FACTORS THAT INFLUENCE GLYCAEMIC CONTROL IN DIABETES MELLITUS: A CASE STUDY OF KENYATTA NATIONAL HOSPITAL.

BY

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A Thesis submitted in partial fulfillment of the requirement for the Degree of Master of Science in Foods, Nutrition and Dietetics.
Declaration

This Thesis is my original work and has not been presented for the degree in any other university or any other award.

2005
Edwina Adhiambo Ochieng

I/We confirm that the candidate under my/our supervision carried out the work reported in this thesis.

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Department of foods Nutrition and Dietetics
Kenyatta University
Dedication

This thesis is dedicated to my husband Duncan, my daughter Kimberly, and my son Davin whose constant support and encouragement sustained through this process.

I am grateful to my supervisors Prof. Judith Wondo and Dr. Nola Arunga for their valuable time and skills to scrutinize this thesis.

I am grateful to Dr. Enoch Omolo of KNH, Dr. Ngaigia Muli with KEMSA, and the diabetes patients who participated in the study without whom this study could not have been completed. Thanks to Mr. Amelia Obue departmental head of the Department of Science and Technology for statistical assistance and Miss Deborah Omungo for computer services.

Finally, but most of all, I extend my sincere gratitude to my husband Duncan for being services, printing, photostyling and clerical support and endurance during this thesis.
Acknowledgement

This thesis is not a product of one person. It developed into the planned products through the committed hands of many people. It would be impossible to name all the individuals involved, but several people deserve special recognition.

First and foremost, I am grateful to my supervisors Prof. Judith Waudo and Dr. Elizabeth Kuria who gave their valuable time and skills to strengthen this thesis.

Second, I am indebted to Dr. Enoch Omonge of Kenyatta National Hospital and all diabetic patients who participated in the study without whom this thesis would not have been completed. Thanks to Mr. Almadi Obere department of Economics Kenyatta University, Mr. Onesmus Muinde for statistical assistance and Miss Deborah Omonge for computer services.

Finally, but most of all, I extend my sincere gratitude to my husband Duncan for typing services, printing, photocopying and for his love, financial support and endurance during this thesis writing.
Abstract

Data from Kenyatta National Hospital indicated that 50 % of all diabetic patients attending the outpatient diabetic clinic recorded random blood glucose levels of over 10 mmol/l. These patients were thus predisposed to suffer from complications of the disorder. Lowering blood glucose levels towards normal decreases the risk of developing some chronic complications of diabetes.

The purpose of this descriptive cross-sectional survey was therefore to investigate factors that influence glycaemic control levels of diabetic patients who attended the outpatient diabetic clinic at Kenyatta National Hospital. The variables considered in this study were therapies patients used; duration patients have suffered from diabetes, diet and weight status. Data were collected using three interview schedules. A hundred patients who had attended the clinic at least thrice prior to the study period, two Nutritionists and one Doctor from the diabetic clinic were surveyed. Data were analyzed using the statistical package of social sciences. The statistics employed were Chi-square, Pearson’s correlation, Independent t-test, linear regression and logistic regression. Descriptive statistics namely frequencies, means and percentages were used to describe characteristics of patients. The anthropometric data were analyzed using the cut-off points for Body Mass Index of 20 - 24.9 and the biochemical data through the recommended cut off points for random blood sugar level of 4 - 10 mmol/l.
Results of the study showed no significant differences in blood sugar levels of male and female patients ($P = 0.85$). There were also no significant differences in body mass index of male and female patients ($P = 0.39$). However, there were significant differences in the blood sugar levels but not in the body mass indices of insulin dependent diabetics and non-insulin diabetics ($P = 0.013$) and ($P = 0.57$) respectively. Glycaemic control and Body Mass Index were most affected by the use of Insulin and type used but not the number of times per day used ($P = 0.05$) and ($P = 0.00$) respectively. Patients on diet alone reported the best glycaemic control levels followed by those on diet and oral hypoglycemic agents. Patients on diet alone were 0.1 times less likely to report poor blood sugar levels compared to those on diet, insulin and oral hypoglycaemic agents.

There were significant differences in blood sugar levels of patients with various Body Mass Index and those who engaged in varied levels of physical activities ($P = 0.004$). The poorer the weight control was, the poorer the glycaemic control was. There were however no significant differences in Body Mass Index of patients who engaged in various levels of physical activities. Results also showed no significant difference in blood sugar levels of patients who had suffered from the disorder for different durations ($P = 0.67$) ($r = 0.18$). However from the cross-tabs, it was concluded that the longer patients had suffered from diabetes, the poorer the blood sugar levels were.
Generally, the calorie intake of patients was significantly related to glycaemic control levels and Body Mass Index \((P = 0.03)\) and \((P = 0.01)\) respectively. The intake of calories had a strong positive relationship with glycaemic control levels of patients \((r = 0.787)\). Patients generally adhered to their dietary recommendations.

From this study it was concluded that the type of diabetes, therapy patients used in managing their condition, patient's Body Mass Index and the calorie intake influenced their glycaemic control levels. It was therefore recommended that in counseling the patients, these factors should be taken into consideration and counseling tailored to meet each patient's characteristics in this regard.
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CHAPTER ONE: INTRODUCTION

1.0 Background

Diabetes mellitus represents a spectrum of inherited and acquired disorders all of which are characterized by elevated circulating blood glucose levels (Paige, 1988). Robinson, Lawler, Chenoweth and Garwick (1986) classify diabetes into insulin dependent diabetes mellitus (IDDM) that occurs mainly in juveniles and non-insulin dependent diabetes are gestational diabetes that affects expectant women and diabetes that is as a result of other disease conditions.

The incidences of diabetes are increasing greatly throughout the world. Table 1.1 gives a summary of the projected rise in cases of diabetes in various continents worldwide between the years 1994 and 2010.

1.0.1 Estimates of diabetes mellitus

Table 1.1: Global estimates and projections of diabetes – 1994 to 2010

<table>
<thead>
<tr>
<th>World/Region</th>
<th>Total Population In 1994 ('000)</th>
<th>Number of people with diabetes in 1994 ('000)</th>
<th>Number of people with diabetes in 2000 ('000)</th>
<th>Number of people with diabetes in 2010 ('000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>5,638,219</td>
<td>110,186</td>
<td>175,331</td>
<td>239,250</td>
</tr>
<tr>
<td>Africa</td>
<td>698,388</td>
<td>5,299</td>
<td>12,091</td>
<td>18,823</td>
</tr>
<tr>
<td>Asia</td>
<td>3,346,376</td>
<td>51,237</td>
<td>94,732</td>
<td>138,145</td>
</tr>
<tr>
<td>North America</td>
<td>286,041</td>
<td>15,085</td>
<td>16,976</td>
<td>18,868</td>
</tr>
<tr>
<td>Latin America</td>
<td>483,862</td>
<td>12,605</td>
<td>16,469</td>
<td>20,248</td>
</tr>
<tr>
<td>Europe</td>
<td>510,873</td>
<td>18,460</td>
<td>23,714</td>
<td>27,994</td>
</tr>
<tr>
<td>Former USSR</td>
<td>284,654</td>
<td>6,636</td>
<td>10,251</td>
<td>13,852</td>
</tr>
<tr>
<td>Oceania</td>
<td>28,025</td>
<td>864</td>
<td>1,098</td>
<td>1,320</td>
</tr>
</tbody>
</table>

Apart from Kenya, incidences of the disorder are on the increase worldwide. Asia has the greatest number of diabetics followed by Europe, North America, Latin America, Africa, Former USSR and lastly Oceania in the year 2000. By 2010, the same trends were projected to continue with Asia having the greatest increase in cases of diabetes followed by Europe.

1.0.2 Diabetes in Kenya

Since the 1960's there has been a tremendous increase in the number of known diabetics. This could be attributed to an increase in awareness of the disease thus leading to more individuals seeking medical attention. A random stratified preliminary Nairobi City Council survey carried out proved that diabetes was common in Kenya (Mngola, Mugo and Noel, 1975), but there was lack of epidemiological data pertaining to diabetic mortality and morbidity and this made it difficult to assess accurately the extent of the disease in Kenya.

Abdulla (1976) reported that by 1966 the magnitude of diabetes mellitus had become sizeable enough to necessitate the starting of a diabetic clinic at Kenyatta National Hospital wholly devoted to the problem. The diabetic clinic of the hospital is a referral clinic and thus serves patients from the entire country. According to (Mngola, et al., 1975), an average of 2-3 patients were seen weekly at the same clinic then. Omonge (2000) stated that this same clinic booked a minimum of 60 patients every week at the time of the study. This indicated that the magnitude of the disorder was high taking into account the number of other
health facilities in Nairobi to which most economically able individuals prefer to attend.

1.0.3 Glycaemic control in diabetes

The overall goal of therapy is to restore metabolic equilibrium to a state as close as possible to normal physiology in order to facilitate the control of the glycaemia and minimize the known risk factors for atherosclerosis, retinopathy, nephropathy and neuropathy (Katzen and Mahler, 1978). The inputs of both doctors and nutritionists working with diabetic patients play an important role in the control of glycaemia. The doctors diagnose the condition and take medical history of the patients from which appropriate regimen is recommended for individual patients. From this information nutritionists determine dietary requirements of each patient through recommended dietary allowances, growth charts and recommendations of various diabetic associations. However, how doctors and nutritionists achieved the above mentioned roles at the diabetic clinic of Kenya National Hospital was not known, therefore this study investigated how health personnel carried out their duties in the management of this condition.

The patients also play an important role in managing their condition by ensuring that they comply with recommendations of medical professionals. Sakwa (1996) stressed the importance of compliance in the management of diabetes, however she did not look into parameters such as blood sugar control levels of patients in relation to compliance and the exact intake of various nutrients by the patients. Compliance can only be evaluated in terms of the effects of the diet on
parameters of diabetic control of which glycaemic control is one. It was therefore important to investigate the glycaemic control levels in an attempt to determine compliance of patients (Thomas, 1994).

Research had however shown that there were many factors that influence the glycaemic control levels of diabetic patients beside compliance to prescribed regimen. Holmwood et al. (2000) stated that changes in blood glucose levels can occur for a number of reasons including the type of food consumed, when consumed, exercise, losing or gaining weight, illness and medication. The following factors were however addressed by this study: - glycaemic index of food consumed which is dependent on how foods are combined and consumed, cooking methods used, frequency of consumption and the type of food itself (Thomas, 1994).

Insulin used in the management of their condition was especially associated with weight gain. Shillitoe (1988) stated that insulin heightens the appetite of patients leading to increased food consumption. In case this positive caloric intake is sustained over a period of time results in obesity that in turn diminish sensitivity of peripheral tissues to insulin and thus leads to poor glycaemic control.

The duration that a patient has suffered from diabetes is another factor considered. Peterson (1982) reports that after 30-35 years of juvenile diabetes, only a small number of patients still function without significant impairment of one or more important organ systems. Finally the importance of nutrition therapy
could not be overlooked in the control of glycaemia. Robinson, et al. (1986) stated that it is the corner stone of all the therapy employed in diabetes management. The diet is modified to suit individual patients.

Factors influencing glycaemic control are many and varied depending on circumstances and situations. However, what influenced the glycaemic control among Kenyan diabetic patients at Kenyatta National Hospital is not yet known. There was therefore need to investigate factors that influenced the levels of glycaemic control among the diabetic patients who attended the out patient diabetic clinic of Kenyatta National Hospital.

1.1 Statement of the Problem

The importance and impact of diabetes will only be widely accepted if its' potential seriousness is fully acknowledged. Diabetes can have a devastating effect on peoples' health, largely due to the long-term complications that may occur (Isitt, Cullen and Saunders, 2000).

Data from Kenyatta National Hospital indicated that a majority of diabetic patients attending the outpatient diabetic clinic at the hospital had poor glycaemic control levels and thus were predisposed to suffer from many complications of diabetes (Omonge, 2000). Omonge (2000) stated that 50% of all patients recorded fasting blood glucose levels of over 10 mmo1/l, as opposed to a normal control considered to be between 4-10 mmo1/l.

Diabetes complication and control trial (DCCT) (cited in McLarty and Swai, 1996) has given significant evidence that lowering blood glucose levels will
decrease the risk of developing chronic complications of diabetes. Barr, et al. (2001) reported that many experts agree that by keeping blood sugar levels as close to the normal range can delay or reduce the harmful effects of these complications. They stated that improved glycaemic control has been shown to reduce long term micro-vascular complications.

According to McCarty and Zimmet (1997), the prevalence of diabetes is set to rise worldwide. International Diabetes Federation, (2000) (Table 2.2.) indicated that 1.4 % of Kenyans between the ages 20-79 suffered from the disorder in the year 2000. This percentage is set to rise. This implied that the number of people who will suffer from complications of this disorder would also rise as the prevalence of the disorder rises.

The net effect of the rise in the number of people suffering from the disorder and with complication is that individual and government medical budget will increase. As complications set in, there is need for specialized medical attention for example, if there is Kidney failure, there will be need for dialysis. At Kenyatta National Hospital where this study was carried out, one session of dialysis costs Kshs 3000/=. If the kidney failure is very severe, this procedure can be carried out several times in a week.

Kenyatta National Hospital is the leading national referral hospital in Kenya. It serves the whole country but mainly those of low socio-economic status. The rich prefer to attend private hospital where service provision is faster. With cost sharing already in force in Kenya meaning that patients seeking medical
attention even in government hospitals have to pay part of their own medical bills with government only subsidizing part of it, the poor patients are set to suffer especially since diabetes does not choose economic status. The cost of living in Kenya is already too high for the average citizen that additional expenditure on medical bills is disheartening. Glycaemic control is therefore important.

In order to control glycaemic levels, knowledge of factors that influence blood sugar control in diabetic patients is important. Nevertheless, these factors were not yet investigated. This indicated a need to conduct research to investigate factors that influenced glycaemic control levels of patients with a view to control complications arising from poor glycaemic control.

1.2 Purpose of the study

This study sought to investigate factors that influence glycaemic control in diabetic patients who attended the outpatient diabetes clinic at Kenyatta National Hospital.

1.3 Objectives

The specific objectives of the study were as follows: -

i. To investigate the glycaemic control levels of diabetic patients.

ii. To determine body mass index of diabetic patients.

iii. To determine the duration that the diabetic patients had suffered from diabetes and therapy they used to manage diabetes.

iv. To investigate the nature and extent of dietary counseling given to diabetic patients at Kenyatta National Hospital.
v. To determine the dietary intake of diabetic patients
vi. To investigate complications of the disorders that diabetic presented at the clinic.

1.4 Significance of the study

The data from this research would give diabetic patients a picture of various factors that influence their ability to achieve proper control levels of their blood sugar. This knowledge would enable them to achieve the desired blood sugar control levels and thus prevent or control the development of complication of the disorder.

The results of this study may also enable the medical professionals to individualize dietary recommendations and other regimens depending on the circumstances of patients. This may then enable individual patients achieve better glycaemic control levels. The findings of this study may also be beneficial to organizations such as the world Health Organization (WHO), Diabetes Management information Center (DMI) and Diabetes Association of Kenya (DAK). The findings of this study may also contribute to the field of knowledge in Food and Nutrition is a basis for future research in the area.

