coefficient		0.35	
Cramer's V		0.27	

3 Obese patients in the study population

Table 4.87: Correlation between the frequency of obese patients in the study and the frequency of blood glucose measurement

F2		1	2	3	5	6	9	Total
Group B	Frequency	3	1	0	2	1	21	28
	Percent	7.32	2.44	0	4.88	2.44	51.22	68.29
	Row Pct	10.71	3.57	0	7.14	3.57	75	
	Col Pct	50	100	0	100	100	72.41	
Group C	Frequency	3	0	2	0	0	8	13
	Percent	7.32	0	4.88	0	0	19.51	31.71
	Row Pct	23.08	0	15.38	0	0	61.54	
	Col Pct	50	0	100	0	0	27.59	
Total	Frequency	6	1	2	2	1	29	41
	Percent	14.63	2.44	4.88	4.88	2.44	70.73	100

Table 4.88: Statistics for the correlation between the frequency of obese patients in the study and the frequency of blood glucose measurement

Statistic	DF	Value	Prob
Chi-square	5	7.32	0.2
Likelihood Ratio Chi-square	5	8.74	0.12
Mantel-Haenszel Chi-square	1	1.44	0.23
Phi coefficient		**0.42**	
Contingency coefficient		0.39	
Cramer's V		0.42	

Table 4.94: Correlation between the frequency of obese patients in the study and their average blood glucose levels

F3		2	3	4	Total
Group B	Frequency	6	12	10	28
	Percent	14.63	29.27	24.39	68.29
	Row Pct	21.43	42.86	35.71	
	Col Pct	85.71	60	71.43	
Group C	Frequency	1	8	4	13
	Percent	2.44	19.51	9.76	31.71
	Row Pct	7.69	61.54	30.77	
	Col Pct	14.29	40	28.57	
Total	Frequency	7	20	14	41
	Percent	17.07	48.78	34.15	100

Table 4.95: Statistics for the correlation between the frequency of obese patients in the study and their average blood glucose levels

Statistic	DF	Value	Prob
Chi-square	2	1.68	0.43
Likelihood Ratio Chi-square	2	1.81	0.41
Mantel-Haenszel Chi-square	1	0.14	0.71
Phi coefficient		**0.2**	
Contingency coefficient		0.2	
Cramer's V		0.2	

Table 4.101: Correlation between frequency of obese patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L)

F4		1	2	3	4	Total
Group B	Frequency	24	4	0	0	28
	Percent	58.54	9.76	0	0	68.29
	Row Pct	85.71	14.29	0	0	
	Col Pct	75	66.67	0	0	
Group C	Frequency	8	2	2	1	13
	Percent	19.51	4.88	4.88	2.44	31.71
	Row Pct	61.54	15.38	15.38	7.69	
	Col Pct	25	33.33	100	100	
Total	Frequency	32	6	2	1	41
	Percent	78.05	14.63	4.88	2.44	100

Table 4.102: Statistics for the correlation between the frequency of obese patients in the study population and patients experiencing low blood glucose levels (≤ 3 mmol/L)

Statistic	DF	Value	Prob
Chi-square	3	7.13	0.07
Likelihood Ratio Chi-square	3	7.59	0.06
Mantel-Haenszel Chi-square	1	5.68	0.02
Phi coefficient		**0.42**	
Contingency coefficient		0.39	
Cramer's V		0.42	

Table 4.109: Correlation between obese patients in the study population and patients experiencing elevated blood glucose levels (≥ 10 mmol/L)

F6		1	2	3	4	Total
Group B	Frequency	11	4	4	9	28
	Percent	26.83	9.76	9.76	21.95	68.29
	Row Pct	39.29	14.29	14.29	32.14	
	Col Pct	73.33	57.14	57.14	75	
Group C	Frequency	4	3	3	3	13
	Percent	9.76	7.32	7.32	7.32	31.71
	Row Pct	30.77	23.08	23.08	23.08	
	Col Pct	26.67	42.86	42.86	25	
Total	Frequency	15	7	7	12	41
	Percent	36.59	17.07	17.07	29.27	100

Table 4.110: Correlation between obese patients in the study population and patients experiencing elevated blood glucose levels (≥ 10 mmol/L)

Statistic	DF	Value	Prob
Chi-square	3	1.23	0.75
Likelihood Ratio Chi-square	3	1.21	0.75
Mantel-Haenszel Chi-square	1	0.0004	0.98
Phi coefficient		**0.17**	
Contingency coefficient		0.17	
Cramer's V		0.17	

