

Determination of the Level of Adherence to Diet Recommendations among Diabetic Patients

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Abstract

Diabetes mellitus is a group of metabolic disorders that is characterized by prolonged hyperglycemia. It has become a serious public health problem that threatens the quality of life of an individual with diabetes mellitus and effective therapy relies massively on the compliance of the patient to the therapeutic plan. Statistics from international diabetes federation state that, about 463 million people are living with diabetes globally and about 2.2 million deaths are attributable to high blood glucose and associated complications. Adherence to diet recommendations among diabetic patients is very important for effective therapy as poor or inadequate adherence to diet among patients can be consequential as it leads to the exacerbation of the disease resulting in the development of avoidable complications. This study is aimed at determining the level of adherence to diet recommendations among diabetic patients and to find out if there are specific diet guidelines that have been outlined for them.

Methodology: A descriptive cross-sectional study was used. It targeted type 1 and type 2 diabetes patients of Kitwe teaching hospital and they were assessed by use of a standard questionnaire and a sample size of 217 participants was used. The criteria for selection were based on having been diagnosed with diabetes mellitus more than a year ago and above.

Results: Of a total population of 217 who met the inclusion criteria of which 35 (16.1%) were type 1 diabetes mellitus patients and 182 (83.9%) were type 2 diabetes mellitus patients. The study revealed that males were more adherent with satisfactory adherence of 27.19% and good adherence of 1.38% than the females with satisfactory of 25.35% and good adherence of 0.92% but despite the males recording a higher level of adherence than the females, it was not statistically significant. The study revealed that there was low consumption of fruits (1.8%) and foods rich in fiber (8.8%). According to the survey of the participants, inability to afford the cost of a healthy diet a busy schedule, availability of the healthy foods, old age and disease acceptance were the most cited reasons for poor dietary adherence. Findings indicate that involvement of health professionals in nutritional education was good with 94.47% and 5.53% not being able to state what has been recommended. Age, the type of diabetes, job occupation, duration of diabetes mellitus, knowledge on diet and diet recommended were statistically significant factors associated with adherence.

Conclusion: These results indicate that adherence to diet recommendation is satisfactory but not good even in copperbelt, Zambia. This calls for sensitization programs on the diet recommended for diabetes and its importance in the management of the disease. With hopes that it results into a more proactive approach toward diet recommended and an intentionality to adhere to it.

Key words: Diabetes mellitus type 1 and 2 • Dietary recommendations • Adherence • Nutritional education • Sensitization • Disease

Abbreviations: WHO-World Health Organization; KTH-Kitwe Teaching Hospital; ADA-American Diabetes Association

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Introduction

Background

Diabetes is one of the world's fastest growing non-communicable diseases, and a major public health issue [1]. The global burden of diabetes is rising significantly throughout the world as an estimated 422 million adults suffer from diabetes mellitus. Diabetes mellitus is defined as a group of metabolic diseases of prolonged hyperglycemia due to either the pancreas not producing enough insulin, or the cells of the body not responding properly to the insulin produced. Chronic hyperglycemia of diabetes mellitus is linked to long term destruction, loss of function, and failure of various organs [2].

Diabetes mellitus is usually treated with insulin and oral hypoglycemic agents like glibenclamide, metformin and nateglinide in order to lower the blood glucose levels but these drugs have adverse effects like weight gain, hypoglycemia, insulin toxicity and acute kidney injury [3]. With the passage of time, it has been discovered that since diet affects the blood glucose levels it can be used to maintain glycemic levels and improve the quality of life of individuals living with diabetes therefore, it has become important to adhere to diet guidelines because glycemic control is more than just taking medicine [4].

Patterns of food intake that have been recognized to lower the blood glucose levels include foods high in vegetables, fruit, whole grains, legumes, nuts and dairy products. Recent studies have stated that dietary interventions such as very low calorie or low carbohydrate diets will benefit individuals with diabetes mellitus as this would usually result in them stopping or reducing their diabetes medication but should be monitored closely.

Several studies have shown the benefit of healthy dietary habits and regular exercise in diabetes mellitus prevention and management [5]. It has been shown that adherence to prescribed lifestyle changes will improve glucose, lead to lower blood pressure and correct lipid abnormalities which are factors associated with micro and macro vascular complications of diabetes. Hence, primary prevention based on strict adherence to healthy lifestyle habits must be advocated in health policies worldwide to control diabetes especially in developing countries like Zambia where access to and quality of health care is still under development [6]. It has therefore become important to determine the level of adherence to diet among diabetes patients of Kitwe teaching hospital in Zambia.

Problem statement

On a global scale, poor control of diabetes has been recorded in many low and middle-income countries as its heavy impact on longevity and quality of life poses enormous challenges in terms of social, economic and clinical aspects urging appropriate preventive measures. Studies have been conducted worldwide and in Africa to identify factors associated with non-adherence to treatment among diabetic patients especially type 2 diabetes. However, studies on adherence to lifestyle recommendations are inadequate.