1.5 Thesis organization

This thesis comprises of five chapters. Chapter 1 gives the background of the study. Relevant literature is reviewed in Chapter 2 to give a clear picture of diabetes mellitus and the factors that influence glycaemic control in the disorder in different regions of the world. The methodology employed to investigate the
factors that influenced glycaemic control among diabetic patients who attended the outpatient diabetic clinic of Kenyatta National Hospital is discussed in Chapter 3. Results of the study are presented and discussed in Chapter 4. Conclusion drawn from the study, summary and recommendations are given in Chapter 5.
CHAPTER TWO: LITERATURE REVIEW

2.0 Introduction

This section on literature review is discussed under the following topics: -

The nature of diabetes mellitus, prevalence rates, glycaemic control, management of diabetes mellitus, nutrition and disease management, roles of doctors and nutritionists in the management of diabetes and suggested factors that could result in poor glycaemic control.

2.1 The nature of diabetes Mellitus.

Robinson, et al. (1986) define diabetes mellitus as “a genetically and clinically heterogeneous group of disorders all of which show glucose intolerance. It is characterized by a partial or total lack of functioning insulin”. Robinson, et al. (1986) state that, “this insulin defect may be a failure in its formation, liberation or action”. Insulin is produced by the islets of langerhans thus any reduction in the number of functioning cells will decrease the amount of insulin. The insulin that is secreted when blood glucose and amino levels rise assists their entry into the cells to be used as energy.

There are two main classifications of diabetes mellitus. (a) insulin dependent diabetes mellitus (IDDM, (b) non-insulin dependent diabetes mellitus (NIDDM). Robinson, et al (1986) in their description of diabetes, state that:

Insulin dependent diabetes (TYPE 1) is characterized by an absolute deficiency of endogenous insulin and susceptibility to ketosis. Thus type 1 diabetics depend on exogenous insulin to sustain life. The onset is usually abrupt and is seen most frequently in juveniles but may
occur at any age. Most patients are of normal weight or underweight. They manifest the classic symptoms of diabetes, polyuria, polydipsia, polyphagia, weight loss and ketosis (p.504).

In the non-insulin dependent diabetes mellitus patients, the basal insulin levels are usually normal or increased while glucose stimulated insulin is diminished. They often do not present the classic symptoms and are usually not dependent on exogenous insulin. It’s onset is often after the age of 40 years. This type of diabetes has been sub-divided into type IIa and type IIb. Type IIa individuals are thin while type IIb individuals are obese. This latter type accounts for 80 percent of all diabetics (Rodwell, 1989)

### Table 2.1: Characteristic of Insulin dependent (IDDM) and Non-insulin dependent diabetes mellitus (NIDDM)

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>IDDM</th>
<th>NIDDM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Percentage of cases</td>
<td>10-20%</td>
<td>80-90%</td>
</tr>
<tr>
<td>Age of onset</td>
<td>Usually under 20 years</td>
<td>Usually over 40 years</td>
</tr>
<tr>
<td>Symptoms</td>
<td>Classic</td>
<td>Often asymptomatic</td>
</tr>
<tr>
<td>Onset of symptoms</td>
<td>Sudden</td>
<td>Gradual</td>
</tr>
<tr>
<td>Insulin dependence</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Oral hypoglycaemic</td>
<td>No</td>
<td>Sometimes</td>
</tr>
<tr>
<td>Weight</td>
<td>Normal or under weight</td>
<td>Usually overweight</td>
</tr>
<tr>
<td>Genetic</td>
<td>Rarely</td>
<td>Frequently</td>
</tr>
<tr>
<td>Beta cell function</td>
<td>Little or none</td>
<td>Erratic</td>
</tr>
<tr>
<td>Insulin receptors</td>
<td>Normal</td>
<td>Decrease of defective</td>
</tr>
</tbody>
</table>

Source: Robinson and Weigley (1989)

Robinson, et al. (1986) in their description of diabetes secondary to other conditions state that:
These include pancreatic disease, endocrine disorders such as acromegaly, Cushing’s syndrome, primary aldosteronism and others, drug therapy including diuretics, oral contraceptives, thyroid hormones, antidepressants, or catecholamines. This sub-type may also be associated with abnormalities in insulin receptors or certain genetic syndromes (p.506).

The final type of diabetes mellitus discussed by Robinson, et al. (1986) is gestational diabetes. “This class includes women who develop glucose intolerance during pregnancy.... Complex hormonal and metabolic changes during pregnancy are probably involved in the etiology and insulin resistance" Chronic complications of diabetes may be categorized as follows: -

1. Micro vascular complications (micro-anginopathy or small vessels diseases). These include – retinopathy, neuropathy and nephropathy.

2. Macro vascular complications (macro-anginopathy or large vessel diseases). These include: - coronary artery diseases, cerebrovascular diseases and peripheral vascular diseases.

3. Mixed vascular and neuropathic complications e.g. leg ulcers, foot ulcers and impotence.

4. Skin problems and gastrointestinal problems.

5. Connective tissue and joint disease, osteopenia and hypercalciuria.

The onset of diabetes may be slow or dramatic but the effects can be disastrous and even tragic. The regimen adopted should be able to achieve good glycaemic control and thus minimize these symptoms and complications related to either hyper or hypoglycaemia.
2.2 Prevalence Rates.

Diabetes is one of the world’s major health problems with the number of people having the conditions set to double to around a quarter of a billion in the next ten years (Isitt et al., 2000). The World Health Organization (cited by Adler and Kals, 2000) predicts that diabetes cases worldwide will more than double by the year 2025 to reach 300 million. Developing regions, particularly Asia and Africa are expected to bear the brunt of the increase. McCarty and Zimmet (1997) state that currently diabetes affects 15.1 million people in North America, 12.6 million people in Latin America, 18.5 million people in Europe, 6.6 million people in the former USSR, 53 million people in Africa, 51.2 million people in Asia and just over 1 million people in Oceania. In 1994, approximately 110.2 million people had diabetes in the world.

According to the world projections as indicated in Table 1.1, by the year 2010 diabetes will affect slightly more people in North America (19 million) but almost twice as many people in Latin America (20 million). The number of people with diabetes may increase by 60% in Europe (28 million) and Oceania (13 million). In the former USSR the number may double (14 million). By far the regions with the greatest potential increase are Africa and Asia where diabetes could become 2.5-3 times more common than it is today. In Asia the total number affected could reach 138 million and in Africa 19 million by 2010 (McCarty and
Zimmet, 1997). Few cases diagnosed world wide per year are about 789,000. The estimate for the African region is given in Table 2.2 below.
<table>
<thead>
<tr>
<th>Country</th>
<th>Population (20 - 79) (000's)</th>
<th>DM prevalence</th>
<th>Number of people with DM (000'S) in the 20 - 79 age group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>%</td>
<td>Age Rural Urban M F 20 - 39 40 - 49 60 - 79 TOTAL</td>
</tr>
<tr>
<td>Cameroon</td>
<td>6,822</td>
<td>0.9</td>
<td>20 - 79 13.2 47.9 23.5 37.6 10.9 42.8 7.3 61.1</td>
</tr>
<tr>
<td>Congo, DC</td>
<td>21,078</td>
<td>1.2</td>
<td>20 - 79 92.5 160.0 139.4 113.2 83.3 84.7 84.5 252.6</td>
</tr>
<tr>
<td>Congo</td>
<td>1,257</td>
<td>0.7</td>
<td>20 - 79 4.3 4.3 3.9 4.7 1.0 6.8 0.8 8.6</td>
</tr>
<tr>
<td>Cote d' Ivoire</td>
<td>6,547</td>
<td>0.7</td>
<td>20 - 79 26.9 15.9 23.5 19.3 3.8 35.5 3.1 42.7</td>
</tr>
<tr>
<td>Ethiopia</td>
<td>6,985</td>
<td>1.0</td>
<td>20 - 79 171.9 96.3 153.5 114.6 89.8 91.6 86.7 268.1</td>
</tr>
<tr>
<td>Gabon</td>
<td>612</td>
<td>0.9</td>
<td>20 - 79 2.7 2.7 2.5 3.0 0.5 4.4 0.6 5.5</td>
</tr>
<tr>
<td>Gambia</td>
<td>652</td>
<td>0.3</td>
<td>20 - 79 1.4 0.8 1.1 1.1 1.1 1.0 0.0 2.2</td>
</tr>
<tr>
<td>Ghana</td>
<td>9,168</td>
<td>0.4</td>
<td>20 - 79 14.9 17.4 16.0 16.3 17.1 15.0 0.2 32.3</td>
</tr>
<tr>
<td><strong>Kenya</strong></td>
<td><strong>13,334</strong></td>
<td><strong>1.4</strong></td>
<td><strong>20 - 79 14.5 176.0 109.0 81.4 71.9 57.1 61.5 190.4</strong></td>
</tr>
<tr>
<td>Madagascar</td>
<td>7,249</td>
<td>1.0</td>
<td>20 - 79 40.4 34.5 41.9 33.1 25.8 26.2 23.0 75.0</td>
</tr>
<tr>
<td>Mali</td>
<td>4,685</td>
<td>0.4</td>
<td>20 - 79 3.9 14.5 9.0 9.4 9.9 8.3 0.2 18.4</td>
</tr>
<tr>
<td>Mozambique</td>
<td>8,772</td>
<td>1.3</td>
<td>20 - 79 29.2 88.1 65.1 52.2 37.0 39.6 40.7 117.3</td>
</tr>
<tr>
<td>Nigeria</td>
<td>50,671</td>
<td>0.4</td>
<td>20 - 79 45.0 164.4 13.0 106.4 115.9 91.8 1.7 209.4</td>
</tr>
<tr>
<td>Senegal</td>
<td>4,219</td>
<td>0.8</td>
<td>20 - 79 12.2 21.3 14.7 18.8 4.9 25.6 3.0 35.5</td>
</tr>
<tr>
<td>S. Africa</td>
<td>21,932</td>
<td>4.0</td>
<td>20 - 79 99.5 786.9 383.3 503.0 114.4 491.8 280.1 886.4</td>
</tr>
<tr>
<td>Tanzania</td>
<td>14,466</td>
<td>0.9</td>
<td>20 - 79 90.5 44.3 76.0 58.8 48.9 44.4 41.6 134.8</td>
</tr>
<tr>
<td>Togo</td>
<td>1,991</td>
<td>0.5</td>
<td>20 - 79 0.4 9.2 4.7 4.9 5.2 4.3 0.1 9.6</td>
</tr>
<tr>
<td>Uganda</td>
<td>8,405</td>
<td>1.1</td>
<td>20 - 79 34.2 54.5 50.8 38.0 36.1 27.7 25.0 88.7</td>
</tr>
<tr>
<td>Zambia</td>
<td>3,692</td>
<td>1.1</td>
<td>29 - 79 12.8 28.0 22.8 18.0 16.8 12.0 12.0 40.8</td>
</tr>
<tr>
<td>Zimbabwe</td>
<td>5,404</td>
<td>1.0</td>
<td>20 - 79 26.5 28.9 31.7 23.6 21.4 17.1 16.9 55.4</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>217,89</strong></td>
<td></td>
<td><strong>736.9 1,796 1,276 1,257 715.8 1,128 688.9 2,532.9</strong></td>
</tr>
</tbody>
</table>

The general picture from Table 2.2 is that the prevalence of diabetes is higher in the urban areas of Africa than the rural areas. The prevalence of the disorder is however not that different between men and women. This finding corresponds with that of (McCarty and Zimmet, 1997). These are as follows:

**Table 2.3: Prevalence of diabetes mellitus by gender People 20 years or older**

<table>
<thead>
<tr>
<th>Gender</th>
<th>Number ('000)</th>
<th>Percentage of total men and women worldwide</th>
</tr>
</thead>
<tbody>
<tr>
<td>Men</td>
<td>7.5</td>
<td>8.2</td>
</tr>
<tr>
<td>Women</td>
<td>8.1</td>
<td>8.2</td>
</tr>
</tbody>
</table>


According to Table 2.3, the prevalence of diabetes is higher among women as compared to men in actual numbers. When the prevalence rates are compared in percentages, the level is the same for both men and women.

Other estimates provided by (McCarty and Zimmet, 1997) are as follows:

**Table 2.4: Prevalence of diabetes mellitus by age worldwide.**

<table>
<thead>
<tr>
<th>Age</th>
<th>Number ('000)</th>
<th>Percentage of total number of different age groups</th>
</tr>
</thead>
<tbody>
<tr>
<td>65 years or older</td>
<td>6.3</td>
<td>18.4</td>
</tr>
<tr>
<td>20 years - 65 years</td>
<td>15.6</td>
<td>8.25</td>
</tr>
<tr>
<td>Under 20 years</td>
<td>123</td>
<td>0.16</td>
</tr>
</tbody>
</table>

Source: McCarty and Zimmet (1997)

According to Table 2.4 the prevalence of diabetes is higher with advancing age. The elderly, 65 years and above have the highest cases of diabetes followed
by the 20 years old and above. The numbers in 1000's of the under 20 years is higher than all the other age groups but as a percentage of that age group it is only 0.16% meaning that juvenile onset diabetes is not very prevalent.

2.3 Management of diabetes mellitus

Depending on the severity of the disorder one of these three regimens may be selected in the management of diabetes.

(i) Diet and Insulin

(ii) Diet and oral hypoglycaemic agents

(iii) Diet alone

2.3.1 Diet and insulin.

Insulin lowers blood sugar by allowing it to leave the bloodstream and enter cells. People with insulin dependent diabetes mellitus must take insulin injections every day to survive because they cannot manufacture it. The non-insulin dependent diabetics on the other hand can survive without insulin injections but may take insulin shots to more effectively control blood sugar levels. Robinson, et al. (1986) state that insulin must be injected under the skin using a needle and syringe or in some cases an insulin pump because its protein nature thus would be hydrolyzed in the digestive tract and be inactivated if taken orally. It is not available in oral form. Robinson, et al. (1986) classify insulin into rapid action, short duration – Semilente and Regular crystalline, intermediate action and duration – lente and NPH and finally delayed action, prolonged duration – Protamine Zinc and Ultralente. The doses are determined by the
amount of exercise the patient does, their stress level, presence of infections and their food consumption.

2.3.2 Diet and oral hypoglycaemic agents.

Oral hypoglycaemic agents on the other hand are pills usually taken once or twice a day. They work by preventing the body from sending sugar into the bloodstream when insulin is not working properly, releasing more insulin into the bloodstream and helping the body’s own insulin to move glucose from the bloodstream into the cells. According to Jones, Shainberg and Byer (1978), oral hypoglycaemic agents cannot help individuals who need insulin and are only used by the non-insulin dependent diabetics. Several preparations are available which differ from each other in potency and duration of action”. These include sulphonylureas and biguanides (Robinson, et al., 1986)

2.3.3 Diet.

Dietary management of diabetes mellitus is inseparable from the overall management of the condition (Katzen and Mahler, 1978). Nutritional strategies for both insulin dependent diabetes and non-insulin dependent diabetes are different but in both groups the use of concentrated simple sugars needs to be restricted from regular meals planning and sweetened foods eliminated in an attempt to avoid rapid elevation of blood sugar (Katzen and Mahler, 1978). Paige (1988) states that simple sugars were assumed to be more rapidly absorbed thus leading to more hyperglycaemia than complex carbohydrates. The primary aim of diet therapy is to control caloric intake for non-insulin diabetics and provision of
adequate calories for normal growth and development for insulin dependent diabetics. This is summarized in the Table 2.5

Table 2.5: Summary of Nutritional recommendations for people with diabetes for the 1990s according to the nutrition Sub-committees, British Diabetic Association 1991.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Recommendations for diabetes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Energy at a level, which attains BMI in the region of 22.</td>
<td></td>
</tr>
<tr>
<td>Carbohydrate (Energy)</td>
<td>50-55%</td>
</tr>
<tr>
<td>Added sucrose of fructose (g/day)</td>
<td>&lt;25g</td>
</tr>
<tr>
<td>Dietary fiber (g/day)</td>
<td>&lt;30g</td>
</tr>
<tr>
<td>Total fat (% energy)</td>
<td>30-35%</td>
</tr>
<tr>
<td>Saturated fatty acids</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Monounsaturated fatty acids</td>
<td>10-15%</td>
</tr>
<tr>
<td>Polyunsaturated fatty acids</td>
<td>&lt;10%</td>
</tr>
<tr>
<td>Protein (% energy)</td>
<td>10-15%</td>
</tr>
<tr>
<td>Salt (g/day)</td>
<td></td>
</tr>
<tr>
<td>Normatensive</td>
<td>&lt;6g</td>
</tr>
<tr>
<td>Hypertensive</td>
<td>&lt;3g</td>
</tr>
<tr>
<td>Diabetic foods</td>
<td>None (avoid)</td>
</tr>
</tbody>
</table>

Source: Thomas (1994).

