



Nutritional Knowledge and Dietary Habits among Diabetic Patients at the Bono Regional Hospital, Sunyani, Ghana

Ali Sabior Dawuda ^{a*} and Amidu Abdul-Aziz ^b

^a *International Department of Medicine, Poltava State Medical University, Germany.*

^b *School of Medical Sciences, University for Development Studies, Tamale, Ghana.*

Authors' contributions

This work was carried out in collaboration between both authors. Author ASD designed the study, performed the statistical analysis, wrote the protocol, and wrote the first draft of the manuscript. Author AAA managed the analyses of the study and literature searches. Both authors read and approved the final manuscript.

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ABSTRACT

Background: The rising mortality rate of diabetes mellitus and the upsurge in diabetes complications is very alarming. This has been attributed to the poor knowledge patients living with diabetes have on diabetes and its management, especially the nutritional management.

Objective: This study sought to explore the knowledge on knowledge on diabetes and nutrition among patients living with diabetes mellitus who attended clinic at the Bono Regional Hospital.

Methods: A cross-sectional descriptive quantitative research design was used for this study. Simple random sampling was used to recruit 150 participants for the study. The participants were interviewed using a semi-structured questionnaire. Respondents were recruited from the clinic until the desired sample size was obtained. A pre-tested interviewer-administered questionnaire was

*Corresponding author: E-mail: asaskwa@gmail.com;

used to collect data. Dietary habits were assessed using food frequency questionnaire and BMI was assessed following standard procedure and compared with the World Health Organization (WHO) standards. Data was analyzed using IBM SPSS (Version 20). Chi-square test was used to determine the association between variables. The level of significance was set at p-value less than 5%.

Results: The study revealed that the participants have adequate knowledge on DM and Nutrition. Majority of Participants in had high knowledge on diabetes and nutrition, 77.3%. This was associated with adequate education by their health care providers and with strong beliefs in modern medicines as well as diet therapy, which influenced attitudes and practices on Diabetes. Overall, good dietary practice among the participants was 57.3%. Age and level of education were found to be significantly associated with knowledge of diabetes and nutrition whiles gender, religion, occupation, ethnicity, marital status were not significantly associated with knowledge level of diabetes and nutrition.

Conclusion and Recommendation: Dietary counselling will be necessary to improve the dietary pattern and nutritional status of the diabetic patients.

Keywords: Dietary habit; nutritional knowledge; diabetic patient; BMI.

1. INTRODUCTION

“Chronic diseases (CDs) are one of the major health and developmental challenges of the 21st century and have implications on the socioeconomic fabric of countries, particularly low- and middle-income countries” [1]. “Chronic diseases such as diabetes require continuous medical care and ongoing patient self-management education and support to prevent multiple complications and premature mortality” [2]. According to WHO report [3] “diabetes now accounts for at least 15% of total health care expenditure in many low- and middle income countries”. “Currently, 422 million adults worldwide have diabetes” [3]. “In developed countries, most people with diabetes are above the age of retirement, whereas in developing countries those most frequently affected are the working group (aged between 35 and 64 years)”[3].

“Diabetes is a chronic disease that occurs either when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces” [3]. “Insulin is a hormone that regulates blood sugar” [4]. Diabetes mellitus is a chronic metabolic disorder characterized by impairment of carbohydrate utilization [2]. “The effect of diabetes mellitus on human health is alarming hence the need for continuous and regular blood glucose checks. Other complications that may result from diabetes mellitus include: water and electrolyte loss, ketoacidosis and coma, neuropathy, retinopathy, and an increased susceptibility to infection” [2]. “Hypertension has been found to exist in diabetic patients due to degenerative changes in large

and small blood vessels. Diabetes Mellitus is an endocrine disease that is characterized by high blood sugar levels” [4]. “There are three types of diabetes, these are: type 1, type 2 and gestational diabetes (GD). Type 1 diabetes is often diagnosed at childhood and it peaks up at puberty, Type 1 diabetes can be complex when it comes to treatment. Type-1 diabetes is also referred to as insulin dependent. When the immune system goes out of order and it is destroying the cells in the pancreas that produce insulin, it is called type 2 diabetes” [2]. “The type 2 diabetes is more common than the type 1 diabetes. Without insulin, glucose cannot get into the cells of the body where it is used. Gestational diabetes (GD) is the start of glucose intolerance during pregnancy” [2]. “Reported cases of gestational diabetes range from 2% to 10% of pregnancies. Women with gestational diabetes are found to have diabetes (usually type- 2) instantly after pregnancy” [5].

“The global prevalence estimate of diabetes was 11.3% among adults aged 18 years and above, and accounted for more than 87% of diabetes deaths occurring in low- and middle-income countries” [6]. “The prevalence is higher in urban (10.8%) than rural (7.2%) and in high-income countries (10.4%) than low income countries (4.0%)” [7]. “This growing problem of diabetes was largely related to overweight and obesity, due to reduction in physical activity and adoption of unhealthy diets, which are high in calories from fats and sugars, high in salt, and low in vegetables and fruits” [8]. “Excess body fat which also gives an indication of poor dietary habits and physical inactivity served as another predisposing factor for type-2 diabetes (T2DM)”

[8]. "Intrinsically, percentage body fat is the clearest evidence-based and the largest relative risk for many chronic diseases" [3]. "Diabetes mellitus affects at least 37 million Americans, ranks eight as a cause of death in the United States, and costs the national economy over \$100 billion yearly"[9]. "The American Diabetes association (ADA) estimated the national costs of diabetes in the USA for 2017 to be \$327 billion" [9]. "Diabetes continues to afflict the global population in pandemic proportions" [9]. "The disease has devastating consequences on people living with diabetes, healthcare systems, the economy and the society at large. Diabetes will be the fifth leading cause of death in the world by the year 2030" [9]. "In Africa the prevalence of diabetes is 5.7% and about 19.8 million adults who live on the continent have diabetes" [10]. "Even with this information, the management of diabetes in general continues to be challenging especially in resource limited countries including Ghana" [11].

2. METHODS

2.1 Study Area

The study was conducted in Sunyani Regional Hospital in the Sunyani Municipality. The municipality is located in the western part of Bono Region and has Sunyani as its capital town. Sunyani municipality is one of the twenty-seven districts in the Brong Ahafo region. The municipality was established on 10th March, 1989 by a legislative instrument (LI) 1473. This was the period Ghana adopted the District Assembly concept. The overall goal is to accelerate growth and development in the Municipality. The Sunyani west district was carved from this Municipality on November 2007. The Sunyani Municipal Assembly covers a total land area of 506.7 Km². It is located at the heart of Bono Region lying between Latitudes 7° 20'N and 7° 05'N and Longitudes 23° 30'W and 23° 10'W. It is bordered on the north by Sunyani West District; west by Dormaa East District south by Asutifi District to the South and east by Tano North District. Six hospitals, twelve clinics, seven chips compound, three maternity homes and three (3) health centers provide health services to the district. The Region has a population of 1,208,965 [12].