Poor adherence to healthy lifestyle recommendations among diabetes mellitus patients especially type 2 diabetic patients was found to be associated with global urbanization of communities (especially developing countries) with an increasing number of fast-

food outlets serving unhealthy food [7]. In these patients, rates of non-adherence to diet recommendations ranged from 35%-75% in studies conducted outside Africa. Poor adherence to diet and recommendations for exercise in people with type 2 diabetes mellitus are known to occur through frequent hospitalizations leading to increased health care costs.

Adherence to recommended dietary practices for diabetic patients is very important to achieving optimum metabolic regulation because non-adherence is associated with higher levels of glucose and cholesterol, which potentially lead to significant complications [8].

In Zambia, the lack of readily available or publicized health information and diet related standard guidelines have posed long-term glycemic control crises in patients with diabetes therefore this study aims to bring to attention the importance of diet in controlling glycemic levels and to measure the level of adherence to diet.

Justification of problem

It has been reported that there is poor adherence to diet recommendations by diabetic patients which leads to poor control of the condition and consequently to complications. Optimal treatment and management of diabetes mellitus should encompass lifestyle modifications and this transition is more effective if the health care practitioner sits down with the patient and explains the benefits and consequences for adherence and non-adherence to diet recommendations. Few studies have been done in Africa on this topic and no study has been done in Zambia therefore, the results obtained from this study will be used by the government through the ministry of health for greater researches that will increase the knowledge and utilization of diet for management of diabetes. This will further lead to the implementation and formulation of new policies to combat the poor adherence and lack of diet usage in management of diabetes mellitus.

Literature Review

Diabetes mellitus has increased significantly in African communities worldwide with a prominent number noted. Ideally, the management of diabetes is multifactorial in order for the glycemic levels to be kept in check and to minimize complications. Among the many factors, diet adherence is very important in the management of diabetes mellitus.

According to a study done by Ayele, Emiru, and Tiruneh in Ethiopia on the level of adherence to dietary recommendations, it was discovered that the overall adherence levels to dietary recommendations for T2DM were poor among T2DM patients in Ethiopia, with only 25.75 of study participants were following their doctor's recommendation. This was supported by the results of an analysis done by Rivellese, et al. which showed that adherence to dietary recommendations was not completely satisfactory in that 43% of patients were eating >10% of saturated fat, 6% were approaching the ideal intake of fibre and 25% were consuming the more acceptable and achievable diet.

Carbohydrate is the principal insulin secretagogue, evidence from different randomized controlled trials over the last few years stated that some type of restriction on carbohydrates is necessary for diabetes management and that such diets are safe and effective.

With regard to adherence to the prescribed diet, 41.7%, 38.8% and 19.4% were more regular, less regular and non-compliant comparing with dietary diabetes management respectively [9]. In addition, a study by Alhariri, et al. in Yemen indicated that 21.0% had good adherence, 46.7% partial adherence and 32.4% had non-adherence to the recommended diet regimen. Kapur, et al. also reported that for the full duration of diabetes, 28% followed a diet, 38% practiced a partial diet and 34% did not follow diet recommendations. The most common barriers to dietary adherence were low education and long duration of diabetes. The most popular barriers to dietary adherence encountered were as a result of inability to receive diet self-management training and to get the right messages across to change the eating behavior [10].

However, Mariusz, Alicja, Mariusz and Malgorzata in Warsaw on adherence to dietary recommendations in diabetes mellitus on a subject of 91 patients found that on a score differentiation for the patient diet adherence in diabetes scale and the acceptance and action diabetes questionnaire, a variability coefficient of 36.6% versus 36.1% respectively was obtained. It was also discovered that disease acceptance was also associated to patient's adherence to dietary recommendations.

In a cross-sectional study on adherence and non-adherence to diet and exercise recommendations on type 2 diabetic patients, it was discovered that more than one-third (37.2%) of the participants did not adhere to diet while most participants recognized that diet and exercise were essential for achieving and maintaining good glycemic control. The majority gave different reasons for their non-adherence to dietary recommendations and the reasons that were most frequently reported for their non-adherence with dietary guidelines were poor self-discipline. Lack of knowledge, eating out (especially at fast-food outlets), social gatherings and financial constraints.

The aforementioned study corresponds to a study conducted at Southampton University evaluating the knowledge of 135 qualified community nurses' knowledge on dietary recommendations for people with DM. Researchers concluded that participants had inadequate knowledge to adequately educate patients on diet related issues and it was associated with poor patient compliance. This is in line with a study done by Badshah in Pakistan where 54% of the nurses had poor knowledge, 21.3% had average knowledge, 13.33% had good knowledge and only 13% of the participants had excellent knowledge. From the findings, apart from poor knowledge on diabetic diet, there was an association found with poor knowledge on diet recommended and the quality of care provided to the diabetic patients [11].

In a cross-sectional study of 1,057 respondents to a questionnaire assessing the usefulness of the Glycemic Index (GI) as a tool in nutrition education, 39% responded by saying they used the tool while 61% said that they did not use the concept when educating/counselling patients with DM [12].