2.3.3.1 Calories

Robinson, et al. (1986) states that a level of 100 g will prevent ketosis. 50-60% of total calories should be derived from carbohydrates (compared to 45% for the average non-diabetic American). This moderately higher carbohydrate intake facilitates blood glucose control by increasing sensitivity and thus enhancing
glucose clearance as long as sufficient insulin, (exogenous insulin in IDD, endogenous insulin in NIDD) is available (American Diabetic Association cited in paige 1988).

By increasing the percentage of total calories provided as carbohydrate, fat calories are reduced. This may be important in preventing the accelerated atherosclerosis seen so often in diabetes (p. 631)

Holmwood, et al. (2000) point out that slow acting carbohydrates with low glycaemic indices which include whole grain breads, low fat, low sugar breakfast cereals, pasta, beans, lentils, apples, oranges, pears and plums are preferable. However, sugar should not be eliminated since research has shown that if it is consumed as part of a mixed meal it does not adversely affect blood sugar levels (Holmwood, et al., 2000).

2.3.3.2 Fibers.

An increase in unrefined fiber’s, guar, pectin and some hemicellulose can help decrease blood sugar response to meals. However the amount needed to achieve this often causes gastro-intestinal side effects that make the meal unpalatable. Also the basal blood glucose is not affected and its long-tem benefits have not been demonstrated (Paige, 1988). Robinson, et al. (1986) supports this statement by stating that, short-term studies with high fiber intakes have however shown reductions in postprandial blood glucose cholesterol and triglycerides in persons with non-insulin dependent diabetes.
2.3.3.3 Fat

Fat intake should also be appropriately reduced when a diabetic takes alcohol so that energy intake is not excessive (Robinson, et al, 1986). Holmwood, et al (2000) recommended that fat intake should be reduced to less that 30% of total energy intake as this has a beneficial effect on serum lipids and helps with weight reduction.

In diabetic patients at ideal weight or weight maintenance diets, the fat content of the diet should be moderately reduced in the hope of preventing or slowing the development of atherosclerosis (Paige, 1988). Saturated fat intake that is mainly from animal fats and dairy products along with cholesterol are mainly restricted. These should be replaced partly by foods rich in polyunsaturated fatty acids, partly by monounsaturated fatty acids, and partly by carbohydrates. Paige (1988) further states that: -

Fat should account for approximately 30% of total calories. Saturated fate content should be less than 10% the remaining 20% being divided almost equally between polyunsaturated and monounsaturated fatty acids. The remaining caloric deficit resulting from fat restriction can be compensated by the increase carbohydrates intake recommended (p.613-632).
2.3.3.4 Proteins

Proteins should be high quality to provide all the essential amino acids for adequate nutrition. American Diabetes Association (1998) recommends that up to 12-15% of calories should be provided by proteins. Holmwood, et al. (2000) on the other hand recommend that proteins should contribute 10-20% of total energy.

Approximately 15% of total calories should be derived from protein apart from the avoidance of food rich in both proteins and saturated fat; no dietary recommendations are specific for diabetic patients (Paige, 1988). This study investigated patients intake of nutrients discussed above.

2.4 Nutrition and disease management.

A good diet prescription taking into account the body mass index of a patient is very important in the management of the disorder. Once the diet is determined, it is very important to take meals of consistent times for the insulin dependent diabetics and non-insulin dependent diabetics on oral hypoglycaemic agents.

2.4.1 Meal timing.

For the insulin dependent diabetics, foods must be eaten at appropriate times and in the right amounts to correlate with the effect of insulin. A diabetic receiving insulin once or twice daily should consume some carbohydrate at least every 3-4 hours during the day when awake. In addition to 3 meals a day they should have mid morning and mid afternoon snacks and an additional one before bed (Paige, 1988). For the non-insulin dependent diabetics on oral hypoglycaemic
agents the medication may produce hypoglycemic if food intake is delayed; thus the regularity of meals is important (Robinson, et al., 1986).

Once the diet prescription is determined, the number of serving from each exchange list is calculated. The manner in which patients diet was determined at Kenyatta National Hospital was not known thus the study investigated how nutritionist determined them.

**2.5 Roles of medical doctors and nutritionists in the management of diabetes.**

In discussing the roles of medical personnel in the management of diabetes, (Holmwood, et al., 200) point out that.

Diabetes is a chronic condition that can result in disability and early death. Management of the person with diabetes requires the skills of several professionals (general practitioner, specialist physicians, podiatrist, diabetes nurse, dietician, ophthalmologist and optometrist) and the active participation of the patient (p.2)

The general practitioner is the key member of the therapeutic team. In many instances he/she may be the principal medical professional and in other instances there may be shared care. The general practitioner is the point of contact and usually assumes responsibility for overall management (Holmwood, et al., 2000).

The role of the general practitioner ideally involves initial diagnosis, treatment, co-ordination of consultant and allied professional care and continuing management including education and counseling of the patient and family (Holmwood, et al., 2000). Medical doctors diagnose the disorder when the patients report to the hospitals and prescribe the necessary regimen for management of the
disorder. They also take the medical history of patients from which proper diagnosis can be made (Rodwell, 1989).

The general practitioner must have adequate records and systems in place which will assist in the recall of patients for further investigations or continuing management and to monitor outcomes of management (Holmwood, et al., 2000).

The role of the dietician in the management of diabetes is paramount. Dieticians help patients change their lifestyles in order to improve their glycaemic control. The nutritionist should learn as much as possible about each patient’s needs through the medical history. They should learn about personal and family needs, psychosocial development, social activities, work and social commitments, a typical day's routine and food habit (Rodwell, 1989).

Nutritionists should also have data on blood sugar tests and anthropometric measures of weight and height (Rodwell, 1989). Through this information, they then determine appropriate diet prescriptions for the patient. They calculate the energy needs and nutrient ratios using the recommended dietary allowances, growth charts for children and recommendations of various diabetic associations. Factors that they should take into consideration include needs for growth and development, levels of physical activities and maintenance of desirable weight.

The other medical professionals provide expert care in various areas as follows: the podiatrist renders expert preventive care of food complications, the endocrinologist may be valuable for patients with complicated problems related to diabetes and the Ophthalmologist/Optometrist provides care of eyes (Holmwood,
et al., 2000). However how Doctors and Nutritionists carry out their roles at the diabetic clinic of Kenyatta National Hospital, Kenya was not known. This study therefore investigated the manner in which they helped patients' control their glycaemic levels.

2.6 Glycaemic Control.

The importance and impact of diabetes will only be widely accepted if potential seriousness of diabetes is fully acknowledged. Diabetes can have a devastating effect on people's health, largely due to the long-term complications that may occur (Isitt, et al., 2000). Diabetes complications and control trial (DCCT) (cited in Mclarty and Swai, 1996) has given significant evidence that lowering blood glucose levels will decrease the risk of developing some chronic complications of diabetes. Many experts think that by keeping blood sugar levels as close to the normal range can delay or reduce the harmful effects of these complications (Barr, et al., 2001). Improved glycaemic control has been shown to reduce long-term microvascular complications (Barr, et al., 2001). Control of blood glucose and blood pressure reduces renal damage and stabilize renal function in patients without renal damage and in patients with microalbuminuria. However, the effects of glycaemic control in-patients with renal damage are not clear.

Diabetes vascular thickening of the basement develops in relation to the duration of diabetes and the degree of glycaemic control (Feener and King, 1993). Holmwood, et al. (2000a) state that if the level of glucose remains high for a long
period of time, excess glucose builds up in the body tissue, this can cause damage
to the eyes, kidneys, nerves and blood vessels leading to development of diabetic
complications. Mclarty and Swai (1996) supporting the same state that prevention
of clinical nephropathy in diabetes is possible by good glycaemic control. Barr, et
al. (2001) explaining how this happens state that when blood sugar is high, nerve
cells swell and scar and with time are unable to send signals through the body.

This nerve damage may cause the feet and lower legs to tingle, feel numb,
burn, ache or throb and in some instances there may be no pain at all from cuts,
bruises and other kinds of injuries to the feet. This support by Isitt, et al., (2000)
who add that high blood glucose can damage ones circulation, preventing a
healthy flow of blood to the legs and feet as a result sores and infections take long
to heal. They state that if blood glucose is under control, the body will take no
longer to heal than a person without diabetes.

The body’s ability to fight germs is also affected by glycaemia (Mclarty
and Swai, 1996). High blood sugar slows down the body’s germ fighting system
making diabetics susceptible to infections, and blood glucose levels are high a
diabetic’s healing response will be slower and this increases the risk of skin
infections (Isitt, et al., 2000a). High blood sugar also weakens the small blood
vessels that carry blood to fingers, toes, skin and other parts of the body thus
damaging them. High blood sugar also makes red blood cells stiff. These stiff
cells damage small blood vessels when they pass through them. Thus small vessel
disease specific to diabetes does not occur without ongoing standing hyperglycaemia (Barr, et al., 2001).

Other complications of diabetes are heart problems. Blood fat levels tend to be high when blood sugar levels are high thus heart and blood vessels damage happens to diabetics at an earlier age (Barr, et al., 2001). Diabetes accelerates the aging process so that people have heart attacks earlier and are less likely to survive them (Willcox and Kiechel, 1999). In 50% of men with diabetes, nerve damage leads to erectile dysfunction but it is possible to restore potency with good control of blood glucose levels and other treatments (Willcox and Kiechel, 1999).

Years of clinical and research experience have demonstrated that diet can influence several aspects of the diabetic state, some of which are likely to relate to these long term complications (Paige, 1988). Secondary emphasis on aggressive hyperglycaemia therapy is likely to produce the greatest reduction in coronary heart diseases in these patients (Nathan, et al., 1997).

Glycaemic control is thus an important factor in the controlling the development of complications of diabetes. Factors that influence glycaemic control were thus investigated with the aim of identifying them in an attempt to achieving desirable levels.

2.7 Factors that could result in poor glycaemic control.

From the literature reviewed, factors such as the body mass index of patients, duration that they have suffered from the disorder and therapy diabetic patients use in managing their condition have been shown to have an important
influence on the blood sugar control levels and thus play an important role in the development of complications. Diet is also important in the control of glycaemia.

2.7.1 Duration of diabetes.

Shillitoe (1988) reports that many insulin dependent diabetics who developed the disease in childhood may show signs and symptoms of complications in young adulthood. Peterson (1982) in support states that, after 30 years of diabetes, virtually all juvenile diabetics appear to lose their Achilles tendon reflex, only a small number of patients are still alive and functioning without significant impairment of one or more important organ system. Many studies have found an increased frequency of hypertension in diabetic patients, which is usually rarer in early childhood but becomes increasingly common after the disorder has been present for more than 10 years (Peterson, 1982).

Not everyone with diabetes will develop complications but they are more likely to occur the longer the person has had the condition (Holmwood, et al. 2000b). If people become diabetic at age 10 or 15 or 20, one can predict that when they are 30 or 40, they could have terrible complications. Since development of complications is largely influenced by glycaemic control and vice versa, it is important to take note of the length of time a diabetic has had the disorder in determining the cause of poor glycaemic control in these patients (Adler and Kals, 2000).
2.7.2 Insulin and Oral hypoglycaemic agents

Peterson (1982) asserts that although insulin deficiency can be ameliorated by treatment with diet, insulin or oral hypoglycaemic agents, these standard modes of therapy have not been effective in prevention of chronic complications involving the eye, kidney, the peripheral nervous systems and the peripheral arteries. He continues to say that there is considerable evidence suggesting the possibility that insulin might be atherogenic. Insulin over a wide range of values can be related to increase smooth muscle cell proliferation. Insulin brings about a degeneration of blood vessels, which causes diabetics to die of cardiovascular renal disease. Long-term use of the diabetic drugs increases cardiovascular mortality of these patients. Even with the best insulin supervision and dietary control, 85% of all diabetics of long-term treatment of 15 years or more, develop other complicating diseases such as coronaries, cataract, leg gangrene and ulcers. Holmwood, et al. (2000a) also state that short acting medication such as clear insulin, the food eaten affect glycaemia.

Obesity may develop as a consequence of excessive insulin use in the management of diabetes; the hypoglycaemic action produced may result in heightened appetite and thus an increased consumption of food. Any positive caloric balance sustained over any considerable period of time will result in obesity. It also has an effect on peripheral insulin resistance (Shillitoe, 1988).
Isitt, et al. (2000) state that any change in insulin regimen can have a significant effect on a person’s diabetes and thus require careful monitoring to ensure that good control is maintained. There may be several systems involved in the adverse reactions to sulphonylureas. The main side effects from sulphonylureas are weight gain, symptomatic hypoglycaemia, anorexia, nausea, diarrhea, skin rashes and occasionally blood dyscrasias. These reactions to sulphonylureas may in turn affect glycaemic control (Holmwood, et al., 2000a). This study thus investigated whether there was a relationship between the therapy patients receive and their levels of glycaemic control.

### 2.7.3 Weight

Hypocaloric diets and weight loss usually improve short-term glycaemic levels and have the potential to improve long-term metabolic control. Moderate weight loss (5-9 kgs) irrespective of starting weight has been shown to reduce hyperglycaemia, dyslipidemia and hypertension (American Diabetes Association, 1998). Weight reduction promotes a decrease in insulin resistance (Thomas 1994). Paige (1988) states that, “this measure alone usually will result in a marked improvement of blood glucose levels and glucose tolerance because of improved insulin sensitivity”

In many instances, the reduction to ideal weight and maintenance at this new level will result in complete normalization of blood glucose levels in NIDD. Some people no longer need medication if they loose weight because their own insulin works better without extra weight, fat and sugar (Paige, 1988).
Regular exercise is thus recommended for people with diabetics as it helps control the amount of sugar in the blood and burn excess calories and fat to achieve optimal weight. A body mass index (BMI) in the region of 22 is recommended for these patients (Thomas, 1994). The diet of the patients plays a very important role in weight reduction or maintenance and thus influences their levels of glycaemic control. The choices of food the patients make are therefore very important; factors that influence these choices should thus be considered in giving dietary counseling.