2.2 Study Design

A descriptive cross-sectional design was employed using quantitative method to obtain

broader view or generalized results from a larger population. A cross-sectional design is a non-experimental study design that seeks to establish the relationship between independent and dependent variables [13]. Also, a cross-sectional survey design was appropriate for describing phenomena or their relationships at any given point. "Quantitative methodology is useful for uncovering a relationship between specified known variables but does not reveal new processes or explain the nature of the relationship between the known variables. Quantitative research is used to answer questions about relationships among measurable variables to explain, predict, and control phenomena" [14]. This information was obtained only once from each respondent during the study period. A descriptive questionnaire comprising five sections was used to obtain this information. The primary outcome variables was the level of knowledge on diabetes and nutrition.

2.3 Target Population and Sample

Patients with diabetic mellitus seeking healthcare at the diabetic clinic of the Bono Regional Hospital were enrolled in this study. DM patients were identified by using patients' folders where medical physicians have confirmed diagnosis of the condition using consistently high Fasting Blood Sugar (FBS) results greater or equal to 126 mg/dL (7.0 mmol/L) and RBS results greater or equal to 200 mg/dL (11.1 mmol/L) as well as Glycated Haemoglobin (HbA1c) results of more than 6.5%. The sample size was determined using the sample size formula by Yamane (1967) for cross-sectional study. Total number of DM patients who attended diabetic clinic from period of March 2023 to August 2023 was 220 [15]. An additional 5% was added to control for non-response and missing data. Hence, a sample size of 150 participants was employed in the study.

2.4 Inclusion/Exclusion Criteria

All patients with diabetes aged 18 years of age and above. Participants on medication for at least six months and receive services at the diabetic clinic. Participants with glycated haemoglobin laboratory test or three consecutive fasting blood sugar (FBS) measurements not later than three months prior to study. Patients with cognitive impairment and cannot give consent. Diabetic Patients below 18 years of age. Those who are critically ill during data collection time will be excluded from the study.

2.5 Sampling method or Recruitment of participants

Systematic random sampling technique was employed to select consented DM patients for the study. A sample frame of the names of all DM patients was drawn from the register of all diabetic patients based on the inclusion and exclusion criteria. Numbers were then assigned to the list of all qualified DM patients in the sample frame. The total number in the sample frame was then divided by the sample size (150) and a sample location, which was also used to subsequently identify selected participants', determined. A number from a list of numbers from one (1) to the sample location number within the sample frame was then randomly selected using blind-folded method. This randomly selected number was then set aside as the first selected and qualified number and the subsequent numbers identified from each step by adding the sample location number till all the 150 selected DM patients were drawn. A structured questionnaire was then administered to each selected subject.

2.6 Data Collection Techniques

"To ensure quality control, the researcher ensured that the instrument used is easily understood by the respondents. On each day of data collection, the researcher introduced herself to patients waiting to see the clinician/doctors after which the researcher and the research assistants engage the patients individually. The patients were given the consent form to sign or make a mark indicating their acceptance of voluntary participation. The respondents who could read and write were allowed to fill (self-administered) the questionnaire themselves. Interviewer-administered technique was used to interview those who could read or write. During the data collection, uncompleted questionnaires were exempted from processing and subsequent analysis" [16].

"Data on socio-demographic variables such as age, gender, educational status and ethnicity were also collected using semi-structured questionnaire. Data on nutrition Knowledge were collected using the modified nutrition knowledge questionnaire" [16]. "These included assessing participants' knowledge on appropriate dietary habits; various food groups and; disease conditions/ health problems related to dietary intakes. Data on dietary habits were collected using Food Frequency Questionnaire (FFQ). These will include the timing of meals; frequency

of meals and choices of meal intakes and lastly data on motivational factors that influencing participants to undertake nutritional management of their condition was also taken" [16].

2.7 Data Analysis

The data for the analysis was obtained from a cross-sectional facility based survey. The data obtained was cleaned, coded and entered into Microsoft excel 2013 and then transferred into Statistical Package for the Social Sciences (SPSS) version 24.0, computer statistical Software package for analysis. Chi square (χ^2) analyses was performed to determine the association between dependent and independent variables under the study. Logistic regression was also used to determine the simple relationship between the outcome variable and each of independent variable. Socio demographic characteristics was included into regression model to control confounding. Inferences was made with 95% confidence interval with 5% error margin and p value <0.05. The results was presented in frequency and cross tabulation tables as well as charts or graphical presentation with the use of Microsoft Excel 2013 and Statistical Package for the Social Sciences (SPSS) version 24.0. Finally, a level of significance was set at $p < 0.05$ to determine the associations that the study sought to find out.

3. RESULTS

3.1 Socio-demographic Characteristic of the Study Population

The characteristics of the population are shown in Table 1. Out of the 155 respondents sampled for the study, 150 responded, representing a response rate of 96.7%. A total of 150 respondents were included in the analysis and there were more women 82(54.7%) than men 68(45.3%). The mean age of the respondents was 53.8 (± 12.5) years and the largest proportion (35.3%) aged 55-64 years. Although most of the participants were old enough to marry, 25.3% had never been married before. Of those who had married before, 60.7% were currently together, 4.0% have been separated and 10.0% were widowed. The majority 60(40.0%) of the sample had tertiary education while 4.0% has no formal education. The highest proportion (43.3.0%) were employed whereas 20% were unemployed. Participants had a largely uniform cultural structure, more than nearly two-thirds of the participants 64.0% were from the Bono tribes collectively known as

the Akans followed by Dagombas (11.3%), then Ewe, 10.0% and Hausas, 8.0%. With respect to income status, the highest 53(35.3%) proportion of the participants indicated they earned more than GHC 2,000.00 as their monthly income.

Regarding religion, four-fifths of the respondents 80(80.0%) were Christians whereas 16.7% of them were Muslims. Majority 105(70%) are under the National health insurance scheme however, 10% of the participants has no insurance scheme. Seventy (46.7%) of them have a family history of diabetes.

3.2 Knowledge Level of Respondents on Nutrition and Diabetes

Regarding knowledge level of respondents on Diabetes Mellitus and nutrition, the participants

were asked ten (16) questions. The range of possible knowledge scores for each respondent in this study was from 0 to 16 with a maximum possible score of 16. A significant number of respondents 117(78.0%) knew the meaning of DM as high level of sugar in the blood however majority 120(80.0%) of them didn't know that Insulin is the hormone associated with Diabetes. More than two-thirds of the respondents 110(73.3%) indicated correctly that DM is associated with foods that are high in carbohydrate. Nearly half 92(61.3%) of the participants reported family history of diabetes as a risk factor of Diabetes Mellitus.77(51.3%) also indicated inadequate physical activity as a risk factor of DM. Surprisingly, more than half 80(53.3%) of the participants indicated erroneously that high blood pressure as a risk factor for DM. The majority of the respondents

Table 1. Demographic characteristics of the respondents

Demographic characteristics	Frequency N=150	Percent (%)
Age (years) 18 – 24	2	1.3
25 – 34	10	6.7
35 – 44	20	13.3
45 – 54	37	24.7
55 – 64	53	35.3
65 and above	28	18.7
Gender Male	68	45.3
Female	82	54.7
Employment status Employed	65	43.3
Self -employed	55	36.7
Unemployed	30	20.0
Marital status Single	38	25.3
Married	91	60.7
Divorced	6	4.0
Widowed	15	10.0
Educational Status No formal education	6	4.0
Primary	12	8.0
Junior High School	25	16.7
Senior High School	47	31.3
Tertiary	60	40.0
Ethnicity Akan	96	64.0
Dagomba	17	11.3
Ewe	15	10.0
Hausa	12	8.0
Other	10	6.7
Religion Christianity	120	80.0
Islam	25	16.7
Traditional	5	3.3
Monthly Income Less than GH¢ 500	15	10.0
GH¢ 500- GH¢ 1000	25	16.7
GH¢ 1000- GH¢ 1500	27	18.0
GH¢ 1500- GH¢ 2000	30	20.0
More than GH¢ 2000	53	35.3