APPENDIX E

Questionnaire numbering translated

1 Section B

Questionnaire number	Translation
1	B1
3.1	B3N1
3.2	B3N2
3.3	B3N3
3.4	B3N4

2 Section C

Questionnaire number	Translation
2.1	C2N1
2.2.1	C2N2N1
2.2.2	C2N2N2
2.2.3	C2N2N3
2.3	C2N3
3.1	C3N1
3.2	C3N2
3.3	C3N3
3.4	C3N4
4.1.1	C4N1N1
4.1.2	C4N1N2
4.1.3	C4N1N3
5.1.1	C5N1N1
5.1.2	C5N1N2
5.1.3	C5N1N3
5.1.4	C5N1N4
5.1.5	C5N1N5
5.1.6	C5N1N6
5.1.7	C5N1N7
5.2	C5N2
5.3.1	C5N3N1
5.3.2	C5N3N2
5.3.3	C5N3N3
5.3.4	C5N3N4
5.3.5	C5N3N5
5.3.6	C5N3N6
5.3.7	C5N3N7
5.4.1	C5N4N1
5.4.2	C5N4N2
5.4.3	C5N4N3

Section C continues:

Questionnaire number	Translation
5.4.4	C5N4N4
5.4.5	C5N4N5
5.4.6	C5N4N6
5.4.7	C5N4N7
5.4.8	C5N4N8
5.5	C5N5
5.6	C5N6
5.7	C5N7
5.8	C5N8
5.9	C5N9
5.1	C5N10
5.11.1	C5N11N1
5.11.2	C5N11N2
5.11.3	C5N11N3

3 Section D

Questionnaire number	Translation
1.1	D1N1
1.2	D1N2
1.3	D1N3
1.4	D1N4
1.5	D1N5
1.6	D1N6
1.7	D1N7
2	D2
3.1	D3N1
3.2	D3N2
3.3	D3N3
3.4	D3N4

4 Section E

Questionnaire number	Translation
1	E1
2.1	E2N1
2.2	E2N2
2.3	E2N3
2.4	E2N4
3.1	E3N1
3.2	E3N2

Section E continues:

Questionnaire number	Translation
4	E4
5	E5
5.1.1	E5N1N1
5.1.2	E5N1N2
5.1.3	E5N1N3
5.1.4	E5N1N4
5.2.1	E5N2N1
5.2.2	E5N2N2
5.2.3	E5N2N3
5.2.4	E5N2N4
6.1.1	E6N1N1
6.1.2	E6N1N2
6.1.3	E6N1N3
6.2.1	E6N2N1
6.2.2A	E6N2N2A
6.2.2B	E6N2N2B
6.2.2C	E6N2N2C
6.2.3	E6N2N3

5 Section F

Questionnaire number	Translation
1.1	F1N1
2	F2
3	F3
4	F4
5.1	F5N1
5.2	F5N2
5.3	F5N3
5.4	F5N4
5.5	F5N5
5.6	F5N6
6	F6
7.1	F7N1
7.2	F7N2
7.3	F7N3
7.4	F7N4
7.5	F7N5
7.6	F7N6
8.1	F8N1
8.2	F8N2
8.3.1	F8N3N1
8.3.2	F8N3N2
8.3.3	F8N3N3
8.3.4	F8N3N4

Section F continues:

Questionnaire number	Translation
8.3.5	F8N3N5
8.4.1	F8N4N1
8.4.2	F8N4N2
8.4.3	F8N4N3
8.4.4	F8N4N4
8.5.1	F8N5N1
8.5.2	F8N5N2
8.5.3	F8N5N3
9.1	F9N1
9.2	F9N2
9.3	F9N3
9.4	F9N4

6 Section G

Questionnaire number	Translation
1	G1
2.1	G2N1
2.2	G2N2
2.3	G2N3
2.4	G2N4
2.5	G2N5
2.6	G2N6
2.7	G2N7
2.8	G2N8
3	G3

Appendix F

Questionnaire

Section A: Demographic Information

1 Name _____

2 Title _____

3 Gender

Yes	No
1	2

4.1 Date of birth _____

4.2 Age at last birthday _____

4.3 Approximate age _____

5 Postal address _____

_____

_____

_____

6 Phone _____

7 Race

Black (African)	1
White	2
Coloured	3
Indian	4

8 Language

Yes	No
1	2

Section B: Diagnostic Data

1 What is the classification of your diabetes?

Type 1	1
Type 2	2
Type 2 requiring insulin	3
Gestational	4

2 For how many years have you had diabetes? _____

3 Is there a history of diabetes in your family?

3.1	Brother/Sister	1
3.2	Mother/Father	2
3.3	Grandparents	3
3.4	Aunt/Uncle	4

Section C: Lifestyle

1 Please specify your weight and height:

1.1 Weight _____

1.2 Height _____

2 Exercise

2.1 Do you exercise?

Yes	No
1	2

2.2 What type?

		Yes	No
2.2.1	Walk to work	1	2
2.2.2	Walk/run for exercise	1	2
2.2.3	Gym	1	2

2.3 How often do you exercise?

Less than once a week	1
2 – 3 Times a week	2
5 Times a week	3

3 Smoking

3.1 Do you smoke?

Yes	No
1	2

3.2 How many a day?

1	2	3	4
1 - 10	11 - 20	21 - 30	30 +

3.3 For how many years? _____

3.4 Are you considering quitting?

Yes	No
1	2

4 Alcohol

4.1 What quantity of alcohol do you use per week (number of beers, glasses of wine or standard measures of spirits)?

		1	2	3	4
4.1.1	Beer	1 - 2	3 - 4	5 - 6	2
4.1.2	Wine	1 - 2	3 - 4	5 - 6	3
4.1.3	Spirits	1 - 2	3 - 4	5 - 6	4