2.7.4 Diet

Variables that can be influenced by dietary treatment include blood glucose concentration, urinary glucose excretion, plasma triglyceride level, plasma-cholesterol level and body weight (Paige, 1988). The diet should be carefully controlled to achieve optimal control of the disorder. It is vital that great effort is made to prevent the long-term complications of diabetes by keeping good control of blood glucose levels (Isitt, et al., 2000). Special emphasis is laid on calories, carbohydrates, proteins, fats, cholesterol, and fibers. However it is important to remember that the diabetic diet is not set in concrete. Suitor and Crawley (1984) state that a diabetic diet consists of everyday foods prepared by common cooking methods in amount needed to attain or maintain a desirable weight.

Traditionally, it was assumed that simple sugars were absorbed more rapidly than starch and thus were restricted, but now it is known that they have a similar rate of absorption (Thomas, 1994). Ayuo and Etyang (1996) in their study
at the Eldoret District Hospital, Kenya, found that cereals had a higher glycaemic index than root vegetables. After consumption of millet, patients had the highest rise in blood sugar levels followed by a consumption of white rice, white bread and brown bread. English potatoes produced the least change in blood sugar levels of patients.

Glycaemic effect of food can also vary according to the way it is cooked or processed for instance by forming resistant starch. There is also evidence that these effects may differ when the foods are consumed as parts of mixed meals (Thomas, 1994). Taking the case of Kenya, cooking methods are ethnic based (cultural) and the way food is mixed and consumed differs according to different ethnic groups. Culture intervenes to define which foods are acceptable and appropriate. People learn through their culture at what temperature and at what time of the day food is usually served as well as the usual fat content. This implies that a diabetic’s ethnic group could play an important role in their level of glycaemic control as effected by the glycaemic index of foods they consume. This study therefore investigated the dietary patterns of diabetic patients attending the out patient diabetic clinic of Kenyatta National Hospital.

2.8. Summary

The literature reviewed showed that diabetes mellitus could have effects that are disastrous and tragic. Good control of glycaemia was seen as an important means of controlling and delaying the development of complications. Factors that influence the levels of glycaemic control of diabetics among others were shown to
include the following: - the duration patients had suffered from diabetes, insulin and oral hypoglycaemic agents they use, their weight and their diet. The study therefore sought to investigate how these factors influenced the levels of glycaemic control in these patients. The literature also revealed that doctors and nutritionists play an important role in the management of diabetes.
CHAPTER THREE: METHODOLOGY

3.0 Introduction

This section is discussed under the following sub-topics: research design, study location and population, sample selection, instruments used, data collection procedures, data analysis and operational definitions of variables.

3.1 Research design

This study adopted a cross-sectional descriptive survey design. This design is convenient in deriving extensive data from a large sample of respondents within a short period of time. It also helps to arrive at comprehensive descriptions of the characteristics of a defined population or sample of that population without altering variables experimentally (Tuoliatos and Compton, 1988).

3.2 Study location and population

The target population was all diabetic patients attending the outpatient diabetic clinic at Kenyatta National Hospital. This is a referral clinic thus serves patients from the entire country. Patients sampled were those who had attended the clinic at least thrice for check ups. This enabled the researcher to determine a trend of blood sugar control of patients since a test of glycosylated hemoglobin levels could not be performed. This population consisted of both non-insulin dependent and insulin dependent diabetics. The sub-sample consisted of nutritionists and medical doctors who worked at the clinic.
3.3 Sample selection

The patients were selected purposively in order to obtain patients who had attended the clinic at least three times prior to the study. A randomly compiled list of these patients was then made. Simple random selection was used to select patients to participate in the study. A table of random numbers was used to select the patients. The accessible population of the patients during the research period was 480 patients. A total of 100 patients were included in the study based on consultation with the researcher's supervisors and the funds available for the study. This sample size was felt to be adequate since individual interviews with respondents were carried out, personal hospital records studied and anthropometric and biochemical tests carried out for each patient.

A purposive sampling technique was used to select 2 nutritionists and 1 doctor who worked at the clinic to be part of sub-sample. These were health practitioners who were involved in the day to day counseling of the patients.

3.4. Instruments.

Three interview schedules were used to collect data. One was used to obtain information from patients, the other from nutritionists and the final one from a medical doctor. The information that was obtained from patients included demographic data, information on dietary patterns, duration they had suffered from diabetes and therapy they used to manage their condition. Other information included anthropometric and biochemical data. From the nutritionists, information on dietary counseling and dietary prescriptions was obtained and from medical
doctors information on common complications of the disorder seen at the clinic was obtained. Hospital records were used to gather retrospective information on past blood sugar control levels of patients with permission from patients and the clinic.

3.5 Pre-testing

The patient's interview schedule was pre-tested on 6 patients. Health practitioners' instruments were pre-tested on 1 nutritionist and 1 medical doctor who were not included in the final samples. This was done to check on the instrument's validity and reliability of the instruments. Corrections were then made on the instruments before the study commenced.

3.6 Data collection procedures.

Respondents were informed of the purpose of the study prior to the interviews. The researcher with the help of two-trained research assistants conducted interview for the patients during diabetic clinic days. The research assistants were trained two weeks prior to the research during pre-testing on how to weigh patients and take height measurements. They were also taught how to probe and prompt respondents in order to obtain sought data. They were also trained to record information from respondents concurrently with the interviews. Since it was difficult to trace patients after that day (the patients attend the clinic once in six months) all the interview schedules were completed by the end of each session.

Each patient was accurately identified in terms of age, sex and ethnic group. Other information that were solicited included occupation and income, information
concerning the duration they had the disease, the therapy patients received and their dietary patterns. Hospital records were reviewed with permission of patients to investigate blood glucose control in the past three visits when the patient attended the clinic.

Blood sugar levels of the patients on the clinic attendance day were gathered at the hospital laboratory in the presence of the researcher or the research assistants to ensure validity and reliability. After each patient interview, the interviewer accompanied the respondent to the lab for a random blood sugar test.

A standardized bathroom scale set at zero was used to take the weight of patients. Patients in light clothing stood barefoot on the weighing scale, two readings were taken when the needle stopped moving and an average calculated to the nearest 0.1cm. A stadiometer was used to take the height measurements of patients. Patients stood barefoot on the flat surface of the scale. The backs of their heads, shoulders and heels of their feet touched the upright scale. With their heads upright, the headpiece was lowered to touch the head gently. Two readings were taken and an average calculated to the nearest 0.1m. The interviews for the doctor and nutritionists were conducted one week after the patients’ interviews.

3.7 Data analysis

Data were analyzed using the statistical package of social sciences (SPSS). Descriptive statistics, percentages and frequencies were used to describe the characteristics of the patients. The dependent variable was - glycaemic control levels of the patients. The independent variables were the duration they had
suffered from diabetes, therapy they used in managing their condition, their dietary patterns and their body mass index. Frequencies were used to present the consumption of individual foods in the food frequency table. These were then manually compared with the recommendations stated in the diet sheets provided by the hospital.

The anthropometric data were analyzed using the cut off points for body mass index (BMI). \( \text{BMI} = \frac{\text{Weight (kgs)}}{\text{Height (m)}^2} \) provided by Helpage International (2000). The patient's BMI were categorized as follows:

<table>
<thead>
<tr>
<th>BMI Classifications</th>
<th>BMI Classifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Underweight</td>
<td>&lt;16</td>
</tr>
<tr>
<td>Borderline</td>
<td>16.1-18.9</td>
</tr>
<tr>
<td>Desirable body weight</td>
<td>19 - 24.9</td>
</tr>
<tr>
<td>Obesity 1</td>
<td>25 - 29.9</td>
</tr>
<tr>
<td>Obesity 1</td>
<td>30 - 39.9</td>
</tr>
<tr>
<td>Obesity III</td>
<td>&gt;40</td>
</tr>
</tbody>
</table>


The biochemical data were analyzed using the cut off points for optimal control of blood sugar levels considered appropriate for diabetics. These were as follows:
Table 3.2: Classifications of Blood Sugar Control Levels

<table>
<thead>
<tr>
<th>Blood sugar</th>
<th>Classifications levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;4 mmol /L</td>
<td>Hypoglycaemia</td>
</tr>
<tr>
<td>4-10 mmol /L</td>
<td>Good blood sugar control</td>
</tr>
<tr>
<td>&gt;10.1mmol /L</td>
<td>Hyperglycaemia</td>
</tr>
</tbody>
</table>

Source: Holmwood et al. (2000), Bonnici, et al. (1999), and Omonge (2001)

Chi-Square was used to determine whether significant differences existed between groups categorized from independent variables. Cross tabulation tables were used to explain Chi-Squares data. Independent t-test was used to investigate if there was significant difference between the means of blood sugar levels of insulin dependent and non-insulin dependent diabetics and for male and female patients. Independent t-test was also used to investigate the difference in dietary consumption of male and female patients. Linear regression was used to investigate relationships between blood sugar levels, body mass index and duration of diabetes. Logistic regressions were used to determine relationships between therapies used and blood sugar levels and body mass index of patients.

Responses to the open-ended questions, dietary counseling and prescriptions and complications of diabetes were collapsed into categories in order to obtain themes and patterns that address the objectives of the study. Tables, bar charts and pie charts were used to present data.

3.8 Operational definitions of variables

Cultural foods: Staple foods commonly consumed by different communities in Kenya traditionally before the introduction of western foods.
Duration of Disease: The length of time in years the patient had suffered diabetes since diagnosis.

Body Mass Index: The weight of the patient in kilograms divided by the square of their heights in meters. It was classified as underweight, borderline, desirable weight, obesity I, obesity II and obesity III according to Helpage International standards.

Glycaemic control level: The blood sugar level of patients in mmol/l. They were categorized as hypoglycaemia, Good control level and Hyperglycaemia.

Diet counseling: This referred to the individual professional guidance to patients in adjusting daily food consumption to meet their health needs.

Diabetes care: This referred to areas of concern that patients should take into consideration in the management of diabetes.

Diet sheets: Written list of foods and how they should be consumed provided to the patients at Kenyatta National Hospital.

Diabetic complications: Diseases patients suffered from due to diabetes. These included kidney diseases, eye problems, nervous problems and heart complications.

Therapy: The intervention/regimen prescribed for the patient. This was diet alone, diet and insulin or diet and oral hypoglycaemic agents.
CHAPTER FOUR: RESULTS AND DISCUSSION

4.0 Introduction

The study aimed at investigating whether insulin, oral hypoglycaemic agents, Body Mass Index and diet influence glycaemic control in diabetes mellitus. The data presented in this chapter was obtained from forty-six male and fifty-four female diabetic patients attending the out patient diabetes clinic at Kenyatta National Hospital. This chapter presents findings of the study.

The results are presented under the following sub topics: demographic characteristics of patients, Socio- economic profile of patients, glycaemic control levels of patients, patients' Body Mass Index, dietary patterns of patients, therapy used to manage diabetes and duration of diabetes, factors that influenced glycaemic control level of patients, diabetes counseling at Kenyatta National Hospital, complications of diabetes mellitus commonly seen at Kenyatta National Hospital.

4.1 Demographic and Socio- economic characteristics of patients

4.1.1 Patient's age distribution

The age distribution was thought to be important to this study since it is associated with employment status, income, formal education status and residence. These factors could affect the diet of a patient in that for instance the level of income will affect the purchasing power of an individual thus determining the types of food they buy. The age of a patient also affects their level of
understanding and ability to follow instructions hence affecting their glycaemic control levels.

Information presented in Table 4.1 shows that in this study the youngest patient interviewed was twelve years old and the oldest was seventy-eight years old. The highest percentage (24%) was between ages 30-39 years and the smallest group was between 10-19 years and 70-80 years. However, 64% of the patients were in the age brackets between 40-60 years.

Table 4.1: Age distribution of diabetic Patients attending Kenyatta National Hospital

<table>
<thead>
<tr>
<th>Age in years</th>
<th>Frequency</th>
<th>Valid percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-19</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>20-29</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>30-39</td>
<td>24</td>
<td>24</td>
</tr>
<tr>
<td>40-49</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>50-59</td>
<td>22</td>
<td>22</td>
</tr>
<tr>
<td>60-69</td>
<td>18</td>
<td>18</td>
</tr>
<tr>
<td>70-80</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

From the results, it is evident that the largest percentage of patients was middle aged, which was consistent with the number of non-insulin diabetics in the sample as will be seen in later discussions. Results showed no significant differences in the blood sugar levels nor Body Mass Index of patients of different age groups at \( P = 0.29 \) and \( P = 0.36 \) respectively.

4.1.2 Employment status, education levels and income of diabetic patients

The employment status of the patients was determined from what they stated as their occupations. The researcher used the information provided to decide
whether they were in formal employment, self-employed or unemployed. Results showed that 27% of the patients were employed, 42% self-employed and 31% unemployed.

Employment status of an individual is normally associated with their purchasing power. The dietary patterns of the patients is important in glycaemic control. The income of the patients determines the foods available to them. The nutritive value of foods from different parts of the country has been shown to be varied, thus their influence on glycaemic control levels of the patients vary (Sehmi, 1993).

This small number of those employed corroborates the fact that economic conditions in Kenya are not favourable thus the lack of employment opportunities. This finding even further emphasizes the importance of preventing the development of complications of diabetes since it is that most of these patients are of low socio economic status and therefore cannot easily afford to spend extra money of treating these complications.

The income of the diabetic patients was categorized from the actual amounts patients stated as their monthly income. Table 4.2 indicates that only 27% of the patients earned a monthly salary of over ten thousand Kenya shillings. A total of 31% had no income at all and therefore their families supported them. The rest of the patient (52%) earned less than ten thousand shillings per month.

A possible explanation for this number of patients who fell in the high-income category was that this group of patients sought treatment from private
hospitals and therefore did not attend Kenyatta National Hospital. These findings could also have been due to the limited percentage of those employed as shown in Table 4.2. Most of the patients who had indicated they were involved in business were small businessmen and women who ran small kiosks or hawked various goods thus the limited amounts of income.

The level of education of an individual is usually associated with employment status. However this relationship is not always linear. Level of employment also depends on the availability of jobs in the job market. Results showed that 17% of the diabetic patients received no formal education while 9% had post secondary education. The remaining 74% had either secondary or primary education.

These results could explain the low number of patients who were in formal employment. Only 27% of the patients were in formal employment. However these findings showed that 83% patients had achieved basic literacy skills. These findings could therefore explain the findings from Nutritionists at the clinic that they did not experience difficulty in counseling the patients.
Table 4.2: Income levels of diabetic patients at Kenyatta National Hospital

<table>
<thead>
<tr>
<th>Monthly income in Kshs</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>None</td>
<td>31</td>
</tr>
<tr>
<td>0-1000</td>
<td>5</td>
</tr>
<tr>
<td>1001-2000</td>
<td>3</td>
</tr>
<tr>
<td>2001-3000</td>
<td>11</td>
</tr>
<tr>
<td>3001-4000</td>
<td>4</td>
</tr>
<tr>
<td>4001-5000</td>
<td>3</td>
</tr>
<tr>
<td>5001-6000</td>
<td>5</td>
</tr>
<tr>
<td>6001-7000</td>
<td>8</td>
</tr>
<tr>
<td>7001-8000</td>
<td>8</td>
</tr>
<tr>
<td>8001-9000</td>
<td>3</td>
</tr>
<tr>
<td>9001-10000</td>
<td>2</td>
</tr>
<tr>
<td>10001 and above</td>
<td>17</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

The level of education of an individual is usually associated with employment and income status, however the relationship is not always linear. Employment depends of availability of jobs in the job market.