Field survey, 2023

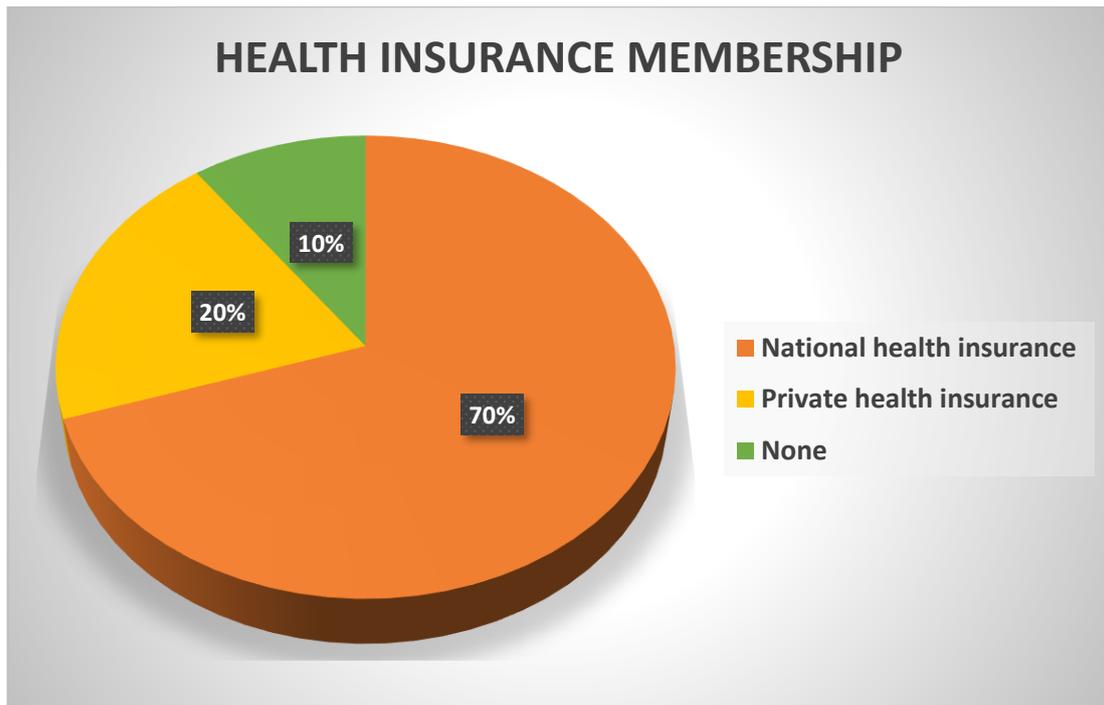


Fig. 1. A chart showing the health insurance membership of the respondents

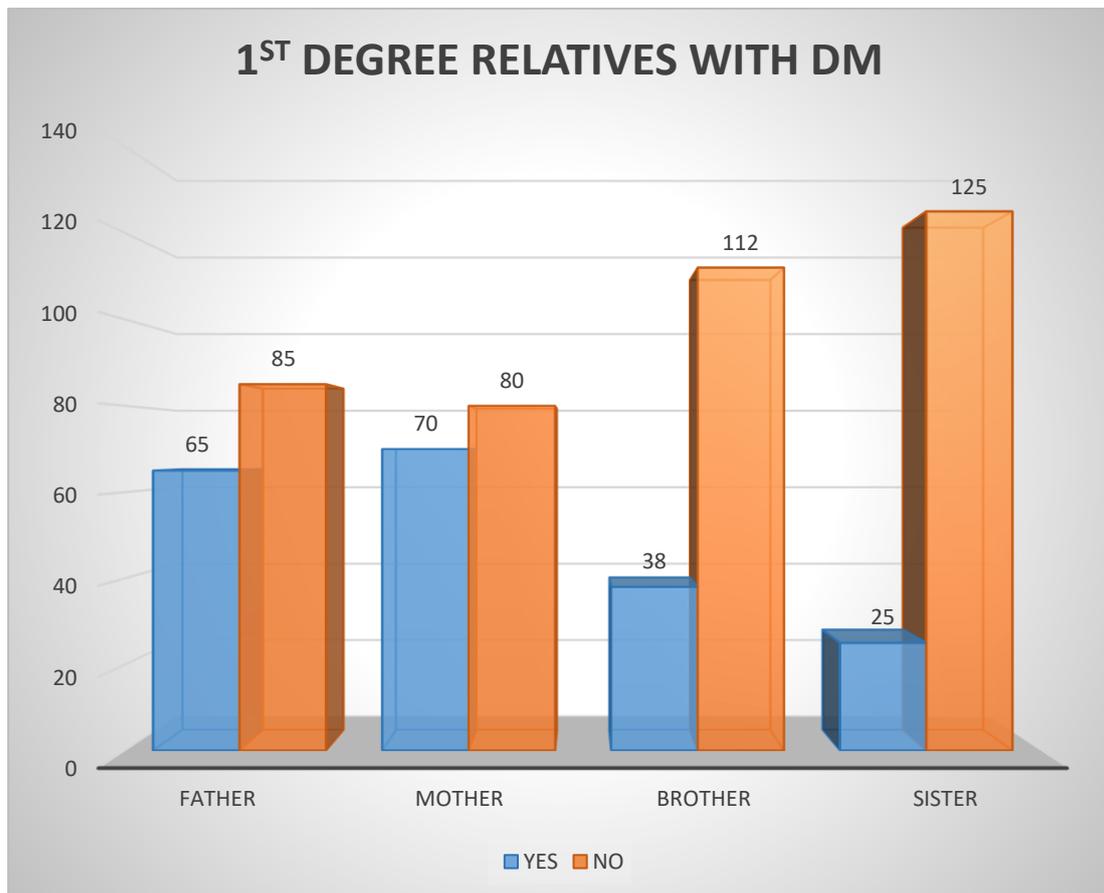


Fig. 2. Chart showing DM status of respondents' 1st degree relatives

identified frequent urination 114 (76.0%) and increased thirst 96 (64.0%) as possible signs and symptoms of Diabetes Mellitus. Nevertheless, most of them wrongly identified increased body temperature (87, 58.0%) to be sign of diabetes. Medications 126(84.0%) and diet management 103 (68.7%) were indicated by the respondents as ways of controlling DM, while 111 (74.0%)

correctly indicated that bitter substances cannot control DM. From the composite scores of the individual respondents and using a cut-off point of 8, levels of knowledge were categorized in dichotomy. Any respondent who scored 8 and above was considered as having adequate knowledge and those scoring below 8 as having inadequate knowledge.