5 Diet

5.1 What are your reasons for eating?

		Yes	No
5.1.1	Hungry	1	2
5.1.2	Stress	1	2
5.1.3	Frustration	1	2
5.1.4	Depression	1	2
5.1.5	For energy	1	2
5.1.6	To stay healthy	1	2
5.1.7	Dietician/Prescribed	1	2

5.2 How many meals do you eat per day?

2 Meals	1
3 Meals	2
3 Meals with 2 - 3 snacks	3
5 – 6 Meals	4

5.3 Do you eat every day?

		Yes	No
5.3.1	Fruit (3 – 4 servings)	1	2
5.3.2	Vegetables (3 – 4 servings)	1	2
5.3.3	Chicken	1	2
5.3.4	Fish	1	2
5.3.5	Mutton	1	2
5.3.6	Beef	1	2
5.3.7	Pork	1	2

5.4 Do you eat more than 3 times a week:

		Yes	No
5.4.1	Bread	1	2
5.4.2	Porridge	1	2
5.4.3	Potatoes	1	2
5.4.4	Rice	1	2
5.4.5	Dried beans	1	2
5.4.6	Soya beans	1	2
5.4.7	Split peas	1	2
5.4.8	Lentils	1	2

5.5 How much fat do you use per day?

1 – 2 tsp	1
3 – 4 tsp	2
More	3

5.6 How much salt do you use per day?

1 – 2 tsp	1
3 – 4 tsp	2
More	3

5.7 Do you drink lots of safe, clean water, 6-8 glasses per day?

Yes	No
1	2

5.8 Do you have problems to get the right food for your diabetes?

Yes	No
1	2

❖ **Please specify** _____

_____

_____

5.9 Do you have problems to follow the diet?

Yes	No
1	2

❖ **Please specify** _____

_____

_____

5.10 When was the last time that you attended a session with a registered dietician?

0 – 6 months	1
7 – 12 months	2
More than a year	3

5.11 Did you visit any of the following in the past year?

		Yes	No
5.11.1	Dentist	1	2
5.11.2	Podiatrist	1	2
5.11.3	Ophthalmologist	1	2

Section D: Well-being

1 Strong feelings about diabetes are common. Regarding diabetes, have you recently felt:

		Yes	No
1.1	Angry	1	2
1.2	Sad	1	2
1.3	Afraid	1	2
1.4	Alone	1	2
1.5	Guilty	1	2
1.6	Uninformed	1	2
1.7	Depressed	1	2

2 Are you seeing close friends and families less often?

Yes	No
1	2

3 Are you suffering physical complaints such as:

		Yes	No
3.1	Aches	1	2
3.2	Pains	1	2
3.3	Headaches	1	2
3.4	Lingering	1	2

Section E: Compliance

1 Do you take your medication according to your doctor's prescription?

Seldom	1
Sometimes	2
Most of the time	3
Always	4

2 What is the reason for not taking your medication?

		Yes	No
2.1	Side effects	1	2
2.2	Forgot	1	2
2.3	Felt to ill	1	2
2.4	Not important	1	2

3.1 Has the doctor adjusted your medication?

Yes	No
1	2

3.2 What was the main reason?

Symptoms	1
Blood glucose	2
Previous dose not taken	3

4 Which of the following do you use to control your diabetes?

Insulin	1
Tablets	2
Combination of tablets and insulin	3

5 Insulin

Actraphane®	1
Actrapid®	2
Protophane®	3

5.1 Where do you give your injections?

		Yes	No
5.1.1	Stomach	1	2
5.1.2	Back of upper arm	1	2
5.1.3	Upper buttocks	1	2
5.1.4	Outer sides of thighs	1	2

5.2 Any problems with injection sites?

		Yes	No
5.2.1	Bleeding	1	2
5.2.2	Pitting	1	2
5.2.3	Lumping	1	2
5.2.4	Skin infections	1	2