The few numbers that were in formal employment and education levels of the patients could also explain the low-income levels of the patients. Only 9% of the patients were college graduates. There were 62% of high school graduates, 29% graduated from primary school and 17% had no formal education.

The income levels of the patients were related to their education levels. The higher the levels of education the higher the income at. $P=0.02$. 
4.1.3. Gender distribution

Gender is related to the metabolic rates of individuals and sometimes to the kind of work they perform as a routine. The rate of metabolism and the amount of physical work performed is expected to have an influence in the body mass index. Physical works especially when carried out as routine cuts as a form of exercise and is considered very important for the patients. Paige (1988) states that physical activity alone will usually result in marked improvement of blood glucose levels and glucose tolerance because of improved insulin sensitivity. Out of the 100 patients interviewed in this study, 54% were female and 46% were male.

Results however showed no significant differences in the blood sugar levels nor the Body Mass Index of male and female patients at \( P = 0.96 \) and \( P = 0.39 \) respectively. The mean differences in the blood sugar levels and Body Mass Index were at \((- 0.62)\) and \((- 0.86)\) respectively.

4.1.4: Ethnic distribution of patients

The ethnic distribution of a patient affects their diet. The way in which one cooks food, combines foods and consumes food is ethnic based. Thomas (1994) states that glycaemic effects of food can vary according to the way it is cooked processed for example by forming resistant starch. There is also evidence that these effects may differ when foods are consumed as part of mixed meals (Thomas, 1994).

Taking the case of Kenya where dietary practices of various ethnic communities are quite varied, ethnicity could influence glycaemic control levels of
patients. The ethnic groups that were represented in this study are shown in Table 4.3 below. The largest population was Kikuyus (50%), followed by Kambas (15%). The high percentage of Kikuyus and Kambas in this study could have been attributed to the proximity of central and eastern provinces where the patients come from to Nairobi where Kenyatta National Hospital is located.

**Table 4.3: Ethnic distribution of diabetic patients at Kenyatta National Hospital**

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kikuyu</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Kamba</td>
<td>15</td>
<td>15</td>
</tr>
<tr>
<td>Luo</td>
<td>11</td>
<td>11</td>
</tr>
<tr>
<td>Luhya</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Kisii</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Embu</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Kalenjin</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Maasai</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Giriama</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Somali</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ethiopian</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Nubian</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>European</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Meru</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

Results of this study showed no significant differences in the blood sugar levels nor the Body Mass Index of patients of different ethnic groups at \( P = 0.62 \) and \( P = 0.21 \) respectively. These results could be explained by the fact that 74% of these patients actually lived in Nairobi and therefore consumed foods of the same kind and from the same sources that contained the same amounts of nutrients.
4.1.5 Residence of diabetic patients

Seventy four percent of patients interviewed were from Nairobi. The remaining 26% were from other towns and peri urban areas of Nairobi. The diabetic clinic of Kenyatta national Hospital although being a referral clinic, its' proximity to Nairobi makes it more accessible to patients living in Nairobi. The percentage from Nairobi could also have been higher since as shown in Table 4.2, 77% of the patients were in the employment age and below (10-59 years).

The remaining 23% were above 60 years. This latter group may have represented those retired and living in the rural areas away from Nairobi. The percentage of patients in the age brackets above 60 years of age could therefore have been due to the distance between various rural areas and the clinic thus discouraging clinic attendance of this age group. The percentage of patients that were in this age group was also low (23%).
Table 4.4: Residence of diabetic patients attending Kenyatta National Hospital

<table>
<thead>
<tr>
<th>Residence</th>
<th>Frequency</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nairobi</td>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td>Kiambu town</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>Murang'a (Kahuhia)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Muranga (Maragua)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mitihato</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kiambu (Ndenderu)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kajiado</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Ngon'g</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Gatundu</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Limuru</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Githunguri</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Muguga</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Karatina</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Meru</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Thika town</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kirinyaga</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Nyahururu</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Thika (Gatuanyaga)</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kisii</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Mbooni</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Kiserian</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

4.2 Glycaemic control levels of patients

Glycaemic control was determined through random blood sugar control levels of patients. Averages were calculated from a combination of patients' blood sugar levels in the past three visits prior to the study together with the one measured during the study. It was felt that using these averages would give a closer estimate of glycaemic control levels of patients as compared to using only one visit. This would represent their blood sugar control levels for the previous two years including the year of the study.
Figure 4.1 shows that 59% of patients had poor glycaemic control levels. They had blood sugar levels of above 10mmol/l with the highest being as high as 27mmol/l. This tallied with the report of Omonge (2000). Only 41% had good control levels of between 4-10mmol/l. Hypoglycaemia (3 mmol/l and below) was not recorded. The implications here were that there was a problem with the patients' management of their diabetic condition.

**Figure 4.1 Glycaemic control levels of diabetic patients**

There were no significant differences in the mean blood glucose control levels of male and female patients (P= 0.89). A mean difference of -0.62 was reported. The mean blood sugar control level of male patients was 10.85 mmol/l and for the female patients was 11.46 mmol/l. From these results it was concluded that gender of patients did not influence the glycaemic control levels.

Nevertheless, at the 95% confidence level, there was a significant difference in the glycaemic control levels of insulin dependent and non-insulin dependent diabetic patients. The mean blood glucose level of insulin dependent
diabetics was 14.05 while that of the non-insulin dependent diabetics was 9.34. The mean difference was 4.71. A significance level of \( P = 0.13 \) was reported.

It was evident from these results that the insulin dependent diabetic patients had poor glycaemic control levels as compared to the non-insulin dependent diabetics.

Rodwell (1989) states that the insulin dependent diabetics completely lack endogenous insulin thus depend on exogenous insulin to sustain their lives. The non-insulin dependent diabetics on the other hand have limited functioning endogenous insulin. This could explain these disparities in glycaemic control levels of these two groups of patients. Another factor that could have resulted in these differences is the therapies patients used to manage their condition. Table 4.9 indicates that patients who used insulin of which the majority were insulin dependent diabetics had poor glycaemic control levels. However it was not conclusive whether insulin caused poor glycaemic control. It was thought that the glycaemic control levels could have been poor as a result of the type of diabetes a patient suffered from. Insulin dependent diabetics totally lack endogenous insulin and depend on exogenous insulin that cannot work as well as endogenous insulin.

4.3 Patients' weight maintenance levels (Body Mass Index)

The weight maintenance was analyzed using Body Mass Index of patients. This was calculated from averages of weight and height measurements of patients. The weight measurements of patients were divided by squares of height measurements to arrive at the Body Mass Index.
BMI = \frac{\text{Weight}}{\text{Height}^2}

Figure 4.2 shows that 47% of the patients had normal weight, 21% had first-degree obesity and 5% had second-degree obesity. Twenty percent of the patients were on the borderline of underweight while 7% were underweight. The lowest body mass index was 10, the highest was 36 giving quite a large range of 26.

**Figure 4.2: Body mass index of diabetic patients at Kenyatta National Hospital.**

Results indicated no significant difference in the Body Mass Index of male and female patients at the 95% confidence level. The mean Body Mass Index of male patients was 12.54 and for female patients was 12.63. The mean difference in their Body Mass Indices was therefore - 0.86 (P = 0.39).
There was also no significant difference in the Body Mass Index of the insulin dependent and non-insulin dependent diabetics at the 95% confidence level (\(P = 0.57\)). The mean Body Mass Index of the insulin dependent diabetics was 13.30 and for non-insulin dependent diabetics were 11.49. This gave a mean difference of -1.81.

Table 4.10 indicated that there was a significant relationship between the type of insulin patients used and their Body Mass Index. It was expected that the insulin dependent diabetics could have had a higher Body Mass Index as compared to those who did not use insulin. Shillitoe (1988) states that the use of insulin could result in obesity due to its' ability to heighten the appetite of patients thus increased food consumption. These findings could therefore have been so because some non-insulin dependent diabetics also used insulin in the management of their condition. Patients' Body Mass Index were significantly related to their blood sugar levels (\(P = 0.004\)). Table 4.5 presents this relationship.

**Table 4.5: Relationship between blood sugar levels and Body Mass Index of diabetic patients at Kenyatta National Hospital**

<table>
<thead>
<tr>
<th>Blood sugar levels</th>
<th>&lt;16</th>
<th>16.1-18.9</th>
<th>19-24.9</th>
<th>25-29.9</th>
<th>30-39.9</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-10mmol/l</td>
<td>14.3</td>
<td>40</td>
<td>29.8</td>
<td>76.2</td>
<td>40</td>
</tr>
<tr>
<td>10.1 mmol/l and above</td>
<td>85.7</td>
<td>60</td>
<td>70.2</td>
<td>23.8</td>
<td>60</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

\(P = (1, n = 100) P = 0.004\)
Results indicated a significant difference in blood sugar levels of patients with different body mass indices. From Table 4.5, 85.7% of the underweight patients had poor glycaemic control levels while 60% of those on the borderline had poor glycaemic control levels. Among the patients with normal weight, 70.2% had poor glycaemic control levels while among those who had obesity, 23.8% had poor glycaemic control levels. As for those with obesity 11, 40% had good blood sugar levels and 60% had poor glycaemic control levels.

These findings showed that the higher the level of obesity, the poorer the blood sugar control levels. They therefore supported the findings of the American Diabetes Association (1998). Weight reduction promotes a decrease in glucose resistance. Paige (1988) in support states that this parameter alone usually results in a marked improvement of blood glucose level and glucose tolerance because of improved insulin sensitivity.

Among patients whose weight was below normal, blood sugar control levels improved as the weight tended towards being normal as was expected. It was however noted that among patients of normal weight, (70.2 %) had poor glycaemic control levels. These latter findings therefore contradicted the earlier stated findings of the (American Diabetes Association, 1998) and (Paige, 1988). It was therefore concluded that several factors and not only the body mass index influenced glycaemic control of these patients.
4.4 **Physical activity levels of patients**

The levels of physical activities patients performed were thought to be an important factor that influences their weight control status (Body Mass Index). The patients were asked to state the activities they engaged in their occupations and at leisure time. From what the patients stated, they were categorized as active, moderately active or sedentary. Sixty two percent of patients were categorized as sedentary, 31% as moderately active and 7% of the patients as active. Figure 4.3 gives a picture of this distribution.

**Figure 4.3: Level of physical activity diabetic patients at Kenyatta National Hospital engaged in.**

As shown in Figure 4.3, only 27% of the patients were obese. This was contrary to expectations. As already shown in Figure 4.3, 62% of the patients lived sedentary lifestyles. However, in later discussions (Table 4.6), the findings of the study were that the level of physical activities was significantly related to the glycaemic control levels of patients. The level of patients' physical activities was
therefore important in influencing glycaemic control levels of patients as was expected.

The levels of physical activity patients engaged in was considered an important factor that could influence the body mass indices of patients and ultimately glycaemic control. Table 4.6 presents the level of physical activities patients engaged in.

Table 4.6: Physical activities and blood sugar levels of diabetic patients at Kenvatta National Hospital.

<table>
<thead>
<tr>
<th>Blood sugar levels</th>
<th>Active</th>
<th>Moderately active</th>
<th>Sedentary</th>
</tr>
</thead>
<tbody>
<tr>
<td>4-10 mmol/l</td>
<td>42.9</td>
<td>58.1</td>
<td>32.3</td>
</tr>
<tr>
<td>10.1 mmol/l and above</td>
<td>57.1</td>
<td>41.9</td>
<td>67.7</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

\[ P = (1, n = 100) \, P = 0.05 \]

Results indicated a slightly significant difference in blood sugar levels of patients who engaged in different levels of physical activity \( (P = 0.05) \). This indicates a significant relationship between level of Physical activities and glycaemic control. Out of the active patients, 42.9% had normal blood sugar levels and 57.1% had poor glycaemic control levels. Of the moderately active patients 58.1% had good glycaemic control levels while 41.9% had poor control levels. These findings show that, among active patients those with poor glycaemic control levels were more than those with poor glycaemic control levels.

However, these findings were the reverse for the moderately active patients. However it was noted 67.7% of the sedentary patients had poor
glycaemic control levels. This gives an overall picture that there was a relationship between blood sugar control levels and level of leisure activities of patients.

Results also indicated no significant difference in Body Mass Index of patients who performed various levels of physical activity \( (P = 0.69) \). It was expected that the higher the level of physical activity patients engaged in, the lower their Body Mass Index would be since exercise helps in weight reduction. These results therefore contradicted this expectations. However comparing the moderately active and the sedentary patients, the relationship was as was expected that the higher the level of physical activity patients engaged in, the better their glycaemic control levels would be. This is taking into consideration the expected relationship between exercise and Body Mass Index and the relationship between Body Mass Index and glycaemic control.

**4.5 Therapy used to manage diabetes and duration of the disorder**

**4.5.1 Type of diabetes**

Results showed that 61% of the patients suffered from non-insulin dependent diabetes while 39% suffered from insulin dependent diabetes. From these results, it is evident that incidences of non-insulin dependent diabetes are higher than those of insulin dependent diabetes.

The onset of non-insulin dependent diabetes is usually after the age of 40 years and represents 80% of all diabetics (Rodwell, 1989). The findings in Table 4.1 indicating that 64% of the patients were in the age brackets between 40-80 years are consistent with the findings of (Rodwell, 1989). The development of
non-insulin dependent diabetes is often times associated with obesity that is associated with lifestyle changes brought about by affluence. Affluence promotes consumption of fast foods that in most cases contain a high amount of fat thus promoting weight gain. This food consumption if combined with sedentary lifestyles highly promotes the development of obesity.

Lifestyle changes are brought about by rural-urban migration as people search for jobs. Nairobi being the main business town in Kenya, it experiences a high influx of people from rural areas in the country searching for employment. These findings could therefore suggest that the Kenyan people have changed their lifestyles due to migration. The findings also suggest that these patients were affluent. However from Table 4.2, it was evident that a majority of these patients were not affluent thus it did not influence the development of this disorder. Nevertheless Figure 6 shows that 62% of the patients led sedentary lifestyles. This could therefore have played a great part in the development of this disorder.

Results indicated significant differences in the blood sugar levels and Body Mass Index of insulin dependent and non-insulin dependent diabetics \( P = 0.05 \). These results could have been due to the different forms of therapy they used in managing their condition as will be shown in later discussions.

4.6 Duration patients had suffered from diabetes

Patients were sampled purposively to ensure that only those patients who had attended the clinic at least three times participated in the study thus the minimum duration a patient had suffered from diabetes was two years. Results
indicated that 32% of the patients had suffered from diabetes for two years. A total of 54% of the patients had suffered from diabetes for five years and below while 29% for between five and ten years.

A total of 83% of the patients had suffered from diabetes for ten years and below suggesting that there were many newly diagnosed cases of the disorder. Only 17% had suffered from diabetes for more than ten years with the longest period being twenty-three years. As already discussed above, this increase in newly diagnosed cases of diabetes could be a product of lifestyle changes in the general population of Kenya thus a need for lifestyle changes. Results indicated that there was no significant relationship between the duration patients had suffered from diabetes and blood sugar levels as shown in Table 4.7.

Table 4.7: Duration of diabetes and blood sugar level of diabetic patients at Kenyatta National Hospital.