It can be inferred from an assessment of the studies and findings obtained from the aforementioned reports that individuals with diabetes mellitus have poor adherence to diet and that insufficient knowledge on nutrition and DM of both the health professionals and patient's knowledge has influenced patients' successful assistance in achieving optimal glycemic regulation.

Therefore, the present study aims to help shed light on the level of adherence to diet recommendations among diabetic patients.

Objectives

General objective: The main objective was to investigate the level of adherence to diet recommendations among diabetic patients of Kitwe teaching hospital in Zambia.

Specific objectives

- To determine the level of adherence to diet recommendations among diabetic patients
- To assess diet normally recommended to diabetic patients by health professionals and if it is in accordance to guidelines already set.
- To investigate the involvement of health professionals in the diabetes management process with the patient.
- To understand the limitations that affect adherence.

Research questions

- What is the level of adherence to diet recommendations among diabetic patients of Kitwe teaching hospital?
- What are the reasons affecting adherence?
- What diet do the health professionals usually recommended to the diabetic patients?
- How did they know about the recommended diet?

Measurement

Independent variable: These are variables that cause a change in a situation and the independent variables in this study are financial constraints, poor adherence to diet recommendations, lack of diet related guidelines and poor involvement of health professionals in describing diet recommendations and its importance.

Dependent variable: These are variables that arise from the introduction of the independent variable and the dependent variable in this study is the increase in diabetes mellitus complications [13].

Operational definitions

Diet: Small meals spread throughout the day (at least 5/day) consisting of fruits and vegetables (should be eaten daily), foods high in fibers and whole grain but low in fats, sugars and carbohydrates that have high glycemic index.

Adherence: The degree to which the action of an individual taking medication, following a diet, and/or performing improvements in lifestyle corresponds to approved guidelines from a health care provider.

To assess the degree of adherence to dietary recommendations in diabetes, a revised 2015 polish diabetes association guidelines were applied (Table 1). A list of 17 behaviors was derived from the above the described guidelines. One point was granted for the behavior in line with the dietary recommendations. The maximum number of points was 17 points indicating closer adherence to recommendations and the lowest was zero (0). Therefore, using the 17 points, the grading system was as follows:

- **14-17 points (80%-100%):** Good adherence.

- **9-13 points (50%-79%):** Satisfactory adherence.
- **0-8 points (less than 50%):** Poor adherence.

S. no.	Question	The answer that gets the points	Point
1.	How many meals do you usually eat during the day?	4-6 meals (2)	1
2.	Do you usually eat meals at the same time?	Yes (2)	1
3.	What are your time intervals between meals?	3-4 hours (2)	1
4.	What do you add to your hot drinks like cocoa, coffee or tea?	I don't take this product (3)	1
5.	What kind of bread do you usually eat?	Brown bread, whole grain (2)	1
6.	What kind of cereal products do you usually eat?	Brown rice (2)	1
7.	What kind of milk and dairy products do you usually eat?	Low-fat dairy products, natural yoghurt or fat-free-milk (2)	1
8.	What kind of protein do you usually take?	Chicken, fish, lean meat (1)	1
9.	What kind of fat do you usually use for meals?	Oils (2)	1
10.	How often do you take fruits?	Several times a day (6)	1
11.	How often do you take these vegetables?	Several times a day (6)	1
12.	How often do you take beans, peas, lentils?	(1) Once a week (3-6) (2) A few times a week (3) Once a day (4) Several times a day	1
13.	How often do you take sweets, cakes, biscuits or chocolate?	(1) Never (1-2) (2) 1-3 times a month	1
14.	How often do you take fast foods e.g., pizza, fries, burger?	(1) Never (2) 1-3 times a month	1
15.	How often do you take water?	Several times a day (6)	1
16.	How often do you take alcohol?	Never (1)	1
17.	How often do you take soft drinks?	(1) Never (1-2) (2) 1-3 times a month	1
Total			17

Table 1. Classification of respondent’s adherence.

Conceptual framework

The conceptual framework will show the relationship between diabetes mellitus and poor adherence to diet (Figure 1).

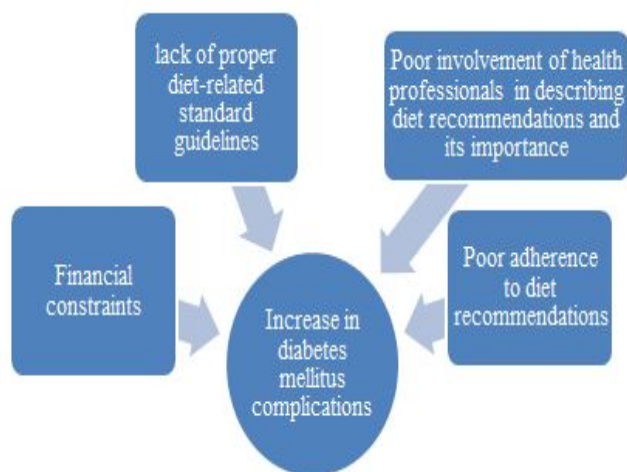


Figure 1. Conceptual framework.

