RESEARCH ARTICLE

# Exploring Dietary Patterns and Nutrition Status of Type 2 Diabetes Mellitus Patients attending a Teaching Hospital in Zambia

Nixon Miyoba[1,*], Abidan Chansa[2], Namakando Liusha[3], Mwatikosela Tembo[4], Bubala Thandie Hamaimbo[1]

[1]The University of Zambia, School of Agricultural Sciences, Zambia.
[2]Ndola Teaching Hospital, Department of Internal Medicine, Ndola, Zambia.
[3]Kitwe Teaching Hospital, Department of Internal Medicine, Kitwe, Zambia.
[4]Ronald Ross General Hospital, Mufulira, Zambia.

*Corresponding author email: nixonmiyoba@gmail.com

## Abstract

This study explored food consumption patterns based on the Zambian Food-Based Dietary Guidelines and assessed the nutritional status of Type 2 Diabetes Mellitus (T2DM) patients attending a diabetic clinic at a teaching hospital in Zambia. A cross-sectional design with quantitative methods was employed for data collection, analysis, and presentation. The hospital was purposively selected as it is the only teaching hospital in the district. A total of 146 consecutively diagnosed T2DM patients were recruited during the study period. Data on the types and frequency of food consumption across the six food groups were collected using a researcher-administered questionnaire. Body Mass Index (BMI) was calculated using standard procedures for measuring height and weight. Blood glucose readings were extracted from patient records. Research tools were pre-tested on a separate group of T2DM patients not included in the main study.

Results showed that 87% of participants had received dietary counselling following their diagnosis. Nearly all participants (97.3%) had consumed foods from the cereals, starchy roots, and tubers group in the previous seven days. While a high proportion (87.7%) reported vegetable consumption during the recall period, the mean vegetable intake score was relatively low (2.00 ± 1.24 SD). Only a quarter (25.3%) reported fruit consumption, with a mean score of 0.32 ± 0.61 SD. Over one-third of participants (36.3%) were overweight, with women comprising the majority (39.3%). BMI was significantly associated with age and sex ($p < 0.05$), whereas marital status, occupation, and education level showed no significant association ($p > 0.05$).

The findings suggest that while patients generally adhered to the Zambian Food-Based Dietary Guidelines by consuming foods from all six food groups, fruit and vegetable intake remained suboptimal. Additionally, the high prevalence of overweight and obesity highlights the need for targeted interventions to promote healthier dietary practices among T2DM patients.

*Key words*: Body mass index, Blood sugar levels, Diabetic clinic, Food consumption patterns, Nutrition status, Type 2 diabetes mellitus, Zambian Based-Dietary Guidelines

## 1.0 Introduction

According to the World Health Organisation (WHO), diabetes mellitus is a chronic metabolic disease characterized by high blood sugar or hyperglycaemia [1]. T2DM is the most common of all types of diabetes (type 1 diabetes mellitus (T1DM), type 2 diabetes mellitus (T2DM) and gestational diabetes) accounting for 90 – 95 % of cases [2]. Evidence exists to demonstrate that T2DM has reached epidemic proportions in developing countries like Zambia [3]. Poorly controlled diabetes can lead to serious complications affecting the heart, kidneys, limbs, eyes and nerves. The disease and its complications can result into loss of livelihoods for households and reduced productivity for society and national economies [1]. Ageing, globalization, poor nutrition, sedentary lifestyle, overweight and obesity are all factors in Africa contributing to the increased prevalence of diabetes [4, 5]. The increase in the incidence of T2DM is attributed in part to dietary practices [6]. Unhealthy dietary patterns such as low intake of dietary fibre, high consumption of saturated and total fat, increase the risk of the diseases [7, 8]. Healthy eating is one of the main principles in the management of diabetes. However, the most challenging part in the management of T2DM for the majority of the patients is eating the right foods to help achieve glycaemic control [8]. A study done in Malaysia, reported a high proportion of T2DM who failed to adhere to the national dietary guidelines [9]. The study suggested as much as two-thirds of the participants did not consume foods from the five major food groups on a daily basis. The Zambian Food-Based Dietary Guidelines (FBDG) classify foods into six groups as; (1) cereals, starchy roots and tubers, (2) vegetables (3) fruits (4) fish, insects and animal source foods (5) dairy and (6) legumes, pulses and nuts [10]. A diet high in fruits, vegetables, whole grains, low-fat dairy, lean meats and legumes are correlated with lower risk of mortality and improved outcomes among diabetics [11].

## 2.0 Materials and Methods

### 2.1 Research design, period and location

The study adopted a cross-sectional design with quantitative aspects in data collection, analysis and presentation. The study design was considered suitable as data was collected at one point in time [12]. Data for the current study was collected from March to May 2022, from the diabetic clinic at a teaching hospital with a capacity of 664 beds. The hospital offers tertiary level health care services to patients within and outside the province [13].