Table 2. Knowledge of Respondents on Diabetes

Variables	Frequency N=150	Percent %
What is the meaning of Diabetes Mellitus		
<i>High level of sugar in the blood</i>	117	78.0
<i>Low level of sugar in the blood</i>	28	18.7
<i>High pressure in the blood</i>	5	3.3
Diabetes is associated with which hormone in the body		
<i>Renin</i>	53	35.3
<i>Insulin</i>	30	20.0
<i>Estrogen</i>	67	44.7
What are the risk factors of DM?		
<i>Family history of diabetes</i>		
Yes	92	61.3
No	78	38.7
<i>Inadequate physical activity</i>		
Yes	77	51.3
No	73	48.7
<i>High blood pressure</i>		
Yes	80	53.3
No	70	46.7
Diabetes is associated with which of the following foods?		
<i>Food that are high in protein</i>	24	16.0
<i>Food that are high in fats</i>	16	10.7
<i>Food that are high in carbohydrate</i>	110	73.3
What are the major signs of diabetes?		
<i>Frequent urination</i>		
Yes	114	76.0
No	36	24.0
<i>Increased Thirst</i>		
Yes	96	64.0
No	54	36.0
<i>Increased body temperature</i>		
Yes	87	58.0
No	72	42.0
How can diabetes be controlled ?		
<i>Medications</i>		
Yes	126	84.0
No	24	16.0
<i>Diet management</i>		
Yes	103	68.7
No	47	31.3
<i>Using bitter substances</i>		
Yes	39	26.0
No	111	74.0
Overall Knowledge level		
Adequate	116	77.3
Inadequate	34	22.7

Majority of the respondents 106 (70.7%) have heard about nutritional management of diabetes, more than half 58(54.7%) of the participants indicated that they heard it at the hospital during diabetic counselling, followed by mass media 35(33.0%), however when asked whether respondents were practicing nutritional management of their condition, less than a third reported that they practice it strictly. Regarding which meals are good for patients with Diabetes, majority 91(60.7%) knew that foods rich in whole grains are good for diabetics as well as food free from sugar 88(58.7%). Majority 125(83.3%) of the respondents affirmed that sugary foods and drinks are not good meals for diabetes patients. Fifty-seven (38.0%) of them knew the recommended number of servings of fruits and vegetables per day (i.e. five servings).

3.3 Dietary Habits and Food Consumption Pattern of Respondents

More than two-thirds 132(88.0%) of the participants have ever had diet counselling on diabetes, however, only half (50.0%) of the

participants adhered strictly to the nutritional management of diabetes. Majority of the respondents, 97 (64.7%) ate three meals every day and 62 (41.3%) skipped meals which was mostly identified as dinner according to the respondents. Nearly a third, 32% of the participants ate 1-3 times/week in fast food restaurants while majority, 40.0% have stopped eating in fast food restaurants after they were diagnosed of the disease.

More than three-quarters 114(76%) of the participants indicated that they usually take snacks. Of these, 50% indicated that they take it between 12noon to 1:00pm. Majority 85(56.7%) of the participants mostly consume disaccharides while 28(18.7%) didn't know the type of carbohydrate they eat mostly. Regarding the consumption of fibre foods, majority, 66% of the participants usually consume high fibre diets whereas 20.0% mostly consume low fibre diet.

Overall, majority 86(57.3%) of the respondents had good dietary habits while the remaining 64(42.7%) had poor dietary habits.

Table 3. Knowledge of respondents on nutrition

Variables	Frequency N=150	Percent (%)
Have you heard of dietary management of Diabetes?		
Yes	106	70.7
No	39	26.0
Don't Know	5	3.3
If yes, Where?		
	N= 106	
Hospital	58	54.7
Mass media	35	33.0
School	10	9.4
Relatives and friends	3	2.8
Which of the following meals are good for diabetics?		
<i>Sugar free foods</i>		
Yes	88	58.7
No	62	41.3
<i>Foods rich in whole grains</i>		
Yes	91	60.7
No	59	39.3
<i>Sugary foods and drinks</i>		
Yes	25	16.7
No	125	83.3
What is the recommended number of servings of fruits and vegetables per day?		
One serving	14	9.3
Five serving	57	38.0
Ten serving	35	23.3
Don't Know	44	29.3

Table 4. Dietary habits among respondents

Variables	Frequency(n=150)	Percentage (%)
Have you ever had diet counseling?		
Yes	102	68.0
No	48	32.0
Frequency of eating in fast food restaurants.		
Daily	5	53.7
1-3 times/week	48	32.0
4-6 times/week	16	10.7
Occasionally (less than once a week)	21	14.0
Avoided eating in fast food restaurant	60	40.0
How many hours' intervals do you often eat your meals?		
Every three hours	112	37.3
Every four hours	98	32.7
Every five hours	28	9.3
Any time am hungry	62	20.7
Do you skip meals?		
Yes	62	41.3
No	88	58.7
IF YES indicate the meal you skip mostly		
Mostly skip breakfast	12	19.4
Mostly skip lunch	23	37.1
Mostly skip dinner	27	43.5
Do you usually take snacks?		
Yes	114	76.0
No	36	24.0
When do you take your snack?		
Between 12pm to 1pm	75	50.0
Between 1pm to 2 pm	30	20.0
Between 2pm to 3pm	18	12.0
Between 3pm to 4pm	20	13.3
After 4 O'clock pm	7	4.7
What type of carbohydrate foods do you mostly eat		
Monosaccharide	24	16.0
Disaccharides	85	56.7
Polysaccharides.	13	8.6
Don't know	28	18.7
What types of fibre foods do you mostly eat?		
Low fibre diets	99	66.0
High fibre diets	30	20.0
Both low and high fibre diets	10	6.7
Don't know	11	7.3
Overall Dietary Habits		
Good practice	86	57.3
Poor practice	64	42.7

3.4 Bivariate Association between Knowledge Level and Background Characteristics

Overall knowledge level as reported in this study was 77.3% adequate and 22.3% inadequate.

Knowledge level of diabetes and nutrition of the females tended to be higher than that of males even though there was no significant difference. Older respondents, 55 years and above, had adequate knowledge level compared to the younger respondents below 34 years. No

significant association was found among respondents' marital status, ethnicity, religion and monthly income, there was also no significant association between employment status and knowledge level of diabetes and nutrition. Those with formal education as well as the professionals also reported adequate

knowledge levels. The study found significant associations between age ($p=0.001$); educational level ($p=0.001$); and knowledge level. Adequate knowledge levels were observed in respondents who had been diagnosed more than 5 years of diabetes.