Methodology

Study site and population: The study was conducted at Kitwe teaching hospital, a teaching hospital under the Zambian government in Kitwe.

Target population: The target population for this study included individuals who were 25 years and above diagnosed with type 1 and 2 diabetes mellitus for a year or more and were on treatment at the hospital [14].

Study design: To assess the level of adherence to diet recommendations among diabetic patients, a cross-sectional descriptive study design was used.

Sample size: The sample size was determined using the Krejcie and Morgan charts that showed sample sizes for a finite population (Table 2). The formula used in the Krejcie and Morgan charts was:

$$\text{Sample size} = \frac{X^2 \times N \times P \times (1-P)}{(ME^2 \times (N-1)) + (X^2 \times P \times (1-P))}$$

Where:

n=sample size

X squared=Chi-square for the specified confidence level at 1 degree of freedom

N=Population size

P=Population proportion
ME=Desired margin of error

Level of confidence (z)	1.96 (at 95% confidence level)
Population proportion (P)	50%
X squared	3.841
Population size (N)	500
Desired margin of error (ME)	5%
n (sample size based on finite population)	217

Table 2. Sample size variables.

Therefore, the sample size according to the Krejcie and Morgan charts is 217 participants.

Sampling procedure: Simple random sampling was used to get the information needed from the participants.

Inclusion criteria

- Male and female.
- Aged 25 years and above.
- Goes for treatment at Kitwe teaching hospital.
- Diagnosed with diabetes mellitus type 1 and 2 for a year or more.

Exclusion criteria

- Aged younger than 25 years.
- Goes for treatment at a hospital other than Kitwe teaching hospital.
- Patients who are critically ill.
- Diagnosed with diabetes mellitus type 1 and 2 before 1 year.

Data collection tool: Information for this research was collected using self-administered questionnaires that have been pre-tested by previous studies. The questionnaire used to determine the level of adherence; the Patient Diet Adherence in Diabetes questionnaire (PDAD) originally published in polish was translated and has been revised to suit both type 1 and type 2 diabetes mellitus although it's generally used for type 2 diabetes mellitus, in order to achieve the objectives of the research.

Data analysis: The data was analysed using the Statistical Package for Social Science (SPSS) software version 16. The collected statistics were summarized by using measure of central tendency which include mean, mode and median [15].

Results

Presentation of findings

This section provides a detailed description of the results obtained from analysis of the study. All the relevant variables are described as frequencies and simple percentages depending on their nature. And association between categorical variables was done using chi square test and results of less than 0.05 were considered statistically significant. It provides a summary of the Sociodemographic data, the level of adherence to diet recommendations, factors affecting adherence to diet and the involvement of health professionals in the disease process [16].

Section A: Socio-demographic characteristics

The expected sample size was 217 however extra questionnaires were handed out hence 221 participants were part of the study. From the 221 administered, only 217 questionnaires were completely filled giving a response rate of 98.1%. 110 were male and 107 were female. Most participants fell in the 46-55 years (47.0%) age category, while the least were (5.1%) aged 25-35 years. In terms of the type of diabetes mellitus, the majority reported having type 2 diabetes mellitus (83.9%) and the least being type 1 diabetes mellitus (16.1%). Concerning job occupation, the majority reported being in informal employment (41.5%), followed by those who were in formal employment (32.3%), then those who were in retired (16.6%), and the minority was those who were retired (9.7%) (Table 3).

Sociodemographic characteristics

Factors	Frequency	Percentage (%)
Age	25-35	5.1
	36-45	15.7
	46-55	47
	>55	32.3
	Total	217

Sex	Male	110	50.7
	Female	107	49.3
	Total	217	100
Diabetes type	Type 1 diabetes	35	16.1
	Type 2 diabetes	182	83.9
	Total	217	100
Duration of diabetes mellitus	1-3 years	29	13.4
	4-6 years	56	25.8
	>6 years	132	60.8
	Total	217	100
Job occupation	Formal employment	70	32.3
	Informal employment	90	41.5
	Unemployed	21	9.7
	Retired	36	16.6
	Total	217	100

Table 3. Sociodemographic characteristics.