<table>
<thead>
<tr>
<th>Duration of diabetes</th>
<th>Frequency</th>
<th>Valid percentage</th>
<th>4-10mmol/l (%)</th>
<th>10mmol/l and above (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5 years</td>
<td>54</td>
<td>54</td>
<td>58.5</td>
<td>50.8</td>
</tr>
<tr>
<td>6-10 years</td>
<td>29</td>
<td>29</td>
<td>29.3</td>
<td>28.8</td>
</tr>
<tr>
<td>11-15 years</td>
<td>7</td>
<td>7</td>
<td>2.4</td>
<td>10.2</td>
</tr>
<tr>
<td>16-20 years</td>
<td>5</td>
<td>5</td>
<td>4.9</td>
<td>5.1</td>
</tr>
<tr>
<td>21-25 years</td>
<td>5</td>
<td>5</td>
<td>4.9</td>
<td>5.1</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

P = (l, n = 100) P = 0.67

There was no significant difference in blood sugar levels of patients who suffered from diabetes for different duration of time. Results also showed no
significant relationship between blood sugar levels, Body Mass Index of patients and duration of diabetes \( (r = 0.18) \ (P = 0.12) \) and \( (P = 0.52) \) respectively.

Looking at the cross tabs, with the exception of the duration of between 11-15 years of the disorder, all the classifications had patients divided almost equally in the levels of glycaemic control. It was expected that the longer patients had suffered from diabetes, the better their blood sugar levels would be. It was thought that the longer a patient had suffered from diabetes the more experienced they would be in managing their condition thus better control. From Table 4.7, it is evident that among patients who had suffered from diabetes for ten years and below, a majority of them had good glycaemic control levels as compared to those who had suffered from diabetes for eleven years and above. This suggested that experience did not play a part in glycaemic control.

The duration a patient has suffered from diabetes could influence glycaemic control in another manner beside experience. This was taking into account the expected relationship between the levels of glycaemic control and development of complications of diabetes, it is possible that the longer a patient suffers from diabetes, the poorer their blood sugar control becomes. The finding that those who had suffered from diabetes longer had poor glycaemic control as compared to those who had suffered from the disorder for a shorter period therefore supported the findings of (Feener and King, 1993). The duration patients had suffered from diabetes could be therefore said to influence glycaemic control.
4.7 Therapy

Results in Table 4.8 indicated that 40% of the patients managed their condition through the use of diet and oral hypoglycaemic agents. Thirty seven percent were on insulin and diet, while 5% used a combination of diet, oral hypoglycaemic agents and insulin. This latter combination of regimens suggested that their condition was quite volatile (very unstable blood sugar levels). Only 18% could manage their condition by diet alone.

Table 4.8: Therapy used by diabetic patients at Kenyatta National Hospital to manage their condition

<table>
<thead>
<tr>
<th>Therapy</th>
<th>Valid percentage</th>
<th>4-10mmol/l (%)</th>
<th>10mmol/l and above (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diet and oral hypoglycaemic agents</td>
<td>40</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>Diet and insulin</td>
<td>37</td>
<td>18.9</td>
<td>81.1</td>
</tr>
<tr>
<td>Diet, insulin and oral hypoglycaemic agents</td>
<td>5</td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>Diet alone</td>
<td>5</td>
<td>72.2</td>
<td>27.8</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

P (1, n = 100) P = 0.001

Robinson, et al. (1986) state that the insulin dependent diabetics completely lack endogenous insulin thus have to depend on exogenous insulin to sustain their lives. As already stated above, the insulin dependent diabetics were 39% while the number of patients who used insulin in managing their condition were 45%. This is different from the general population where 10-20% are Insulin dependent and 80 - 90% are Non Insulin dependent diabetics.
These findings meant that there were 6% of the non-insulin dependent diabetics who also used insulin suggesting that their condition was poorly controlled. The non-insulin dependent diabetics normally used oral hypoglycaemic agents and diet to manage their condition or diet alone especially if they lose weight and maintain their weights at body mass index in the region of 22 (Thomas, 1994).

The number of patients who depended on diet alone were only 9%. Paige (1988) states that some diabetic no longer need medication if they lose weight because their own insulin works better without extra weight, fat and sugar. According to Figure 4.3, 47% of the patients had desirable weights of BMI between 19 - 24.9. The remaining 49% of the non-insulin dependent diabetics used oral hypoglycaemic agents and diet.

There was a significant difference in blood sugar levels of patients who used various forms of therapy in managing their condition (P = 0.00). Mean blood sugar level of the insulin dependent diabetics was 14.05 mmol/l while that of the Non Insulin dependent diabetics was 9.34 mmol/l. In comparing the blood sugar levels of those who used all other forms of therapy with those who used diet, insulin and oral hypoglycaemic agents, those on diet alone were 0.34 times less likely to report poor blood sugar levels (P = 0.05), (Exp (B) = 0.34).

A total of 81.1% of patients who used insulin and diet had poor blood sugar levels. Fifty percent of those who used diet and oral hypoglycaemic agents had normal blood sugar levels and the remaining 50% had poor control levels. In
the category of patients who were on insulin, oral hypoglycaemic agents and diet, 80% had poor glycaemic control levels. Most patients who only depended on diet had good glycaemic control levels. Only 27.8% of these patients had poor glycaemic control levels. The use of insulin and diet therefore recorded the worst blood sugar control levels followed by diet, insulin and oral hypoglycaemic agents, diet and oral hypoglycaemic agents and lastly those on diet alone had the best glycaemic control levels.

This could have been due to the influence of insulin on weight (Peterson, 1988). The use of insulin could result in hypoglycaemia that causes heightened appetite thus increased food consumption. Increased food consumption if sustained for a long period of time could result in obesity (Shillitoe, 1988). Weight then ultimately affects the body's response to blood sugar. Appropriate body mass index of about 22 improves the body's sensitivity to insulin and improves glycaemic control (Thomas, 1994; American Diabetes Association, 1998).

On the other hand, the use of insulin is intended to replace the unavailable insulin in the body thus achieving desired glycaemic levels. It was therefore interesting to note that those who were on insulin reported the worst glycaemic levels. It was therefore concluded that several factors could have affected in glycaemic control levels of these patients. Some of these factors have been shown to include presence of infections, other disease conditions and even stress that accompanies the use of insulin. These factors were however not investigated.
4.7.1 Types of insulin used

The type of insulin a patient is advised to use depends on the severity of their condition. Various types of insulin work within different duration and last for different lengths of time in the body. The Lente group of insulin was the most commonly used (33%). It was thought that this could have been due to its comparatively cheaper cost so most patients could afford it. As already discussed above, only 17% of the patients had a monthly salary of over Kshs 10,000/= thus limited purchasing power. The majority of patients on insulin could also have used Lente because it more easily available in the market and works comparatively faster than other types of insulin. Only 12% of the patients used other types of insulin.

There was no significant difference in blood sugar levels of patients who used different types of insulin (P = 0.14). Nevertheless, in comparing their variances at the 95% confidence level, equality of variances was not assumed (P= 0.003). This meant that the different groups had different standard deviations of blood sugar levels.

The Body Mass Indices of the patients who used various types of insulin were significantly different (P = 0.00). Testing for equality of variances, equality of variances could not be assumed at (P = 0.00). The type of Insulin patients use should therefore be closely monitored and counseling tailored to meet the needs of the patients.
Table 4.9: Type of insulin used and Body Mass Index of diabetic patients attending Kenyatta National Hospital

<table>
<thead>
<tr>
<th>Type of Insulin used</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lente 20/10</td>
<td>6</td>
</tr>
<tr>
<td>Lente 40/20</td>
<td>1</td>
</tr>
<tr>
<td>Lente 18/10</td>
<td>5</td>
</tr>
<tr>
<td>Lente 24/12</td>
<td>7</td>
</tr>
<tr>
<td>Lente 36/18</td>
<td>1</td>
</tr>
<tr>
<td>Lente 28/14</td>
<td>4</td>
</tr>
<tr>
<td>Lente 30/14</td>
<td>2</td>
</tr>
<tr>
<td>Lente 32/16</td>
<td>1</td>
</tr>
<tr>
<td>Lente 10/6</td>
<td>1</td>
</tr>
<tr>
<td>Lente 50/36</td>
<td>1</td>
</tr>
<tr>
<td>Lente 24/14</td>
<td>1</td>
</tr>
<tr>
<td>Humulin 8 units</td>
<td>1</td>
</tr>
<tr>
<td>Humulin 12/6</td>
<td>2</td>
</tr>
<tr>
<td>Humulin 18/10</td>
<td>1</td>
</tr>
<tr>
<td>Humulin 70/30</td>
<td>2</td>
</tr>
<tr>
<td>Mixtard 20/10</td>
<td>6</td>
</tr>
<tr>
<td>N/A</td>
<td>55</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

Lente 24/12 was the most commonly used type of insulin (7%), followed by Mixtard 20/10 (6%) and Lente 18/10/Lente 10/6 (6%). On the overall, Lente was the most commonly used type of insulin. Lente is one the long acting brands of insulin commonly used in Kenya. The rest of the patients (55%) used oral hypoglycaemic agents and diet or diet alone to manage their condition. The various types of insulin work for different durations from rapid action to prolonged action. The influence of the time patients had their injections before the study and the duration these types of insulin lasted in the body was thought to have played an important part in these observations. It was assumed that patients had taken
breakfast before the study. Nevertheless, some patients were interviewed much later, while others were interviewed early in the morning as they arrived at the clinic. This meant that the blood sugar levels of those interviewed earlier could have been higher due to the breakfast they had just taken.

The different types of the insulin used could also have influenced the body mass indices of patients depending on how fast they work and how long after injection they stay in the body. Depending on how they work to promote cell absorption of glucose, patients' food consumption is affected. If insulin works rapidly, a patient is most likely to feel hungry faster thus eats more frequently. This increased food intake can result in obesity (Shillitoe, 1988) and ultimately affect glycaemic control thus the difference in body mass indices of patients reported. The duration insulin used worked was thought to be an important factor in glycaemic control.

Results indicated no significant difference in blood sugar levels of patients depending on the durations the insulin types they used worked \((P = 0.23)\). Nevertheless, testing for equality of variances, equality of variances could not be assumed \((P = 0.00)\).

There was also significant difference in Body Mass Index of patients who used different types of insulin \((P = 0.001)\). In testing for equality of variances, equality of variances could not be assumed \((P = 0.00)\).

Among the patients who used the long acting insulin brands, none was underweight while 66.7% of them were on the borderline and 33.3% of them were
obese. On the other hand, among those who used insulin twice per day, 14.3% were underweight, 23.8% were on the borderline. In this group 47.6% had normal weight and the remaining 14.3% were obese. The type of insulin used could predict 14% of blood sugar levels of the patients (R square = 0.14).

In comparing those who used insulin the long acting insulin with those who did not use insulin at all, those who used the long acting insulin were 5.5 times less likely to report poor blood sugar levels (P = 0.00) and (Exp (B) = 5.49). Patients are normally advised to eat enough food that correlates with their insulin usage. The more insulin is used the more food is consumed, thus the expected influence on body mass index and ultimately glycaemic control.

Thomas (1994) states that weight influences blood sugar control levels by its' effect on insulin resistance. Good weight management reduces insulin resistance thus body cell and thus good glycaemic control absorb more glucose. These findings were therefore contrary to expected results that the better the weight control status, the better the glycaemic control levels.

4.7.2 Oral hypoglycaemic agents

Diabenese 250mg (used by 18% of patients), glucophage 500mg (18%), Glibenimide (5%), Glibenimide 75 mg (3%), Dibenese 500 mg (8%), glucophage 250mg (3%) and gliconimide (3). Diabenese 250mg and glucophage 500mg were the most commonly used. These were the most common oral hypoglycaemic agents in the market and relatively cheaper that the rest. The cost of various oral hypoglycaemic agents could have influenced this distribution. Given the low
purchasing power of most patients as already discussed, they would automatically go for cheaper types of oral hypoglycaemic agents they could afford provided they could work as required.

There was no significant differences in the Body Mass Index or blood sugar levels of patients who used different types of oral hypoglycaemic agents. As for the number of times per day they were used, only diabenese 250mg had a significant relationship with the blood sugar levels of patients \( (P = 0.02) \). In testing for equality of variances, equality of variances could be assumed at \( (P = 0.52) \).

4.8 Dietary counseling of diabetic patients at Kenyatta National Hospital

There were a total of 10 nutritionists who worked at the diabetic clinic of Kenyatta National Hospital. Both nutritionists who participated in the study were females. Both of them had worked at the hospital for more than five years as nutritionists. Both had received specific training in diabetes counseling prior to employment at the hospital. One of them had worked at the clinic for 11 years while the other had worked at the clinic for 8 years.

In diet counseling, they advised patients to eat foods readily available to them. They emphasized a balanced diet for these patients. Patient’s weights, blood sugar levels and therapies they used were taken into consideration in the counseling sessions. Diet prescriptions were not uniform for all patients. The consumption of simple sugars and other high calorie foods were strictly forbidden.

For overweight patients, exercise and low calorie diet was recommended. They stated that most patients adhered to their diet prescriptions. The diet sheets
were given to all patients whenever they needed them. Patients were taught how to use the diet sheets and follow up done. Each patient’s diet was computed though the determination of the weights and heights. The diet was intended to achieve desirable Body Mass Index. They encouraged the patients to go back to them for consultation as often as they needed to.

Among the problems encountered by the nutritionists was illiteracy of some patients. As shown in Table 4.2, 52% off the patients only had primary level education. This led to language barrier since most of the patients could only communicate properly in their mother tongues.

The nutritionists stated that they were satisfied with their work although the high number of patients they dealt with on the clinic days was overwhelming. The hospital was able to accord them time and finances to attend training seminars, camps and other forms of training.

4.8.1 Patients cultural food

The types of foods consumed, methods of cooking used and the way food is mixed and consumed has been shown to influence blood sugar response both in Kenya (Ayuo and Ettyang, 1996).

When patients were asked to state their cultural foods results were as follows; rice (8%) muthokoi (17%) ugali 76% matoke 4% fish 9% sour milk 4% githeri 54% meat (8%) and cassava (1%) these were staple food by a variety of ethnic groups. The Kikuyu, Embu and Meru stated that githeri (mixture of maize and beans) was their cultural food, Luo (fish), Kalenjins and one Maasai (sour
milk and meat), European and Somalis (meat), Ethiopian, Nubians and European (rice), Kamba (Muthokoi).

Pork was not consumed by 5% of the patients because they were Muslims. No patient was found to adhere to cultural restrictions with regard to food this could have been due to most patients living in Nairobi and other urban centers where people eat almost all food stuffs as a result of the influence of promotions and electronic media. All patients stated that they consumed their foods as part of mixture meals.

4.8.2 Meals and snacks consumed per day

Results indicated that twenty six percent of the patients consisting of students and most of those employed only took two meals in a day when they were at home seventy four percent who were either self-employed or unemployed took three meals per day.

The number of meals and snacks diabetic patients consume per day is an important factor in nutritional management of the disorder. Paige (1988) states that a diabetic receiving insulin should consume three meals per day. This is important for the avoidance of hypoglycaemic episodes that could result in coma and in some instances death. All insulin dependent diabetics stated that they did not skip a meal. These results therefore indicated that the patients were educated on the importance of meal timing and the importance of not skipping meals. All the patients who indicated they skipped a meal were obese. They mainly skipped lunch in an attempt to reduce their weights.
Results also indicated that 66% of the patients took a snack in between meals while 29% did not five percent of them only took snacks occasionally. Consumption of snacks in between meals is especially recommended for the insulin dependent diabetics. Page (1988) states that in addition to three meals per day, they should take additional snacks in the midmorning, afternoon and an additional one before bed. All the insulin dependent diabetics stated that they took snacks as recommended. The snacks patients consumed included ripe bananas, cakes, white and brown bread, biscuits, ugali, and tea, sausages, chapatis and mandazis.