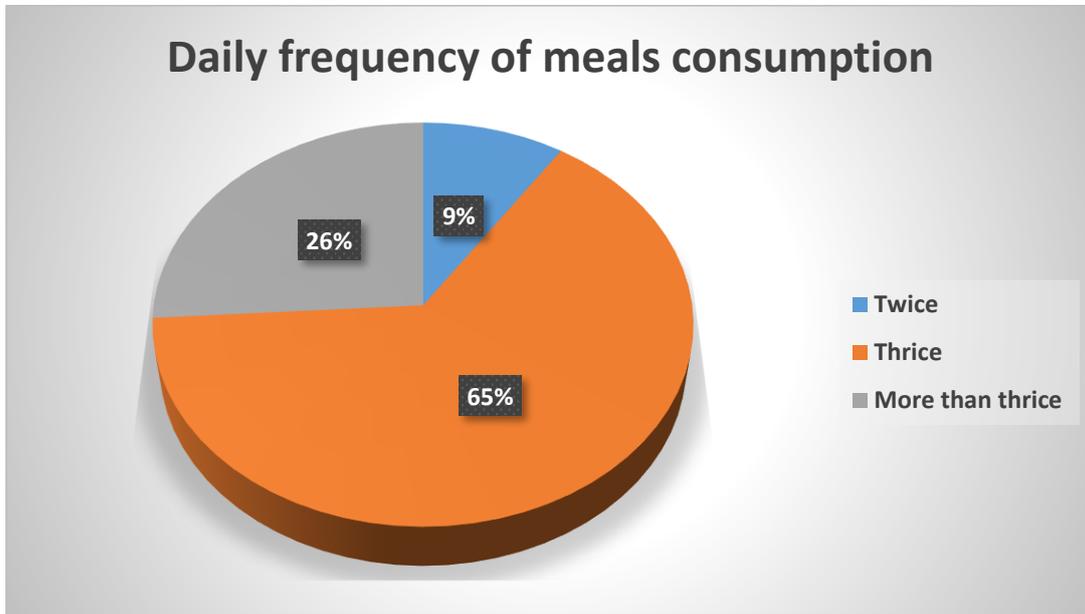


Fig. 3. Frequency of meals per day by study participants

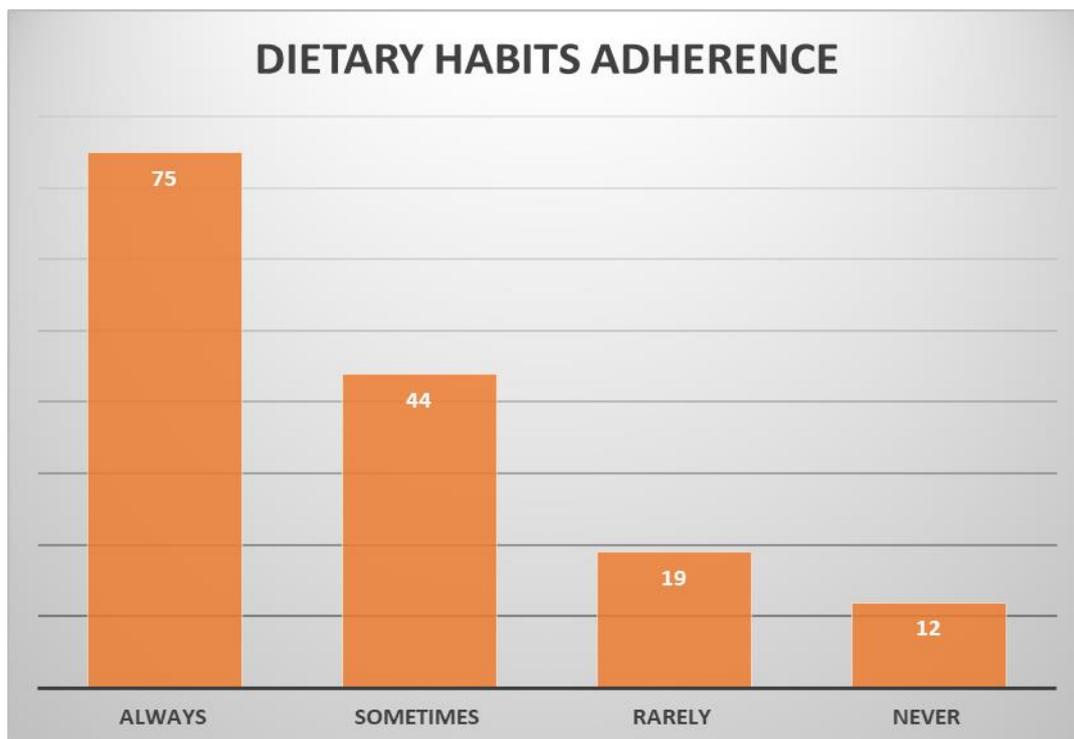


Fig. 4. Adherence to nutritional management of DM by study participants

Table 5. Chi-square analysis of socio-demographic and Knowledge level

		Knowledge level		X ²	P-value
		Adequate 116(77.3%)	Inadequate 34(22.7%)		
Age	≤ 34 years	4(33.3%)	8(66.7%)	32.155	0.001
	35-54 years	47(82.5%)	10(17.6%)		
	≥ 60 years	65(80.2%)	16(19.8%)		
Sex	Male	52(76.4%)	16(23.6%)	0.419	0.517
	Female	64(79.0%)	18(21.0%)		
Marital status	Single	30(78.9%)	8(21.1%)	7.287	0.76
	Married	72(79.1%)	19(20.9%)		
	Divorce	4(66.7%)	2(33.3%)		
	Widow	10(66.7%)	5(33.3%)		
Educational status	No education	1(16.7%)	5(83.3%)	41.445	0.001
	Primary	8(66.7%)	4(33.3%)		
	Junior High	18(72.0%)	7(28.0%)		
	Senior High	39(83.0%)	8(17.0%)		
	Tertiary	50(83.3%)	10(16.7%)		
Occupational status	Employed	55(84.6%)	10(15.4%)	3.349	0.187
	Self-employed	40(57.7%)	15(27.2%)		
	Unemployed	21(70.0%)	9(30.0%)		
Ethnicity	Akan	85(88.5%)	11(11.5%)	2.890	0.473
	Hausa	5(41.7%)	7(58.3%)		
	Ewe	8(53.3%)	7(47.7%)		
	Dagomba	12(70.6%)	5(29.4%)		
	Other	6(60.0%)	4(40.0%)		
Religion	Christian	105(87.5%)	15(12.5%)	2.113	0.549
	Islam	10(40.0%)	15(60.0%)		
	Traditional	1(20.0%)	4(80.0%)		
Monthly Income (GHC)	≤ 500	5(33.3%)	10(66.7%)	6.769	0.672
	501-1,000	19(76.0%)	6(24.0%)		
	1,001-1,500	17(63.0%)	10(37.0%)		
	1,501-2,000	25(83.3%)	5(16.7%)		
	>2,000	50(94.3.6%)	3(5.7%)		

3.5 Association between Demographic Characteristics and Dietary Habits/ Practice

To examine the association between respondents' socio-demographics and their dietary habits, Chi Square test was used and the results are summarized in Table 6. Chi-square analysis identified significant association between dietary habit/ practice and the following socio-economic characteristics; age group, $X^2 (1, 150) = 36.71$, $P < 0.001$, Educational Status, $X^2 (4, 150) = 52.44$, $P < 0.001$, Monthly income, $X^2 (5, 150) = 27.75$, $P < 0.001$. However, the following factors were not significantly associated with dietary habits or practice among the study participants, marital status, sex, religion, Ethnicity and employment status (Table 6).

4. DISCUSSION

"Understanding the nutrition knowledge of patients with DM and its influence on their dietary intake is important for developing nutrition intervention strategies aimed at improving their dietary habits and overall nutritional and health status. The aim of this study was to assess the nutrition knowledge and dietary habits of patients with DM attending the Bono Regional Hospital in the Bono Region of Ghana. Previous studies aiming to assess the link between nutrition knowledge and dietary habits have often been criticised on the bases of uncertain validity and reliability of the instruments used" [17]. "This study therefore looked at all aspects of practical nutrition knowledge which could be used in future researches to link nutrition knowledge, demographic characteristics and dietary habits" [16].