Section b: Frequency distribution of adherence to diet

Results from this below Table 4 show the distribution of responses that were selected to measure the overall adherence to diet recommended for diabetes mellitus. 10 (4.6%) participants ate 4-6 times in a day. 217 (100%) did not eat their meals at the same of the day, 188 (86.6%) participants time interval between meals was 5-6 hours and the least being 4 (1.8%) for a time interval of <3 hours. 132 (60.8%) participants added sugar to their hot drinks, 50 (23.0%) participants added honey and 35 (16.1%) participants didn't add anything to their hot drinks, 129 (59.4%) participants ate brown bread and 88 (40.6%) participants ate white bread. 198 (91.2%) participants ate white rice and 19 (8.8%) ate brown rice, oats, wheat, 122 (56.2%) participants did not take dairy products, 62 (28.6%) took fat free dairy products, and 33 (15.2%) participants took dairy products like whole milk. 207 (95.4%) participants ate

chicken, eggs, fish and lean meat whilst 10 (4.6%) participants ate red meat, 215 (99.1%) participants used oils and 2 (0.9%) used butter for their meals. 95 (43.8%) participants ate fruits once a week and the least were 4 (1.8%) participants who ate fruits once a day, 118 (54.4%) participants ate vegetables several times a day and the least was 1 (0.5%) participant who ate them once a week, 178 (82.0%) participants ate legumes 1-3 times a month and the least was once a week 11 (5.1%). 148 (68.2%) participants never took sweets, cakes or biscuits and the minority 11 (5.1%) took them once a week, 157 (72.4%) participants never took fast food and the minority 9 (4.1) took them once a week, 212 (97.7%) participants took water several times and 5 (2.3%) participants took water once a day. 159 (73.3%) participants never took alcohol, 51 (23.5%) participants took alcohol 1-3 times a month and 7 (3.2%) participants took alcohol once a week. 150 (69.1%) participants never took soft drinks and 67 (30.9%) took them 1-3 times a month [17].

Questions		Frequency	Percentage
How many meals do you eat in a day?	1-3 meals	207	95.40%
	4-6 meals	10	4.60%
	7 or more meals	0	0.00%
Do you eat your meals at the same time?	No	217	100.00%
	Yes	0	0.00%

	Subtotal	217	100.00%
What are you time intervals between meals?	<3 hours	4	1.80%
	3-4 hours	6	2.80%
	5-6 hours	188	86.60%
	>6 hours	19	8.80%
	Subtotal	217	100.00%
What do you add in your hot drinks?	Sugar	132	60.80%
	Honey	50	23.00%
	I don't take that product	35	16.10%
	Subtotal	217	100.00%
What kind of bread do you usually eat?	White bread	88	40.60%
	Brown bread	129	59.40%
	I don't take bread	0	0.00%
	Subtotal	217	100.00%
What cereal products do you eat?	White rice	198	91.20%
	Brown rice, oats, wheat	19	8.80%
	I don't eat this product	0	0.00%
	Subtotal	217	100.00%
What dairy products do you eat?	Whole milk/cheese	33	15.20%
	Fat free milk/natural yoghurt	62	28.60%
	I don't take product	122	56.20%
	Subtotal	217	100.00%
What kind of protein do you usually take?	Chicken, eggs, fish, lean meat	207	95.40%
	Red meat like beef, pork, game meat	10	4.60%
	I don't take this product	0	0.00%
	Subtotal	217	100.00%
What kind of fat do you eat?	Butter	2	0.90%
	Oils like vegetable or olive oil	215	99.10%
	Margarine	0	0.00%
	I don't take this product	0	0.00%
	Subtotal	217	100.00%
How often do you eat fruits?	Never	2	0.90%
	1-3 times a month	88	40.60%
	Once a week	95	43.80%
	A few times a week	28	12.90%
	Once a day	4	1.80%
	Several times a day	0	0.00%
	Subtotal	217	100.00%

How often do you eat vegetables?	Never	0	0.00%
	1-3 times a month	0	0.00%
	Once a week	1	0.50%
	A few times a week	17	7.80%
	Once a day	81	37.30%
	Several times a day	118	54.40%
	Subtotal	217	100.00%
How often do you eat legumes?	Never	28	12.90%
	1-3 times a month	178	82.00%
	Once a week	11	5.10%
	A few times a week	0	0.00%
	Once a day	0	0.00%
	Several times a day	0	0.00%
	Subtotal	217	100.00%
How often do you take sweets, cakes, biscuits?	Never	148	68.20%
	1-3 times a month	58	26.70%
	Once a week	11	5.10%
	A few times a week	0	0.00%
	Once a day	0	0.00%
	Several times a day	0	0.00%
	Subtotal	217	100.00%
How often do you eat fast food?	Never	157	72.40%
	1-3 times a month	51	23.50%
	Once a week	9	4.10%
	A few times a week	0	0.00%
	Once a day	0	0.00%
	Several times a day	0	0.00%
	Subtotal	217	100.00%
How often do you drink water?	Never	0	0.00%
	1-3 times a month	0	0.00%
	Once a week	0	0.00%
	A few times a week	0	0.00%
	Once a day	5	2.30%
	Several times a day	212	97.70%
	Subtotal	217	100.00%
How often do you alcohol?	Never	159	73.30%
	1-3 times a month	51	23.50%
	Once a week	7	3.20%
	A few times a week	0	0.00%

	Once a day	0	0.00%
	Several times a day	0	0.00%
	Subtotal	217	100.00%
How often do you take soft drinks?	Never	150	69.10%
	1-3 times a month	67	30.90%
	Once a week	0	0.00%
	A few times a week	0	0.00%
	Once a day	0	0.00%
	Several times a day	0	0.00%
	Subtotal	217	100.00%

Table 4. Frequency distribution of adherence to diet.