6 Tablets

		Yes	No
6.1.1	Metformin	1	2

			Yes	No
6.1.2	Dosage	500mg 3x/day	1	2
		850mg 2x/day	1	2

		Yes	No
6.1.3	With meals	1	2

		Yes	No
6.2.1	Gliclazide	1	2

			Yes	No
6.2.2	Dosage	40 – 80mg/day	1	2
		160mg/day	1	2
		320mg/day	1	2

		Yes	No
6.2.3	With meals	1	2

Section F: Monitoring

1.1 Do you have your own blood sugar monitor?

Yes	No
1	2

1.2 Type: _____

2 How many times do you measure your blood glucose?

2.1 Weekly:

One time	1
Two times	2
Three times	3
More than 3 times	4

2.2 Daily:

One time	1
Two times	2
Three times	3
More than 3 times	4

3 What is your average reading?

≤ 3mmol/L	1
3 – 5mmol/L	2
6 – 9mmol/L	3
≥ 3mmol/L	4

4 How often do you have a blood sugar reading of 3mmol/L or less?

Never	1
Once a month	2
Once in 2 weeks	3
Once a week or more	4

5 Do you experience and of the following when your blood sugar is low?

		Yes	No
5.1	Trembling	1	2
5.2	Clamminess	1	2
5.3	Palpitations	1	2
5.4	Anxiety	1	2
5.5	Sweating	1	2
5.6	Hunger	1	2

6 How often do you have a blood sugar reading of 10mmol/L or more?

Never	1
Once a month	2
Once in 2 weeks	3
Once a week or more	4

7 Do you experience any of the following when your blood sugar is high?

		Yes	No
7.1	Fatigue	1	2
7.2	Hunger	1	2
7.3	Thirst	1	2
7.4	Increased urination	1	2
7.5	Change in vision	1	2
7.6	Decreased	1	2

8 Have you ever had:

		Yes	No
8.1	Diabetic coma	1	2
8.2	Insulin shock	1	2

8.3 Recurrent:

		Yes	No
8.3.1	Tonsillitis	1	2
8.3.2	Boils	1	2
8.3.3	Abscessed teeth	1	2
8.3.4	Bladder infection	1	2
8.3.5	Kidney infection	1	2

8.4 Disorder of vision:

		Yes	No
8.4.1	Blurred vision	1	2
8.4.2	Double vision	1	2
8.4.3	Visual halo	1	2
8.4.4	Floaters	1	2

8.5 *Heart trouble:*

		Yes	No
8.5.1	Angina	1	2
8.5.2	Ischemic heart disease	1	2
8.5.3	Heart failure	1	2

9 Do you have concerns about the complications of diabetes?

		Yes	No
9.1	Nephropathy	1	2
9.2	Neuropathy	1	2
9.3	Retinopathy	1	2
9.4	Heart disease	1	2

Section G: Consultation

1 How often did you consult your doctor during the previous 12 months?

	Yes	No
1 – 2 Times	1	2
3 – 5 Times	1	2
6 – 8 Times	1	2
More	1	2

2 What were the reasons for the consultation?

		Yes	No
2.1	Diabetes control or routine check-up	1	2
2.2	Repeat prescription	1	2
2.3	Changing or adjusting medication	1	2
2.4	Infections	1	2
2.5	Not feeling well	1	2
2.6	Sugar levels to high	1	2
2.7	Sugar levels to low	1	2
2.8	Complications	1	2

3 Have you been hospitalised for diabetes?

Yes	No
1	2

APPENDIX G

Form of Consent

Toestemming

Titel van projek: .....

.....

Ek was die geleentheid gegun om tersaaklike aspekte van die projek met die projekleier te bespreek en ek verklaar hiermee dat ek vrywillig aan die projek deelneem. Ek gee hiermee my toestemming om as deelnemer in bogenoemde projek op te tree.

Ek vrywaar hiermee die Universiteit asook enige werknemer of student van die Universiteit, teen enige aanspreeklikheid wat teenoor my, in die loop van die projek mag ontstaan.

Ek onderneem verder om geen eise teen die Universiteit in te stel weens skade of persoonlikheidsnadeel wat ek weens die projek/proef of die toedoen van ander proefpersone mag ly nie, tensy dit aan die nalatigheid van die Universiteit, sy werknemers of studente te wyte is.

..... (Handtekening van proefpersoon)

Onderteken te ..... op .....

Vir alle navorsing en intervensies op deelnemers onder die ouderdom van 21 jaar is die skriftelike toestemming van die ouer of wettige voog nodig.

Hiermee gee ek ..... (volle name) ouer of wettige voog van die deelnemer hierbo genoem toestemming dat hy/sy aan hierdie projek mag deelneem en ek vrywaar hiermee die Universiteit asook enige werknemer of student van die Universiteit, teen enige aanspreeklikheid wat teenoor my in die loop van die projek mag ontstaan tensy sodanige besering, skade of dood veroorsaak is deur nalatigheid van die Universiteit, sy personeel of sy studente.

Handtekening ..... Datum .....

Verwantskap .....