Table 6. Chi-squared association between dietary habits and socio-demographic characteristics of participants

Variables	Dietary Habits			X ²	P-Value	
	POOR (n=64)	GOOD (n=86)	TOTAL (n=150)			
Age (years)	18-24	1(50.0%)	1(50.0%)	2(1.3%)	20.71	0.002
	25-34	6(60.0%)	4(40.0%)	10(6.7%)		
	35-44	5(25.0%)	15(75.0%)	20(13.3%)		
	45-54	17(45.9%)	20(54.1%)	37(24.7%)		
	55-64	23(43.3%)	30(56.7%)	53(35.3%)		
	65 and above	12(42.9%)	16(57.1%)	28(18.7%)		
Gender	Male	39(57.4%)	29(42.6%)	68(45.3%)	12.03	0.024
	Female	25(30.5%)	57(69.5%)	82(54.7%)		
Educational Status.	No education	4(66.7%)	2(33.3%)	6(4.0%)	52.44	0.000
	Primary	5(41.7.8%)	7(58.3%)	12(8.0%)		
	Junior High	10(40.0%)	15(60.0%)	25(16.7%)		
	Senior High	20(42.6%)	27(57.4%)	47(31.3%)		
	Tertiary	25(41.7%)	35(58.3%)	60(40.0%)		
Occupation	Employed	30(46.2%)	35(53.8%)	65(43.3%)	13.16	0.041
	Self-Employed	20(36.8%)	35(63.6%)	55(36.7%)		
	Unemployed	14(46.7%)	16(53.3%)	30(20.0%)		
Ethnicity	Akan	36(37.5%)	60(62.5%)	96(64.0%)	13.16	1.242
	Dagomba	10(58.8%)	7(41.2%)	17(11.3%)		
	Ewe	7(46.7%)	8(53.3%)	15(10.0%)		
	Hausa	6(50.0%)	6(50.0%)	12(8.0%)		
	Other	5(50.0)	5(50.0%)	10(6.7%)		
Monthly Income (GHC)	100-500	8(50.0%)	8(50.0%)	15(10.0%)	27.75	0.001
	501-1,000	13(52.0%)	12(48.0%)	25(16.7%)		
	1,001-1,500	12(44.4%)	15(55.6%)	27(18.0%)		
	1,501-2,000	10(33.3%)	20(66.7%)	30(20.0%)		
	>2,000	22(41.5%)	31(58.5%)	53(35.3%)		
Religion	Christian	44(36.7%)	76(64.3%)	120(80.0%)	12.45	0.278
	Islam	16(64.0%)	9(36.0%)	25(16.7%)		
	Traditional	4(80.0%)	1(20.0%)	5(3.3%)		

“One hundred and fifty participants were involved in this study. The research data revealed that the mean age of the study participants was 53.8 years. Female participants were the majority in the study confirming findings of the Ghana statistical survey” [12]. Most of the respondents were within the age category of 55 to 64 years. In sum, about ninety two percent of respondents were aged 35 years and above while, only eight percent were aged less than 35 years. This complements several studies show that Diabetes is seen in most adults as compared to the younger age. According to [17], “about eighty five percent of respondents were aged between 35 to 74 years while fifteen percent were aged less than 35 years in his study”.

“This educational level could be attributed to the urban setting of the study site and perhaps suggest that Diabetes affects people of higher socioeconomic status thus mimicking western life

styles” [18]. Educational attainment was directly proportional to nutritional knowledge as those with tertiary education had high knowledge on diabetes and nutrition as compared to those without formal education. In a community where formal education is low, people are more vulnerable to disease as well as its treatment regimen due to poor health seeking behaviours [18]. “Of all the study participants who were mostly employed either by the Government, private or self-employed, female participants were the majority. This may be attributed to the level of education observed in this study. Income levels of respondents in this study were distributed fairly across the various levels of income. Decision-making on food preparation in participants’ households was mostly done by participants themselves. More than two-thirds of the respondents in the study were married. This is explained by the age groups of respondents. Being married has implication for adherence to

nutrition as have been shown in some studies. Married individual showed higher adherence to dietary practice of diabetes compared with single. Married partners provide social support to each other and sometimes serve as reminders to nutrition adherence" [18].

4.1 Study Participants' Nutrition Knowledge

"The lack of knowledge regarding appropriate nutrition has various implications on nutrition and health. Assessing nutrition-related knowledge offers an opportunity to better understand a given situation by providing insights into the social, psychological and behavioural determinants of nutritional status"[6]. "Information gathered from the study suggested that most of the study participants had very poor nutrition knowledge on the type of fatty foods to cut-down on, frequency of fruits intake, protein levels in red meat, brown sugar as a health alternative to white sugar and local cheese as a starchy food. A similar research on nutrition knowledge of Iranian athletes also had similar findings" [19]. "A poor level of nutrition knowledge could potentially indicate poor dietary habits" [20]. "The findings could also be due to the low level of education in the study area" [4]. "Higher education is associated with lower risk of obesity and higher knowledge about food that can be passed on to children according to a study that examines eating patterns and physical activity characteristics among urban and rural students in Saudi Arabia" [21]. Thus, education plays a key role in acquiring knowledge about food and making appropriate food choices. Very poor nutrition knowledge and misconceptions about the type of food consumed could potentially have serious implications on nutritional status of DM. The sources of nutrition information also play a significant role in determining the level of nutrition knowledge and dietary habits of DM.

"The most prominent source of nutrition information is television" [10]. "Media has been recognized as one of the forces that influence body image" [22]. "However, this study solicited information from clients based on information their health experts give them. As the findings indicated, it may not be adequate enough to acquire the requisite nutrition knowledge and application of appropriate dietary practices. Additionally, the very poor nutrition knowledge of the study participants on these indicators could have implications on their clinical attendances

rates and the type of nutrition education given during every session" [22].

"Findings from the study suggest that knowledge on diabetes and nutrition was above average, 57.3% of them had overall adequate nutritional knowledge. This is in consonance with another study in "Dublin, Republic of Ireland where there were 60.0% adequate knowledge among the diabetics" [16]. Most participants knew about the meaning of Diabetes but few knew the hormone associated with Diabetes, most of them also knew the recommended daily servings of fruits and vegetables. This contrasts with the report of an Indian study where 86.7% did not know the meaning of Diabetes but 62.7% knew the number of servings of fruits and vegetables" [5]. Knowledge of definition of DM (78.0%), risk factors of Diabetes (84.3%) and drinks that are permitted for diabetics (73.1%), major signs of diabetes (65.%) and management of diabetes (84.0%) was high. This is in contrast with studies done in other developing countries such as Gambia (47%) and Saudi Arabia (24.8%) where low level of knowledge was obtained. Similar reports were however obtained from Bangladesh (81%). This may be due to higher level of education among the cohorts in Bangladesh.

"Although the role of patient knowledge about diabetes and nutrition has not been recognized adequately in recent years, dietary modification is still considered a cornerstone of effective DM self-management; therefore, it is one of the most important areas for patients to understand, support informed decision-making and self-care. Family history as well as inadequate physical activity was identified as risk factors for diabetes by many respondents in this present study (61.3%) and (51.3%) respectively similar to that of Bangladesh (62%) and (55%) respectively" [5]. "Adequate nutrition knowledge of food choices helps one to make appropriate food choices" [23]. "Nutrition knowledge is also a central element of health literacy and low health literacy is associated with poor health outcomes [4]. People with adequate nutrition knowledge are able to follow healthy diet to avoid excessive weight gain [10]. Avoiding excess weight gain could lead to a reduction in the risk of microvascular and macrovascular complications among the study participants" [24]. "However, adequate knowledge does not always commensurate with dietary intakes. A study conducted to ascertain the nutritional knowledge, food habits and health attitude of Chinese university students revealed that majority of the

students had nutrition knowledge on balanced diet but very few of them were able to apply this concept when selecting foods from a menu”[13].