As shown in Figure 2 below, it was found that 52.5% of participants had satisfactory adherence towards diet and the minority of 4.8% had good adherence.

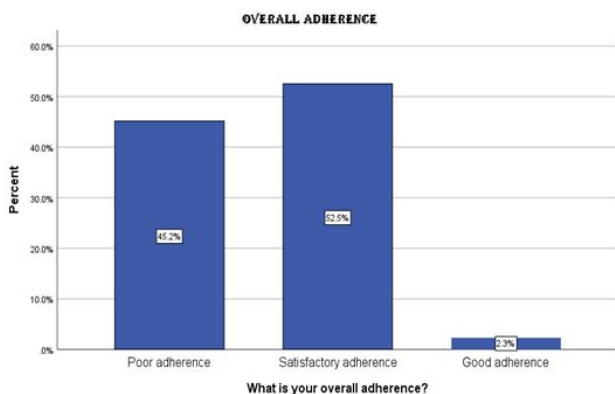


Figure 2. Distribution of overall adherence to diet recommended.

As shown below in Figure 3, it was found that males were slightly more adherent to diet recommended than females [18].

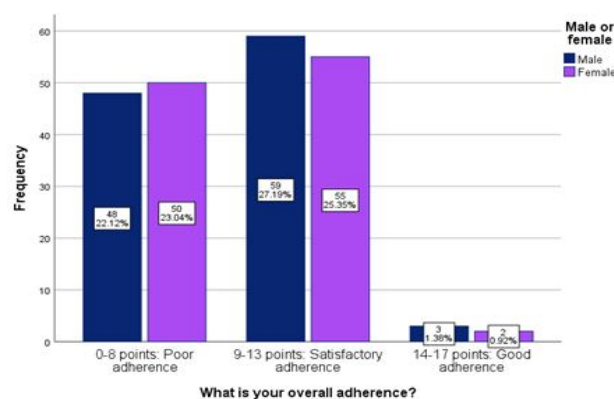


Figure 3. Distribution of overall adherence to diet and gender.

Section c: Association of variables to adherence

As shown in below Table 5, age ($p=0.002$), type of diabetes ($p<0.01$), job occupation ($p<0.01$), duration of DM ($p<0.01$), knowledge on diet ($p=0.001$) and recommended diet were statistically significant ($p<0.01$) hence were associated to adherence to diet while gender ($p=0.844$) was (>0.05) meaning there was no association between gender and adherence.

Variable	Frequency			P-value
	0-8 points: Poor adherence	9-13 points: Satisfactory adherence	14-17 points: Good adherence	
Age	25-35	8	3	0.002
	36-45	23	9	
	46-55	34	67	
	>55	33	35	
Gender	Male	48	59	0.844
	Female	50	55	
Diabetes type	Type 1 DM	28	7	<0.01
	Type 2 DM	70	107	

Job Occupation	Formal employment	13	55	2	<0.01
	Informal employment	50	38	2	
	Unemployed	17	4	0	
	Retired	18	17	1	
DM duration	1-3 years	16	10	3	<0.01
	4-6 years	37	19	0	
	>6 years	45	85	2	
Knowledge on diet	No	45	25	1	0.001
	Yes	53	89	4	
Recommended diet	1-4 times	50	9	0	<0.01
	5-8 times	34	48	0	
	9-12 times	14	53	5	
	More than 12 times	0	4	0	

Table 5. Association of variables to adherence.

Section d: Reasons affecting adherence

From the Figure 4 below, 104 (47.93%) participants said they were able to adhere to the diet recommended, 85 (39.17%) participants reason for failure to adhere was financial limitations, 25 (11.52%) participants had other reasons to failure to adhere like being busy hence had little time and would opt to eat anything when very hungry and tired, the other reasons were that some were still accepting the disease process and were having difficulties adapting to the new lifestyle, some stated not having enough knowledge on diet even after being previously educated on the importance of diet years back and the other reason was that most of the elderly participants were being kept and their diet was decided by the people who kept them. 3 (1.38%) participants were unable to adhere due to failure to access the recommended diet due to various reasons like the nature of their job.

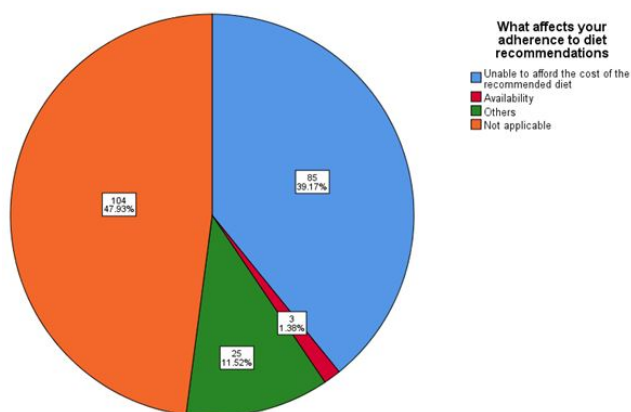


Figure 4. Reasons affecting adherence.