### 2.2 Study population, inclusion and exclusion criteria

Patients diagnosed as having type 2 diabetes mellitus at the teaching hospital were eligible for inclusion into the study. This study included adult T2DM patients (18 years to 85 years) who have been attending the diabetic clinic the past 6 months after being scheduled for reviews by the physician. The study excluded adult T2DM patients who refused to participate in the study. In addition, the study excluded those who never underwent dietary counselling, those with impaired vision and who were unable to communicate. Further, pregnant and lactating women were not part of this study, and also the very elderly aged 65 years and above due to likelihood of other confounders for poor nutritional adherence. Information on other conditions was obtained from patient files in the diabetic clinic.

### 2.3 Sampling techniques and sample size

The hospital was selected purposively because it is the only teaching hospital in the district. T2DM patients attending the diabetic clinic at the hospital were recruited consecutively until the sample size was completed. Such approaches have been used before in similar studies among diabetic patients attending a diabetic clinic [14].

The sample size was determined by a formula proposed by Yamane (1967) [15]

$$n = N/1 + N(e^2)$$

A 95% confidence level and a P=0.5 are assumed in the equation above. Where n is the sample size, N is the population size and *e* is the level of precision. Weekly attendance every Tuesday at the clinic was about 25 patients. Application of the above formula gave rise to a sample size of 155. However, data was only collected from 146 T2DM patients as some patients declined to provide more information during the course of the study.

### 2.4 Research instruments

A researcher-administered questionnaire was employed to elicit information from the patients attending the Diabetic clinic. The questionnaire was divided into five parts: the first part collected data on the socio-demographic characteristics, the second part collected data on the dietary patterns of T2DM patients, while the third and fourth parts collected data on the dietary diversity and body mass respectively. The last part reported data on the random blood sugar readings of T2DM patients. Research instruments were tested on adult T2DM patients who were not part of the study. The pre-test was done on a selected sample (10% of the sample size) of outpatients with characteristics similar to those of the actual study. The procedures employed in pre-testing the instruments were identical to those used in the actual study. Pre-testing helped to clarify any ambiguous questions and instructions.

### 2.5 Data collection procedures

On a randomly selected day in March, 2022, the lead investigator assisted by three nutritionists from the hospital approached the sister in charge of the diabetic clinic to brief her team on the study. Consecutive sampling of patients was done based on the sampling frame of patients provided per week. Access to patient files was granted to collect information on their social-demographic and medical characteristics. Patients were informed of the purpose of the study and informed consent obtained prior to data collection by the research team. COVID-19 prevention guidelines of wearing a face mask, sanitizing hands, keeping a safe physical distance etc. were observed during data collection. Data collection only ceased after attainment of the desired sample size. Structured questionnaires were administered through face-to-face interviews and responses recorded. Information collected using the questionnaire included socio-demographic data of patients, frequency of food consumption and frequency of consuming foods from selected food groups. Food frequency questionnaire was used to collect data on frequency of consuming foods while the ZFBDGs were used to group foods eaten by patients. Anthropometric indices such as weight and height were measured using standard procedures. Weight was measured to the nearest 0.1 kg using a Seca scale while height was determined by use of a stadiometer to the nearest 0.1 cm. Blood sugar readings were obtained from patient files as recorded by the diabetic nurse.

### 2.6 Statistical analysis

After data collection, all questionnaires were checked for completeness, accuracy and consistency. Data were entered into Microsoft excel for cleaning and then exported to Statistical Package for Social Sciences version 21 (IBM Corp., Armonk, NY, USA) for statistical analysis.  Test of quantitative variables for normal distribution was done using the Kolmogorov-Smirnov test A P-value less than 0.05 was considered statistically significant.

## 3.0 RESULTS

A total of 155 participants were eligible to participate in the study. However, only 146 representing a response rate of 94.2%, consented to fully participate in the research. Hence, analysis of data was based on the input of all variables relating to the 146 participants as shown in Table 1. Majority of the participants 112(76.7%) were female, and almost 60% were not married. With regards to education, participants who had reached secondary and primary level were 39% and 42.5% respectively. Close to 80% of the participants were not in any form of employment.