“Diabetes control measures that were identified by the participants include diet modification (68.7%) and medication (84.0%). Less than a third of the respondents (26.0%) knew that using bitter substances does not control the high sugar in the blood. Similar to the finding in another study in Gambia” [1]. “Knowledge about the various food groups, their sources and effects of each of these foods on glucose level is very vital, and will enable diabetics choose their meals properly, reducing certain foods or avoiding them completely for proper management of their blood sugar levels and to prevent development of other non-communicable diseases. In this study, only 34% of respondents knew the role of snacks in a diabetic diet, in contrast with the study in Jordan where well above half (59.1%) of diabetics knew that healthy snacks were important” [25].

“Majority knew foods that could raise blood sugar levels (83.3%). This level of knowledge might be due to the level of education since 88.0% had at least secondary education and they are able to understand messages better than their illiterate counterparts. However, this knowledge about foods that control blood sugar was marred by the wrong perception that all bitter substances reduce blood sugar. The wrong idea that all bitter substances reduce blood sugar featured among 26% of respondents in this study which is in congruent with a research conducted in India by Kant and Thapliyal” [25]. Prevalence of myths about curative substances serve to perpetuate unpleasant diet among diabetics and could lead to other chronic diseases such as kidney, liver and heart diseases. In many cases, herbal drugs may not be produced under hygienic environment or approved by the regulatory bodies. Moreover, since drugs or their metabolites are excreted through the kidney, using them in large doses or for a prolonged period as is common with herbal drugs which do not have prescribed dosing could result in kidney damage.

4.2 Dietary Habits of the Study Participants

“The results of the study showed that majority of the study participants eat three times (3x) per day, followed by more than thrice (>3x) eaters and twice (2x) eaters per day respectively.

Findings also indicate 41.3% of the study participants skipped meals. While several trials reported that appetite was reduced when meals were spaced out over the course of a day. Others failed to detect such differences regardless of feeding frequency” [26]. “Skipping meals is bad for blood sugar level and can cause hypoglycemia, especially when patients are on hypoglycemic medications. This type of hypoglycemic complication, could result in unconsciousness that can lead to other morbidity and even death if not properly handled on time. However, many studies have established that eating 3 times or more daily meals actually have implications on BMI levels” [5]. And that the number of meal frequencies was inversely associated with the risk of obesity. According to another study by Kiren et al. [5], people who ate more than three times (>3x) per day had a 45% higher risk of obesity than those who ate three times or had lesser meal frequencies ($\geq 3x$). Most of the respondents (68.0%) have had diet counselling in contrast to the report of the studies in India (39%) and Iran (25.2%). Diet counselling motivate patients to modify their diet and lifestyle which in turn can lead to better control of blood sugar to normal range, thereby reducing complications and morbidities associated with poor diabetes management.

LeBlanc et al. [27] also demonstrated that “eating four (4) small meals doubled the thermogenic response attributed to the repeated stimulation of the sympathetic nervous system compared with eating the same number of total calories as large in a single meal. However, this study did not establish the relationship between meal frequency and energy expenditure”. “An epidemiologic studies relating meal frequency to body weight also concluded that many studies failed to find any statistically significant relation between meal frequency and energy expenditure, those observed are consistently inverse” [28]. “However, some studies demonstrated that low meal frequency was associated with higher 24-hour insulin concentrations compared with high meal frequency” [26].

“Eating multiple, small meals may suppress hunger and overall serum insulin concentrations” [28]. “Insulin inhibits lipase enzyme activity and increases fat deposition. Since insulin is related to fatty acid storage, meal frequency may be one of the factors affecting body weight of T2DM patients” [28]. “Another study demonstrated that when humans switch from eating three full meals

per day to one moderate size meal every other day or only 500–600 calories 2 d/wk, they exhibit great changes in energy breakdown characterized by increased insulin sensitivity, reduced levels of insulin and leptin, mobilization of fatty acids, and elevation of ketone levels” [29]. Ketones, such as β -hydroxybutyrate, are known to have beneficial effects on high demand energy cells such as neurons in the brain. These findings could have similar implications on the differences in frequencies of meals among the study participants in this study.

“With respect to meal patterns among the various meal frequency groups, the study showed that majority (66%) of them consumed low fibre diets however most of the participants when asked the type of carbohydrate they consume mostly, 56% indicated disaccharides while 18.7% didn't know the type they usually consume. High consumption of sweets and fats is associated with high risk of diabetes complications, obesity and other chronic diseases” [6]. A similar study by Memon et al., [30] on “obesity in low and middle income countries had similar findings. Consumption of legumes, and fruits and vegetables was also generally high among the various meal frequency groups”. “Increased consumption of legumes, fruits and vegetables is associated with good glycaemic control and improve HbA1c levels” [31,32]. “Only few of the study participants in this study consumed milk and milk products, meat, poultry, fish and alternatives, and bread and wheat products. Purchasing power of study participants could play a role in these trends as indicated in the income status of the study clients” [9]. Fruit (12.3%) and vegetable (20%) was inadequate and similar to many other national and foreign studies Memon et al., [30]. Unlike the report of a study in Malaysia where 76.1% consumed fruits daily [14]. These findings are far below the WHO recommendation for five or more daily servings of fruits and vegetables Ignorance about the right portion of fruits and vegetables to be taken daily might have contributed to the low intake since only few of them (38.0%) knew the daily recommendation of five servings of fruits and vegetables. Inadequate consumption of fruits and vegetables may also be due to the low level of income of the patients who are mostly elderly. Nearly half 67(44.6%) of them earned less than GH¢ 1500 monthly (GHC. 50.00 per day) indicating that many of them live below the poverty line. A study conducted among adults in Lagos showed that low income is associated with inadequate consumption of fruits and vegetables

[10]. “Majority of the respondents avoided eating fast foods regularly (40.0%) while 32% ate fast food from restaurants one to three times a week This finding is similar to other studies in Karachi and Abeokuta”, [22.30].

5. CONCLUSIONS AND RECOMMENDATION

Of the 150 respondents interviewed, approximately more than two-thirds have heard of diabetic dietary management, with more than half identifying hospital as source of information. Age and level of education were found to be significantly associated with knowledge of diabetes and nutrition while gender, religion, occupation, ethnicity, marital status were not significantly associated with knowledge level of diabetes and nutrition. The common risk factors in developing diabetes identified by the participants were; family history of diabetes and inadequate physical activity Innovative dietary counselling targeting behavioral change will be necessary to improve the nutritional status of the diabetic patients in Sunyani. The Ministry of Health should embark on a nationwide campaign to enhance the health education of the citizenry on healthy eating habits and healthy lifestyles in order to help decrease the incidence of diabetes mellitus or prevent people from getting diabetes mellitus. Also to ensure that all health care settings set up diabetes peer support groups, and provide the health care settings with the needed logistics and resources to ensure the proper functioning of these groups.