As shown in Figure 5, it is shown that 205 (94.47%) participants were able to state what has been recommended to eat by health practitioners and 12 (5.53%) participants were not able to explain what was recommended to eat.

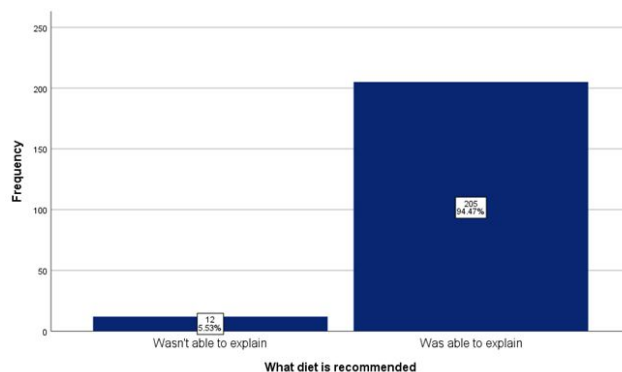


Figure 5. Diet recommended by the health practitioners.

As shown in Figure 6 below, it has shown that 217 (100.0%) participants knew about the diet recommended from health professionals.

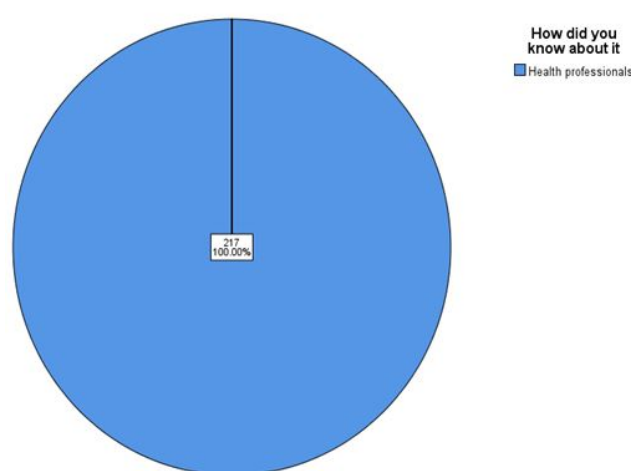


Figure 6. Information on diet recommended.

Discussion

This chapter provides a brief discussion of the major findings from the study of the level of adherence to diet recommended to diabetic patients at Kitwe teaching hospital.

Social demographics

From the study, it was found that the age group of 46-55 years (47%) was the majority and the least being 25-35 years (5.1%), a similar study done by Deshame and Muley in India showed that the maximum was of the age group 41-60 years. The slight differences can be due to age grouping as well as the site setting. The male gender was the majority (50.7%) and females (49.3%). The results matched with the study in India where males were (51.2%) and the females (48.8%). The study showed that there are more type 2 diabetes mellitus (83.9%) than type 1 diabetes (16.1%) participants [19].

It was found that the majority of participants (60.8%) had duration of >6 years and the minority was duration of 1-3 years being (13.4%). Similar studies have been done which revealed the mean duration was 5.3 years. The nature of the job occupation of the participants was similar to a study conducted in Nepal where the ones in informal employment (56.86%) were the majority. The study showed that the participants informally employed were the majority (41.5%) and the least were the unemployed (9.7%).

Level of adherence to diet

The present study assessed the adherence to diet among participants and it revealed that overall, 52.5% of the participants had satisfactory adherence, 45.2% had poor adherence and the least with good adherence (2.3%). A similar study done in Yemen found that 21.0, 46.7 and 32.4% showed good adherence, partial adherence and non-adherence to the recommended diet regimen. Another study done in Ethiopia revealed that 51.4% had poor dietary practices and it is in harmony of the present study but it was noted that assessment of adherence was whether it was 'poor' or 'good' with a variation in the present study where adherence was measured whether it was 'poor', 'satisfactory' or 'good'. Additionally, the prevalence of adherence was higher in males with satisfactory (27.19%) or good adherence (1.38) than the females with satisfactory (25.35%) or good adherence (0.92%) but despite the males recording a higher level of adherence than the females, it was not statistically significant. These results were similar with a study by Siddiqui, et al. where they reported that males followed the recommended diet more than the females with diabetes. It was suggested that female's adherence to diet was closely tied to traditional sex roles that acted as a hidden barrier to compliance to diet as the females or women were not willing to change their whole family's lifestyle to accommodate her health needs.