**Table 1: Socio-Demographic Characteristics**

| Variable | N=146 | % |
|---|---|---|
| Sex | | |
| Male | 34 | 23.3 |
| Female | 112 | 76.7 |
| Marital status | | |
| Married | 83 | 56.8 |
| Not married | 63 | 43.2 |
| Education | | |
| No formal education | 16 | 11 |
| Primary | 57 | 39 |
| Secondary | 62 | 42.5 |
| Tertiary | 11 | 7.5 |
| | | |
| Occupation | | |
| Currently working | 31 | 21.2 |
| Not working | 115 | 78.8 |

Mean age of the participants was 56.88±13.40 years and mean Body Mass Index was 27.20±5.71 kg/m$^2$ as shown in Table 2. The mean Random Blood Sugar level for majority of the patients as recorded in the patient files was 12.21±5.01 mmol/dl. Less than ten patients had their blood sugar readings reported as fasting blood sugar levels, and less than 0.5% had a glycated hemoglobin (HbA1C) percent done or recorded on file.

**Table 2: Mean values of age, Body Mass Index and Random blood sugars of patients**

| Variable | Mean | SD |
|---|---|---|
| Age | 56.88 years | 13.40 |
| Body Mass Index | 27.2 Kg/m$^2$ | 5.71 |
| Random Blood Sugar | 12.21 mmol/dl | 5.01 |

Table 3 shows the distribution of patients according to their BMI categories. Results reveal that most (over 61%) were overweight or obese 53(36.3%) and 37(25.3%) respectively; and females accounted for the majority 44(39.3%). However, results also indicate that more than a quarter 48(32.9%) of the patients had normal nutrition status. Close to 50% (47.1%) of the men had normal nutrition status.

**Table 3: Distribution of patients according to Body Mass Index categories**

| BMI Cut-offs | Interpretation | Males (34) | | Females (112) | | Totals (146) | |
|---|---|---|---|---|---|---|---|
| < 18.5 kg/m$^2$ | Underweight | 5 | 14.7 | 3 | 0.03 | 8 | 5.5 |
| 18.5 – 24.9 kg/m$^2$ | Normal | 16 | 47.1 | 32 | 28.6 | 48 | 32.9 |
| 25 – 30 kg/m$^2$ | Overweight | 9 | 26.5 | 44 | 39.3 | 53 | 36.3 |
| >30 kg/m$^2$ | Obese | 4 | 11.8 | 33 | 29.5 | 37 | 25.3 |

Table 4 shows that 127 (87%) of the participants had undergone dietary counselling after diagnosis with diabetes mellitus. Close to all participants, 142(97.3%) consumed foods from the cereals, starchy root and tuber food group in the past seven days. However, slightly over a quarter 40(27.4%) of the participants consumed foods belonging to the legumes, pulses and nuts. Only 18(12.3%) of the participants reported not to have eaten vegetables. Fruits were notably eaten by 37(25.3%) of the participants. Results seem to suggest that slightly over half 77(52.7%) of the participants consumed foods related to fish, insects and animal source foods.

Mean frequency of consuming foods belonging to the cereals, starchy roots and tubers over the past seven days was 2.62±1.34 as shown in Table 5. Foods of the vegetable group followed by fish, insects and animal source food group had mean weekly consumption values of 2.00±1.24 and 1.03±0.81 respectively. Food groups associated with lowest mean weekly consumption values were the fruit and dairy food groups at 0.32±0.61 and 0.27±0.53 respectively.

**Table 5: Mean consumption scores of foods from the six food groups**

| Food groups | Mean | SD |
|---|---|---|
| Cereals, starchy roots and tubers | 2.62 | 1.34 |
| Vegetables | 2.00 | 1.24 |
| Fruits | 0.32 | 0.61 |
| Fish, insects and animal source foods | 1.03 | 0.81 |
| Legumes, pulses and nuts | 0.50 | 0.94 |
| Dairy | 0.27 | 0.53 |

Results of the study suggest a significant correlation (p=0.000) between age of participants and body mass index. Sex of the participants also seemed to be significantly associated (p=0.003) with body mass index. Other variables of marital status, occupation and education level were not significantly associated with body mass index as show in Table 6.

**Table 6: Correlations between selected variables with Body Mass Index**

| Variable | P-value |
|---|---|
| Education level | 0.161 |
| Age | 0.000* |
| Sex | 0.003* |
| Marital status | 0.267 |
| Occupation | 0.431 |

## 4.0 Discussion

Our study aimed to explore dietary patterns based on the Zambian Food-Based Dietary Guidelines of 2021 [10]. In addition, the study sought to determine nutrition status of T2DM patients attending the diabetic clinic at a teaching hospital in Copperbelt province of Zambia. Our study reveals that majority of the participants were female with a mean age of over fifty years. This finding is similar to that reported in Nigeria among diabetics [14]. Specifically, the study conducted in Ondo State, Nigeria revealed that most of the respondents were female and not working. Studies done elsewhere also reported mean age of most diabetics to be forty years and above [16].