6. LIMITATION OF THE STUDY

The exclusion of most hospitals in the district from the sampling frame and also exclusion of patients below 18 years of age means that the study findings on Nutritional Knowledge and dietary habits of diabetic patients cannot be generalized to all diabetic patients in the Sunyani Metropolis. Time together with urgency of data needed was also a factor considered before chosen the available sample size.

ETHICAL APPROVAL AND CONSENT

Introductory letter was sought from the University for Development Studies. Medical school then ethical clearance obtained from the management of the Bono Regional Hospital and committee for human research publication and ethics. Respondents were approached individually to explain the objectives of the study to them before

their consent to partake in the study after a detailed explanation was given. Respondents were informed that their participation was voluntary and had the right to withdraw from the study at any point in time. All participants were provided with detailed information specifying the nature and purpose of the study, and the benefits and potential risks. This occurred both verbally and in writing. In accordance with ethical requirements, research participants were also asked to acknowledge their informed consent on a consent form prior to data collection. Both the researcher and the participant signed this consent form on the day of the initial interview. The confidentiality and anonymity of participants were protected at all times, including all correspondence between the researcher and her supervisors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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QUESTIONNAIRE

GENERAL INSTRUCTION ON COMPLETING THIS QUESTIONNAIRE

Please where appropriate, tick your choice of answer from the options given, and write in the spaces provided if your answer is not stated in the given options.

SECTION A: SOCIO- DEMOGRAPHIC DATA

1. Age (years)

- A). 18-24 [] B). 25 -34 [] C). 35-44 [] D) 45-54 []
E) 55-64 [] F). 65 and above

2. Sex

- A). Male [] B). Female []

3. Marital status

- A. Married [] B. Single [] C. Divorced [] D. Widow []

4. Religion

- A. Islam [] B. Christianity [] C. Traditional [] D. Other (specify).....

5. Ethnicity

- A).Akan [] B).Dagomba [] C).Gonja [] D).Frafra [] E).Specify for others.....

6. Education level.

- A). None [] B). Primary [] C). JHS [] D). SHS [] E).Tertiary []

7. Employment Status:

- A). Unemployed [] B). Self Employed [] C). Employed

8. Occupation: _____

9. Monthly income

- A). Less than GH¢500 [] B).GH¢500-GH¢1000 [] C).GH¢1000-GH¢2000 []
D). Above GH¢2000 []

10. Which health insurance membership card do you have?

- A). National health insurance [] B) Private health insurance [] C) None []

11. Has any of your first degree relatives ever been diagnosed of diabetes mellitus

- A). Yes [] B). No []

12. If yes to Q11, please specify

- A) Mother [] B).Father [] C).Sister [] D). Brother []

SECTION B: KNOWLEDGE OF NUTRITION AND DIABETES

13. What is the meaning of Diabetes Mellitus (DM)?

- A). High level of sugar in the blood
B). Low level of sugar in the blood
C). High pressure in the blood
D) High level of fats in the blood

14. Diabetes is associated with which hormone in the body...

- A. Renin [] B. Insulin [] C. Estrogen []

15. What are the risk factors of DM?

Risk factor

- A. Family history of diabetes
B. Inadequate physical activity
C. High blood pressure
D). Alcohol drinking

Yes

- []
[]
[]
[]

No

- []
[]
[]
[]

16. What are the major signs of diabetes?

Signs /Symptoms

- A. Frequent urination

Yes

- []

No

- []

- B. Increased Thirst
- C. Increased Appetite
- D). Increased body temperature

17. How can diabetes be controlled (**Check all that apply**)

- A. Diet management B. Using bitter substances C. Medications

18. What is a balanced diet?

- A). A diet that contains low sugar only.
- B). A diet consisting of the right amounts of all the necessary nutrients.
- C). A diet that contains higher amount of proteins, carbohydrates and fats.

19. Which of the following meals are good for diabetics patients

Meal	Yes	No
A. Sugar free foods	<input type="checkbox"/>	<input type="checkbox"/>
B. Vegetable rich foods	<input type="checkbox"/>	<input type="checkbox"/>
C. Foods rich in whole grains	<input type="checkbox"/>	<input type="checkbox"/>
D. Sugary foods and drinks	<input type="checkbox"/>	<input type="checkbox"/>

20. What is the recommended number of servings of fruits and vegetables per day

- A. One serving B. Five serving C. Ten serving D). Don't Know

21 Which fat do experts say is most important for people to cut down on? (Circle one response).

- (A) Unsaturated fat (B) Saturated fat (C) Not sure

22. Diabetes is associated with which of the following foods?

- A). Food that are high in protein
- B). Food that are high in fats
- C). Food that are high in carbohydrate

23. Do you think health experts recommend that people with diabetes should be eating more or less of these foods? (Tick one box per food)

Food	More	Less	Don't Know
Sugary foods			
Fruits			
Starchy foods			
High fibre foods			
Protein			

SECTION C: DIETARY HABITS OF DIABETICS

24. Have you ever had diet counseling?

- A. Yes B. No

25. Frequency of eating in fast food restaurants.

- A). Daily B).1-3 times/week C). 4-6 times/week D). Occasionally (less than once a week)
- E). Avoided eating in fast food restaurant

26. No of meals taken daily

- A) One B). Two C). Three D). Other (specify).....

27. How many hours' intervals do you often eat your meals?

- (A).Every three hours (B). Every four hours (C).Every four hours D) Any time am hungry
- E) Other (specify).....

28. Do you Skip meals?

- A. Yes B. No

29. If **yes to Q26**, indicate the particular meal you skip.

- A) Mostly skip breakfast
- B) Mostly skip lunch
- C). Mostly skip dinner

30. Do you usually take snacks?

A. Yes B. No

(If "No", skip to Q28)

31. When do you take your snack?

A) Between 12pm to 1pm B) Between 1pm to 2 pm.

C) Between 2pm to 3pm. D) Between 3pm to 4pm

E) After 4 O'clock pm .

32. What type of carbohydrate foods do you mostly eat? **Select all that apply**

A) Monosaccharide B) Disaccharides C) Polysaccharides. D).Don't know

33. What types of fibre foods do you mostly eat?

A) Low fibre diets B) High fibre diets C) Both low and high fibre diets D).Don't know

SECTION D: MOTIVATION TO UNDERTAKE NUTRITIONAL MANAGEMENT OF DIABETES

34. Who motivates you to engage in the nutritional management of your condition?

A) Family members B) Friends C) Health care givers D).Other specify.....

35. Have you received diabetes education? Yes No

36. Do you have family or relations who support you financially on the nutritional management your condition Yes No

37. Do you receive any social support at home Yes No

38. What motivates you intrinsically to engage in the nutritional management of your condition?

A). Desire to prove that diabetes can be cured with nutrition.

B). Desire to be healthy.

C). Desire to live longer.

D). Desire to avoid complications of diabetes.

E).Other specify.....

39. Which of these factors motivates you extrinsically to undertake nutritional management of your diabetes.

A). Social Support

B). Diabetes Education

C). Religious Factor

D). Accessibility to the Health Services E). Other specify.....

40. Challenges to adherence of optimal nutritional management of diabetes.

A). Financial constraints

B). Non-availability of preferred foods

C). Loss of appetite

D). Job demands

E). Appetite/Desire for foods to avoid

E). Other specify.....

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