4.8.3 Intake of selected foods listed in the diabetic diet sheets of Kenyatta National Hospital

Compliance to the diet prescription was generally high. Above 90% of the patients did not consume the foods in this category that are not recommended for them by the hospital. This is shown in Table 4.10 below.
Table 4.10: Intake of selected foods listed in the diabetic diet sheets of Kenyatta National Hospital

<table>
<thead>
<tr>
<th>Food item</th>
<th>Once or more per day (%)</th>
<th>Once or more per week (%)</th>
<th>Once a month (%)</th>
<th>Occasionally (%)</th>
<th>Never (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sugar</td>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>94</td>
</tr>
<tr>
<td>Tinned fruits</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>98</td>
</tr>
<tr>
<td>Sweetened bottled or tinned fruit juice</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>96</td>
</tr>
<tr>
<td>Jam or marmalade</td>
<td>4</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>95</td>
</tr>
<tr>
<td>Honey</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>98</td>
</tr>
<tr>
<td>Candy</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Chocolate</td>
<td>2</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>97</td>
</tr>
<tr>
<td>White bread</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>95</td>
</tr>
<tr>
<td>Biscuits</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>93</td>
</tr>
<tr>
<td>Alcohol</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Spirits</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Fried foods</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>95</td>
</tr>
<tr>
<td>Sodas</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>936</td>
</tr>
</tbody>
</table>

Source: Kenyatta National Hospital

Patient’s calorie intake was investigated using a 24-hour recall. A diet history could not be used because the interviews were once only taken once. The patients could not be followed up because they were officially scheduled to attend the outpatient diabetic clinic once in six months. Results are presented below.

4.8.4: 24 (Twenty four) hour recall.

Patients' intake of calories was determined through a twenty-four hour recall. Patients were provided with a cup, plate and glass by the researcher and asked to give an estimate of different foods they took at different times the previous day. Dry beans and rice were used for this purpose of the estimates. Water was used for the purpose of estimating intake of fluids. Patients gave
estimates of the amounts of food they served from which they showed the amount consumed. The raw values were converted to their equivalents; amount of various nutrients consumed and was estimated from there using the estimates provided by (Sehmi, 1993).

Regions of Kenya patients resided in were considered in determining their calorie intake. Sehmi (1993) provides estimates of the amounts of nutrients provided by foods by regions in Kenya. She shows that foods from different areas of Kenya provide varied amounts of nutrients.

There was no significant difference in the consumption of calories by patients. Table 4.11 gives the calorie consumption of patients.

**Table 4.11: calorie consumption of diabetic patients at Kenyatta National Hospital**

<table>
<thead>
<tr>
<th>Calories</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1501-2000</td>
<td>56</td>
</tr>
<tr>
<td>2001-3000</td>
<td>43</td>
</tr>
<tr>
<td>3001-4000</td>
<td>1</td>
</tr>
<tr>
<td>4001-5000</td>
<td>0</td>
</tr>
<tr>
<td>5001-6000</td>
<td>0</td>
</tr>
<tr>
<td>TOTAL</td>
<td>100</td>
</tr>
</tbody>
</table>

Results indicated that 56% of the patients consumed calories of between 15001-2000 kcal. The amounts of calorie recommended for each patient varied. Using the table of heights and weights by age, the recommended allowances of calorie for each patient was calculated using the formula provided by (Robinson, et al., 1989). These amounts were then compared with the actual intakes of
individual patients. Results indicated that 42% of the patients consumed the amounts of calories recommended for them, 38% consumed less and 20% consumed more than the recommended.

In dietary management of diabetes, emphasis is placed upon calorie consumption as an important nutrient that influences the body mass index of patients. Calories are provided by all nutrients consumed in different amounts with fat being the highest calorie-providing nutrient.

It was encouraging to note that almost half the patients consumed the right amounts of calorie recommended for them. The high percentage of those who consumed less that was recommended could have been due to the low incomes of patients as already discussed above in Table 4.2.

**4.8.4.1: Intake of calories and blood sugar levels of patients.**

Results indicated a positive relationship between the consumption of calories and the blood sugar levels of patients \((P = 0.02)\). The relationship was strong and positive \((r = 0.79)\). Calorie restriction is the main aspect of dietary management in diabetes. The intake of high amounts of calories is associated with weight gain. Weight gain on the other hand has been shown to cause a reduction in the body's sensitivity to insulin thus reduced absorption of glucose by body cells hence poor glycaemic control. It is therefore important to take sufficient calories but not excess especially for overweight patients.
Results also indicated significant differences in body mass indices of patients who consumed varied amounts of calorie \( (P = 0.01) \). These Results are shown in Table 4.12

**Table 4.12: Intake of calories and blood sugar levels and body mass indices of patients at Kenyatta National Hospital.**

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Blood sugar levels</th>
<th>Body mass indices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sig.</td>
<td>r</td>
</tr>
<tr>
<td>Calorie</td>
<td>0.03</td>
<td>0.79</td>
</tr>
</tbody>
</table>

4.9: Diabetes complications commonly seen at Kenyatta National Hospital

The most common complications seen at the clinic was high blood pressure (65%). Eye problems were also quite common (40%). Nerve degeneration (15%) and kidney degeneration (17%) were also occasionally seen at the clinic. Those with kidney problems were mainly directed to the renal unit of the hospital for further medical check up and treatment.

Doctors easily differentiated these complications from other seemingly similar diseases by taking into consideration the number of years after a patient was diagnosed as diabetic and when they are reported. The Doctor indicated that these complications are mainly reported after ten years of diabetes and not before. These complications are also symptomatic; they are specific to diabetes only since they affect the capillaries only.

The doctor advised patients to seek immediate medical attention once they notice any unfamiliar symptom in order to facilitate arrest of the situation. They
are also advised patients not to use any therapy especially insulin unless recommended since their misuse can result in diabetic coma and even death. He also advised the insulin dependent diabetics to follow the recommended diet strictly and to take snacks in between meals to avoid the risk of hypoglycaemia. The patients should also ensure that their feet are well cleaned and died. In case one is hurt, they should seek immediate medical attention to avoid the risk of developing gangrenes, which could eventually lead to leg amputations.

The doctor stated that a person could be diabetic for a long period without knowing. Persons should occasionally check their blood sugar level. He stated that due to delayed diagnosis of the condition; the development of complications could be mistaken to be other than of diabetes making their management difficult. The earlier the condition is diagnosed, the easier the management would be.
CHAPTER FIVE: SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction.

This section is discussed under the following topics: Summary, major findings, conclusions, recommendations and suggestions for further research.

5.1 Summary

Data from Kenyatta National Hospital indicated that 50% of diabetic patients attended the outpatient diabetic clinic at the hospital had poor glycaemic control levels (Omonte, 2000).

From the literature review, it was evident that the control of glycaemia is very important in controlling the development of complications of diabetes that are tragic and disastrous. The study therefore sought to determine factors that influence glycaemic control in diabetes mellitus with a view to control these complications and dangers arising from poor glycaemic control.

In order to investigate these factors, a sample of 46 male and 54 female patients, a sub-sample of two Nutritionists and one medical doctor were studied. This study was conducted at the outpatient clinic of Kenyatta National Hospital. Three interview schedules were used to elicit information pertaining to the objectives of the study.

Data were analyzed using the statistical package of social sciences (SPSS). Descriptive statistics namely means, percentages and frequencies were used to describe characteristics of respondents. The statistical tests employed were, Chi-
Square, Pearson's product moment correlation, Independent t-test, linear regression and logistic regression. Data were presented using tables, pie charts and bar charts. Major findings from this study are discussed below.

5.2 Major Findings

From the findings of this study, it can generally be stated that glycaemic control among diabetic patients attending the out-patient diabetic clinic at Kenyatta National Clinic Hospital was influenced by the following factors-therapy they used to manage their condition, their body mass index, type of diabetes they suffered from, duration they had suffered from diabetes mellitus and their dietary consumption.

Results indicated that the number of non-insulin dependent diabetics was higher than the insulin dependent diabetics. The non-insulin dependent diabetics presented 61% of the patients interviewed while the insulin dependent diabetics were only 39%. This was consistent with the age groups represented in the study. The highest percentage of patients was between the ages 30-79 years. These are the ages where the prevalence of non-insulin dependent diabetes is high.

As reported by (Omonge, 2000) that 50% of patients reported poor glycaemic control levels, results showed that 51% had poor glycaemic control levels. Gender of patients did not seem to influence their glycaemic control levels \( (P = 0.97) \). There was no significant difference in the mean blood sugar levels of male and female diabetic patients nor their body mass indices. There was also no
significant difference in the Body Mass Index of male and female patients \( (P = 0.39) \).

There was no significant differences in blood sugar levels and Body Mass Index of patients of various ages at \( (P = 0.23) \) and \( (P = 0.36) \) respectively. Glycaemic control was most affected by the therapy patients used. It was noted that 80% of patients on diets and insulin reported glycaemic control levels of over 10mmol/l. This group was followed by those on diet and insulin and oral hypoglycaemic agents and the best control levels were for those patients who only depended on diet with 72.2% of them reporting normal glycaemia.

It was however not easy to conclude that the use of insulin affected glycaemic control negatively. It was thought that the type of diabetes a patient suffered from played an important part in these results. This was thought to be so since for a patient on insulin their pancreas must either be producing very little amount of insulin or not producing any insulin at all thus they must be dependent on exogenous insulin.

The insulin dependent diabetics mainly use insulin though occasionally when a non-insulin dependent diabetic reports very poor glycaemic control levels they are put on insulin too. On the other hand, for patients to be able to depend on diet alone, it is usually an indication that their blood sugar levels are well controlled and the patient is stable. Most patients on diet alone are the non-insulin dependent diabetics. There was significant difference in the blood sugar levels of the Insulin dependent and the non-insulin dependent diabetics at \( (P = 0.13) \).
The insulin dependent diabetics however reported poor glycaemic control levels as compared to the non-insulin dependent diabetics. When the means of their blood sugar levels was compared, the insulin dependent diabetics reported a mean of over 10 mmol/l (Mean = 14.05mmol/l). The non-insulin dependent diabetics on the other hand reported normal glycaemia (9.34 mmol/l).

There was a significant difference in the blood sugar levels of patients who used various forms of therapy in managing their condition (P = 0.001). In comparing the blood sugar levels of those who used all other forms of therapies with those on diet, insulin and oral hypoglycaemic agents, those on diet alone were 0.1 times less likely to report poor glycaemic control as compared to those on diet, insulin and oral hypoglycaemic agents (P = 0.05). All of those on diet alone are non-insulin dependent diabetics whose diabetes was well managed.

There was a significant difference in the blood sugar levels of patients who used different types of insulin (P = 0.00) at the 95% confidence level. Testing for equality of variances (P = 0.00). There was also a significant difference in the blood sugar levels of those who used different doses of insulin. Comparing the blood sugar levels of those who used insulin and those who did not, those who used insulin two times a day were 5.5 times more likely to report poor blood sugar levels as compared to those who never used insulin. The use of different doses could only predict 14% of blood sugar levels (R Square = 0.14).

On the other hand, with the exception of diabenese 250 mg, there was no significant difference in the blood sugar levels no Body Mass Index of patients
who used various types of oral hypoglycaemic agents ($P = 0.02$). Comparing the blood sugar levels of those who used various forms of oral hypoglycaemic agents and those who did not, those who used 250 mg were 0.05 times less likely to report poor glycaemic control as compared to those who did not use oral hypoglycaemic agents.

There was also a significant difference in the Body Mass Index of insulin dependent and non-insulin dependent diabetic patients ($P = 0.05$). Generally 47% of the patients had normal weight, 21% had first-degree obesity, 5% had second-degree obesity, 20% on the bordering of underweight and 7% were underweight.

Results also showed a significant difference in the blood sugar levels of patients with various Body Mass Index ($P = 0.01$). However in comparing the blood sugar levels of patients with various Body Mass Index with those with Body Mass Index in the range of 30 – 39.9, there were no significant differences. Body Mass Index could predict 14.5% of blood sugar levels (R Square = 0.15). It was also was noted that 85.7% of the underweight patients had poor glycaemic control. Therefore, glycaemic control tended to be good as the weight control status tended towards normal.

A finding that could not be easily explained was that 70.2% of patients with normal body mass index reported poor glycaemic control levels. The level of physical activity a patient engaged in was investigated through determining the amount of physical work they performed in their occupations and the levels of leisure activities they engaged in. Results surprisingly showed no relationship
between exercise and Body Mass Index. Exercise is thought to be important in weight management. This weight management eventually results in good glycaemic levels and therefore exercise is considered very important for diabetics.

It was therefore important to note that despite the seemingly lack of relationship between exercise and weight management, there was significant relationships between exercise and glycaemic control levels, the relationship between tasks performed in occupation and glycaemic control levels, the relationship existed when the glycaemic control levels of these groups of patients were compared to 1) those who performed light tasks versus moderately heavy tasks, 2) light tasks versus heavy tasks. The findings were that the heavier the tasks performed, the better the glycaemic control levels.

The relationship between levels of exercise (physical) activities patients engaged in and their glycaemic control was also strong when comparisons were made between these three groups of patients. 1) the active versus the moderately active, 2) moderately active versus sedentary, 3) active versus sedentary. Results showed clearly that the more active a patient was, the better their glycaemic control levels. Those who were moderately active were 1 times more likely to report good glycaemic control levels as compared to the sedentary patients (P = 0.02) (Exp (B)) = 1.00). Level of physical activity could predict 5.5% of blood sugar levels of patients.

The longest duration a patient had suffered from diabetes was 25 years. A majority of patients (83%) had suffered from the disorder for ten years and below
suggesting that there were many newly diagnosed cases. Only 17% of patients had suffered from the disorder for more than ten years.

Results seemed to suggest that a glycaemic control level of diabetic patients was not influenced by the duration they had suffered from the disorder ($P = 0.67$). In comparing the blood sugar levels of patients who suffered from diabetes for different durations with those who had suffered from diabetes for 20 – 25 years, there were still no significant differences. Using linear regression both the duration patients had suffered from diabetes and the Body Mass Index had no significant relationship with the blood sugar levels of the patients ($r = 0.18$) ($P = 0.5$) and ($P = 0.12$) respectively. These two independent variables could only predict 3.3% of blood sugar levels ($R^2 = 0.03$).

However looking at the cross tab tables, it was noted that with the exception of the duration between 11-15 years, patients were almost equally divided between the two levels of glycaemic control. Results however showed that the longer patients had suffered from diabetes, the poorer their blood sugar levels were. Development of complications has been shown by research to strongly correlate with glycaemic control. Complications are rampant after ten years of diabetes.

Nutritionists who work at the diabetic clinic of Kenyatta National Hospital have received specific training in diabetes counseling and therefore did not experience problems in counseling the patients. The only constrain experienced by a few of them was language barrier. Most patients (50%) were from the Kikuyu ethnic group. Due to the high level of semi-literary of the patients, they preferred
to speak in their mother tongue thus making communication with them difficult for those not from this same community.