Studies done in relation to diet adherence and foods recommended discovered that adherence to fruits and fiber was low and it was similar to the current study were only 1.8% participants ate fruits daily as recommended and 8.8% participants ate whole grain products indicating a low adherence. The study by Worku, et al. 2015 went on to attribute the low adherence to the seasonality of fruits as well as the cost to be the reason why adherence was low not only in

intake of the fruit but even in the type and amount recommended. It was noted in the present study that various participants would consume mangoes more than the proportion recommended as it can also lead to an increase in the sugar levels if not eaten in moderation subsequently forfeiting the purpose of diet being used to control the sugar levels corresponding with an article written by Hill. Another variable that was poorly adhered to (0.0%) was the ability to eat meals at the same time of the day. An article on timing of meals and its importance in diabetes mentions how eating meals at around the same time, makes it less likely for the sugar levels to peak or drop. The other advantage is that the intentionality of picking the specific meal time also helps improve the intentionality to eat the foods recommended as it reduces starving to a point where the sugar levels are too low that an individual is forced to eat any food available even if it's unhealthy [20].

Factors affecting adherence

This study revealed that when the participants were asked if they were able to adhere, 47.93% stated that they were able to but was inconsistent with the findings analyzed where 2.3% had good adherence. 39.17% participant's reason for inability to adhere to the diet was the cost of the food recommended. In a similar study done in Ethiopia, 78% reported that finances were the cause of the lack of adherence, the difference in the results can be due to the fact that there was no account of the individuals who mentioned being able to adhere as a factor when measuring. Another reason for the disparity was that more than one reason affecting adherence could be selected. 25% participant's fell in the 'others' category and their reason for lack of adherence was being too busy and would opt for fast food when hungry, other individuals were still accepting the disease process and were having a difficult time transitioning to the recommended diet, and some other participants stated that because they were being kept by relatives because they were elderly, they had no say on what food was prepared even if they were aware that it was not recommended for them. These findings are consistent with the a study stating low adherence to diet due to poor nutrition education leading to a difficulty in transitioning to the recommended diet regimen.

Another reason for lack of adherence in this study was the availability of the foods required to be eaten. It was shown that 1.38% participants were unable to adequately find the foods recommended as their jobs were very mobile and made it considerably difficult to acquire and prepare the diet they should eat. This is similar to a study done where it was revealed that the individuals who were government employed were 2.38 times capable of adhering to the diet recommended compared to their counterparts.

Involvement of health professionals

From the study, it was concluded that there was good involvement of health professionals as 217 (100.0%) participants knew about the diet recommended from health professionals. as it was explained to them and they helped some participants create a meal plan. The study revealed that 94.47% of the participants were able to explain the diet recommended and what is advised not to be consumed and 5.53% were not able to properly state what is recommended. These results were consistent with a study by Heller, et al. where 90% of the physicians and nurses provided regular nutritional advice to their

diabetic patients and 56% would even prescribe a diet for them. The current study had a disparity with a study done by Badshah where it was stated that 54% of the nurses had poor knowledge, 21.3% had average knowledge, 13.33% had good knowledge and only 13% of the participants had excellent knowledge.

Conclusion

In conclusion, the majority of patients had a satisfactory level of adherence to diet recommended for diabetics at Kitwe teaching hospital. The prevalence of adherence was higher in the male gender, with fruits and foods high in fiber being the least adhered to. The participants gave various reasons why adherence to the food recommended was a challenge but the reason that stood out the most was the cost of the food and finances being a limitation in purchasing the diet they should follow. Having a difficult time transitioning to the meals recommended and availability of food recommended they should adhere to were the other factors that came up to the reasons why the recommended diet was not being followed. Majorly, the involvement of health professionals in providing nutritional advice and helping participants by providing a meal plan was good. This demonstrates a positive involvement of health professionals and is very encouraging as knowledge on the importance of diet in the management of diabetes is essential. Despite participants being educated on the diet recommended, there is still need for adherence to improve since the minority from this study were those who had good adherence to the diet recommended.

Ethical Consideration

Ethical approval was granted by Tropical Disease Research Centre (TDRC) before beginning the study (attached at the end). Consent for participation was obtained verbally from the participants who were willing to participate. Before the research was conducted, the participants were informed about the project and what was required of them. They were informed that they are allowed to withdraw at any anytime they feel like and that all information that was obtained was confidential and for research purposes only. All the participants were treated with utmost respect.

Study Limitations

- Participants may have provided inaccurate or false information due to lack of clarity or saying what the researcher wanted to hear as self-reported data is subject to bias.
- As the research project was carried out, it was identified that some participants were responding to what the ideal way is instead of the current state of their adherence to diet recommendations.
- Reluctant individuals as a result of questioning them on the diet they eat affecting completion of the questionnaire.

Recommendations

- To review the approach taken with nutritional education and make a few changes to make it more proactive.
- The increase in the cost of food has a negative impact on individuals who have a low socioeconomic status so providing reliable information and lists of low cost healthy foods that can be cheaply cooked at home may be beneficial for patients to overcome the cost barrier.
- Since females were less adherent than males, support groups that allow the patients to state what their struggles to eat well have been can be implemented to improve adherence and can as well reinforce the importance of adhering to the recommended diet.
- To participants did not adhere to the advice of eating meals at the same time and it was majorly due to lack of knowledge on why it is important to do so. Hence, they should be reinforcement through sensitization and education on meal times and its relation to management of diabetes mellitus.

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