In 2021, the Government of the Republic of Zambia through the Ministry of Agriculture launched the Zambian Food-Based-Dietary Guidelines [10]. The Zambian FBDGs are meant to be used by dietetic professionals and others to promote good eating habits and physical activity in the general population in the country. The basis for the Zambian FBDGs are the six food groups namely; (1) Cereals, starchy roots and tubers, (2) Vegetables, (3) Fruits, (4) Fish, insects and animal sources foods (5) Dairy, (6) Legumes, pulses and nuts. The technical report on Zambian FBDGs points out the premise for a healthy diet is eating a variety of foods from all the six groups in the right quantities [10].

With respect to the Zambian FBDGs, our results seem to suggest that patients consumed foods from all the six food groups although the mean consumption scores were varied and low. It was noted that nearly all patients ate foods from the cereals, starchy root and tuber food group. This finding is in line with the observation that cereals are the main source of calories in Zambia [17] Firm porridge (nshima) made from roller meal flour and/or millet flour are whole-grain based foods reportedly consumed by most participants. Whole grain cereals are a source of fiber, a dietary component associated with reduced risk of T2DM [10, 18]. Starchy roots and tubers in certain regions of the country significantly contribute to caloric intake [19]. However, excessive caloric intake regardless of food source can precipitate weight gain and increase the risk for diet-related diseases such as diabetes [10].

Evidence indicates that sufficient intake of vegetables is a constituent of a healthy diet [20]. Although most of the patients in the study consumed vegetables, their mean consumption scores for vegetables was low. In congruence with the findings of our study, literature shows that national average intake of vegetables among adults in Zambia is below recommendations [21]. Specifically, only about 10 percent of adults in Zambia meet the recommended quantities of three servings of vegetables per day [22]. Inadequate intake of vegetables among diabetics has also been reported in other studies [23, 24]. Vegetables of different colors confer several benefits to individuals including prevention against chronic conditions. Apart from being a rich source of micronutrients, fiber and phytochemicals, vegetables are low in calories and sodium. Fruit intake in our study as evidenced by the mean consumption scores was low. A similar study among T2DM patients at Dow University Hospital in Pakistan reported suboptimal intake of fruits [25]. At national level, fruit intake in Zambia is reported to be low with most adults consuming fruits only twice in a week [10]. Insufficient intake of fruits and vegetables has been attributed to low levels of awareness among diabetics on the role of these foods to manage blood sugar [24]. Literature points out that eating different fruits can help the body meet its need for vitamins, minerals and phytochemicals that have health promoting effect. Fruits have been associated with prevention of diet-related conditions such as T2DM mainly due to the action of dietary constituents including fiber, micronutrients and phytochemicals [26].

Nutrition status of the diabetics for the majority of them as determined by Body Mass Index was overweight to being obese. This is on the backdrop of majority of these clients being unemployed. The finding of this study compares with that reported in other settings [27, 24].

Our study is in agreement to the findings of other studies that reported that majority of the subjects were either overweight or obese [24, 27, 28]. Men were observed to have normal nutrition status compared to their female counterparts. This study seems to suggest that being male or female was significantly associated with nutrition status. There is limited information in clinical settings in Zambia on the nutrition status of patients such as diabetics [29].

## Conclusion

The objective of the study was to explore dietary patterns as well as determine the nutrition status of diabetics attending the diabetic clinic at a teaching hospital in Zambia. Findings of this study suggest that patients ate foods from all the six food groups found in the Zambian Food-Based Dietary Guidelines although intake of fruits and vegetables was relatively low. Majority of the patients were either overweight or obese with more females being overweight. Initial and reinforced dietary counselling is key to ensuring increased intake of fruits and vegetables that are key components of a healthy diet.

## Acknowledgments

## Funding

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## APPENDICES

### APPENDIX A: TABLES

**Table 4: Frequency of dietary counselling and consuming foods from six food groups**

| Variable | N=146 | % |
|---|---|---|
| Dietary counselling | | |
| Yes | 127 | 87 |
| No | 19 | 13 |
| Cereals, starchy roots and tubers | | |
| Yes | 142 | 97.3 |
| No | 4 | 2.7 |
| Legumes, pulses and nuts | | |
| Yes | 40 | 27.4 |
| No | 106 | 72.6 |
| Vegetables | | |
| Yes | 128 | 87.7 |
| No | 18 | 12.3 |
| Fruits | | |
| Yes | 37 | 25.3 |
| No | 109 | 74.1 |
| Fish, insects and animal source foods | | |
| Yes | 77 | 52.7 |
| No | 69 | 47.3 |
| Dairy | | |
| Yes | 33 | 22.6 |
| No | 113 | 77.4 |