The nutritionists stated that they mainly concentrated on dietary aspect of counseling owing to the large numbers of patients attending the clinic. Dietary recommendations are not uniform. Advice is given with great emphasis laid on weight control. Patients are encouraged to consume foods readily available to the.

They observed that patients adhered to dietary recommendations given to them. This observation was found to be true when dietary consumption of patients was investigated. Very few patients consumed excess nutrients in comparison with the recommended amounts for their heights and weights by age. There was no significant difference in dietary intakes of male and female patients. Nevertheless, the intake of calories, proteins and fats was higher among the male patients with the exception of carbohydrates intake being higher among the male patients with the exception of carbohydrates intake being higher among female patients.

Generally, the dietary intake of patients was found to be significantly related to their glycaemic control levels and their body mass indices. The intake of calories had a strong positive relationship with the glycaemic control level of patients \( r = 0.79 \) \( (P = 0.03) \). The Body Mass Index of patients who consumed varied amount of calorie was significantly different \( (P = 0.01) \).

The most common complications of diabetes seen at the diabetic clinic of Kenyatta National Hospital were high blood pressure and eye disorders. Other complications seen at the clinic were nerve degeneration and kidney problems.
These two latter problems were referred to specialists such as the renal unit of the hospital for further check up and management. These complications could easily differentiated from other seemingly similar diseases since their onset was after ten years of diabetes.

It was recommended that individuals should make it a habit of testing their blood sugar levels regularly to allow for early detection of diabetes. This would enable the persons concerned manage the condition properly early enough to prevent or delay the complications of diabetes.

5.3 Conclusions

From the findings of the study, 61 % of the patients suffered from non-insulin dependent diabetes and 39 % had insulin dependent diabetes. Results showed that 59 % of patients had poor blood sugar levels. In looking at the Body Mass Index of patients, 47 % had normal weight, only 26 % of patients were obese. Overall, 62 % of the patients were sedentary, 38 % were moderately active or active. There were 83 % of new cases of diabetes, diagnosed 10 years and below. Therapies patients used in managing their condition included diet alone, diet insulin and a combination of diet, insulin, and oral hypoglycaemic agents.

Dietary counseling of patients was done properly, however, there was need for more tailored dietary counseling to take care of unique needs and characteristics of patients. The diet sheet provided at the hospital was used with all patients and compliance to the recommendations on the sheet was over 90 %.
The major complications seen regularly at the clinic were high blood pressure, eye problems and kidney problems. It was concluded that glycaemic control levels of diabetic patients at Kenyatta National Hospital was affected by the duration they had suffered from diabetes, the Body Mass Index of the patients, the therapies they used in managing their condition, the type of diabetes they suffered from and their levels of physical activity.

In view of these findings, the following recommendations were made.

5.4 Recommendations

1) Nutritionists involved in counseling diabetics at the out patient diabetic clinic at the hospital should be involved in periodic in-service training so as to keep up with current trends in the management of diabetes worldwide.

2) The hospital should source for funds to purchase blood sugar testing equipment for the patients. These could then be given to the patients at a subsidized price so as to enable them monitor their blood sugar levels constantly as required. The health practitioners involved in the management of diabetes at the hospital would then use these results to tailor counseling for individual patients.

3) The patients should be scheduled to visit the diabetic clinic at Kenyatta National Hospital more than two times a year to allow for close monitoring of their condition.

4) Nutritionists at the clinic should provide patients with a food history sheet every time they visit the clinic in order to closely monitor their dietary
consumption and thus be able to tailor dietary advice to individual patient’s circumstance.

5) Patients who do not perform heavy tasks (energy consuming) tasks in their occupations should be encouraged to engage in some form of physical exercise regularly to enable them maintain desirable Body Mass Index that has been shown to influence the blood sugar levels of the diabetic patients.

5.6 Suggestions for further research

Further research should be carried out on the following:

1) An investigation of dietary patterns using diet histories of diabetic patients at Kenyatta National Hospital

2) The same topic of this study could be conducted in another district hospital in Kenya.
References


Omonge, E. (Personal communication, Aug. 2000).


Appendix 1: letter of Introduction

Edwina Adhiambo Ochieng
P.O Box 8530
NAIROBI
Tel: 534661

Dear Sir/Madam

I am a postgraduate student at Kenyatta University in the School of Environmental and Applied Sciences, department of Foods, Nutrition and Diabetics. I am carrying out research on factors that influence glycaemic control in diabetes mellitus amongst patients at the hospital (Kenyatta National Hospital) as a partial requirement for the degree of Master of Science in Foods, Nutrition and dietetics. I would highly appreciate assistance from you by providing me with the information sought through this interview schedule.

Information received will be treated with strict confidentiality. Results of the study will be shared on request from you but will be used solely for the purpose of this degree.

Yours faithfully,

EDWINA ADHIAMBO OCHIENG
Appendix 2: Interview schedule for Nutritionist

Respondent’s No: ............................. (Do not fill)

1. Gender  a) Male ( )  b) Female ( )

2. How old are you?  ..............................................................

3. What is your highest level of schooling?  ................................

4. How long have you worked as a nutritionist?  ..........................

5. When were you employed at Kenyatta National hospital as a nutritionist
   (Year)-------------------------------------------------------------
   ---------------------------------------------------------------
   ---------------------------------------------------------------

6. Prior to your employment were you specifically trained as nutritionist?
   a) Yes ( )  b) No ( )

7. If yes are you specialized in diabetes counseling?
   a) Yes ( )  b) No ( )

8. What aspects of diabetes care do you counsel the patients on?
   ---------------------------------------------------------------
   ---------------------------------------------------------------
   ---------------------------------------------------------------
   ---------------------------------------------------------------

9. What are the common problems reported by the patients in their attempt to
   manage their condition?  -----------------------------------------
   ---------------------------------------------------------------
   ---------------------------------------------------------------

10. What is the dietary regimen recommended for these patients?
    --------------------------------------------------------------
    --------------------------------------------------------------
    --------------------------------------------------------------
11. What factors do you consider in giving dietary advice to the patients? 

12. What procedure do you use to determine an appropriate diet for a patient?

13. When do you give the patients the printed diet sheets?

14. What constraints do you encounter in the course of carrying out your duties?

15. You can now give any comments.
Appendix 3: Interview schedule for Doctors

Respondent’s No.----------------------------- (do not fill)

1. What services do you offer in your clinic? ---------------------------------------------
2. At what stage of diabetes do most patients come to the clinic? ---------------------
3. How often do you see the same patient? ------------------------------------------------
4. What complications do the diabetic patients present with commonly at the clinic? 
5. How do you determine that the complications are as a result of diabetes? -------
6. What recommendations do you give to the patients to help them achieve better control of their condition? --
7. You can now give any comments.
Appendix 4: Interview schedule for patients

Respondent’s No. —————— (do not fill)

Tick where appropriate in the boxes provided and write the information required in the spaces provided. (To be filled in the researcher and research assistants).

SECTION A:

Background Information

1). How old are you? —-----------------------------------------------

2). Gender a) Male ( ) b) Female ( )

3). Where have you lived for the past six months? —----------------------

4). Which ethnic group do you belong to? —-------------------------------

5). How much money do you earn per month? —-----------------------------

6). What are your sources of income? —-----------------------------------

7). What is your highest level of schooling? —---------------------------

8). What is your occupation? —-------------------------------------------

9). What activities do you engage in, in your occupation and during leisure time? —----------------------------------

10). What leisure activities do you engage in at your free time? —---------
SECTION B

Dietary patterns

11. What are your cultural foods? 

------------------------------------------------------------------

------------------------------------------------------------------
12. State the food consumed and the amount consumed.

<table>
<thead>
<tr>
<th></th>
<th>Amount Served</th>
<th>Amount Consumed</th>
<th>Total amount Consumed</th>
<th>Ingredients (in household Measurements)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Breakfast</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mid morning Snack</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lunch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late afternoon Snack</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Supper</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Late night snack</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
13. For each food item, indicate with a tick the category that best describes the frequency with which you usually eat that particular food item.

<table>
<thead>
<tr>
<th>Food item</th>
<th>Once or more Per day</th>
<th>Once a Week</th>
<th>Once a Month</th>
<th>Occasionally</th>
<th>Never</th>
</tr>
</thead>
<tbody>
<tr>
<td>SIMPLE SUGARS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweetened bottled or Tinned fruit juice</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jam or marmalade</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Honey</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Candy</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chocolate</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bread</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Biscuits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All types of soda</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Spirits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any sweetened drinks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Food fried in a lot of fat</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SECTION C:**

**Duration of diabetes and therapy used**

14. How long have you suffered from diabetes? ________________________________

15. What therapy do you receive to manage your condition?

   a) Diet alone

   b) Diet and insulin

   c) Diet and oral hypoglycaemic agents
16. If your answer to question 15 is (b) specify the type of insulin you use? 

17. How many times per day do you use the insulin?

18. If your answer to question 15 (c), specify which oral hypoglycaemic agent you use?

19. How many times per day do you use the oral hypoglycaemic agent?

SECTION D

20. **Anthropometric measurements** (to be filled in by researcher)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; measurement</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; measurement</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weight</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

SECTION E

21. **Biochemical measurements** (to be filled in by researcher)

<table>
<thead>
<tr>
<th>Test</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; measurement</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; measurement</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Random Blood sugar</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
22. **Retrospective data** (to be filled in by researcher)

<table>
<thead>
<tr>
<th>Test</th>
<th>1st visit</th>
<th>2nd visit</th>
<th>3rd visit</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting blood</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sugar level</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

23. Type of diabetes mellitus a patient suffers from?
   
a) Insulin dependent diabetes
   
b) Non insulin dependent diabetes
Appendix 5A: Diabetic diet sheets issued at Kenyatta National Hospital

Vyakula vya kudimisha uzani

A. (Usitumie vyakula vifuatavyo)
Sukari
Miwa
Matunda ilyowekwa kwa mkebe
Maji ya chupa au ya mikebe iliyonogeza sukari
Mraba wa matunda (Jamu au marmalade)
Asali
Peremende
Chocoleti
Mkate
Biskuti
Soda za kila aina
Pombe
Pombe kali
Vinyuaji vilivyo ongeza sukari
Vyakula vilivyo kaangwa kwa mafuta nyingi

B. (Tumia vyakula vifuatavyo ulivyoelezwa

(i) Vyakula vya kukupa nguvu
(Tumia na mboga nyingi kila wakati)
Ugali
Chapatti
Mchele
Viazi
Ndizi
Mkate
Uji wa wimbi
Mahindi na maharagwe
Viazi vikuu – Tumia kidogo

ii) Mafuta
(Mgonjwa ambaye anatakikana kupunguza uzani anafa kupunguza kula vyakula vya mafuta)tumia kiasi kidogo cha mafuta yoyote kupika, iwe mafuta ya mboga au mafuta binafsi.
Usitumie mafuta yoyote wa mnyama.

iii) Jamii ya maharagwe na kadhalika
ndengu
maharagwe ilyokauka
mbinzi ilyokauka
mbaazi
njugu karanga
(Tumia vyakula hivi unavyotaka)

iv) Vyakula vya kujenga mwili
nyama ya ngombe
nyama ya mbuzi
kondoo
kuku
samaki
mayai matatu kwa wiki
bilauri mbili ya maziwa
jibini

v) Mboga
Kundi hili tumia upendavyo (Tumia kwa wingi)
Sukuma wiki
Kabichi
Spinachi
Nyanya saladi
Mboga yoyote ya majani ya kienyeji
Kundi la tatu : tumia ulivvoelezwa.
Karoti
Mbinzi mbichi
Maharagwe mbichi
Mahindi mbichi
Malenge
(Tumia na mamboga mengine ya majani)
Vi) Matunda
(Tumia moja au mbili kila siku)
machungwa
ndizi iliyoiva
paipai
nanasi
mapera
zambarau
tafaa
maembe
limau
ndimu
viii) vinyuaji
Chai
.Kahawa
Cocoa
Mchuzi na supu ya mifupa.
viii) viungo vya kutia kwa chakula
Chumvi
Pilipili
Bizari
Tanga wizi
Viungo ladha

(English translation)

Diet sheet issued for use at Mwanza Central Hospital

(English translation)

The following foods should be avoided without any alteration other than translating into the local diet sheet.

- All types of sugar
- Alcohol
- Fruits
- Animals said to drunk
- Spices
- All fats and oils
- Meat of any kind
- Fish
- The following foods according to the local diet sheet

- Unleavened bread (chapatti)
- Risoles
- Potatoes
- Barmah...

(Use the above with plenty of vegetables always)

Brown bread
Appendix 5B: Diabetic diet sheet issued at Kenyatta National Hospital
(English translation)

(This sheet has been retyped without any alteration other than translating it into English from the Kiswahili diet sheet).

Weight management diet

A. (Do not use the following foods)
Sugar
Sugar cane
Tinned fruits
Sweetened bottled or tinned fruit juice
Jam or marmalade
Honey
Candy
Chocolate
Bread biscuits
All types of soda
Alcohol
Spirits
Any sweetened drink
Food fried in a lot of fat

B. (Use the following foods according to instructions given)

i) Energy giving foods
Stiff porridge (ugali)
Unleavened bread (chapatti)
Rice
Potatoes
Bananas

(Use the above with plenty of vegetables always)

Brown bread
Millet porridge
Maize and beans
Sweet potatoes (use sparingly)

**ii) Fats**

Patients on weight reduction diet need to reduce their fat intake.
Use limited amounts of any cooking fat whether it is vegetable oil or fat.
Avoid animal fats.

**iii) Pulses and other cereals**

(These foods can be used as desired)
Green grams
Dry beans
Dry peas
Pigeon peas
Groundnuts

**iv) Body building foods**

Beef
Goat meat
Mutton
Chicken
Fish
Eggs (minimum of three per week)
Milk – 2 glasses
Cheese

**v) Vegetables (use as desired)**

Kale
Cabbages
Cowpeas leaves
Spinach
Tomatoes
Any traditional vegetables

Use the foods listed below as per instructions given.

Carrots
Peas
Green beans
Green maize
Pumpkin
(Mix with other green vegetables)

vi) Fruits
(Use one or two fruits per day)
Orange
Ripe bananas
Paw paw
Pineapple
Guavas
Grapes
Apples
Mango
Lime
Lemon

vii) Beverages
Tea
Coffee
Cocoa
Soup
(These can be used as desired)

(viii) Seasonings
Salt
Pepper
Curry
Ginger
Any other spices and flavourings
Appendix 6: Determination of diet prescription.

This is calculated depending on the patient’s age and body mass index.

An example given by (Robinson, et al., 1986) is as follows: -

... for a secretary who is 25 years old and 170 cm (67 in) tall

according to the tale of heights and weight ... her desirable weight is

63 kg (139 pounds) (medium frame)

1. Calories 30 kcal per kg of desirable body weight

63 x 30 = 1,890 kcal per day (p. 507)

2. Protein 12-20% of total calories

1890 x 18% = 340 kcal

340 kcal/4 = 85g per day

3. Carbohydrate 50-60% of total calories

1990 x 53% = 1,002 kcal

1,002/4 = 250g carbohydrate per day

4. Fat: Total calories minus calories from proteins and carbohydrates,

1890 – (340 + 1,002) + 548kcal

5. Fat: Fat calories divided by 9

548/9 = 61 g fat per day.