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Research Article

Association between Nutrition Knowledge on Diabetes and Dietary Practice of People Living with Diabetes Mellitus in Nandi County

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Abstract

Introduction: Diabetes mellitus is growing fast the world is witnessing. The incidence of alarming concern health care providers is rapidly rising. The main burden of this disease will fall on all developing countries. The number of diabetic patients will reach 300 million by the end of 2025 it is known through the estimation mostly developing countries will have such dramatic and significant impacts.

Methodology: The quantitative descriptive cross-sectional study design was used with convenient sampling (n = 200). There was a relatively good knowledge (76.16%) among patients on dietary recommendations in management of type 2 DM. Older patients had lower level of education on recommended dietary practices.

Conclusion:

- Consequently, knowledge on need to carry candy as a first aid when one is hypoglycemic was low. In addition, knowledge on the need for patients with type 2 DM to keep the times one consume their meals (meal timings) as well as consume snacks in between main meals in order to reduce incidences of hypoglycemia was low. Level of formal education of patients with type 2 DM influenced strongly the assimilation of information provided by healthcare providers. Age was also strongly associated with how much a patient was able to grasp information and remember. Continuous education on recommended dietary practices was noted as important.
- Compliance to recommended dietary practices was 59.6%. Unlike the level of knowledge which was influenced by various demographic characteristics like age and level of formal education, compliance was not influenced by any of the assessed demographic factors. While the level of knowledge was high at 76.2%, this was found not to directly translate to compliance to recommended dietary practices in management of type 2 DM.
- Compliance to recommended practices was not influenced by level of knowledge on recommended dietary practices in management of type 2 DM. Support by those related/living with the patients was reported as one of the strong facilitator towards compliance. Management of type 2 DM was reported to be resource intense; financially and time wise. It was therefore sometimes difficult for patients to balance all aspects of recommendations.

Keywords: Diabetes Mellitus; Nutrition Knowledge; Dietary Practice

Abbreviations

KNBS: Kenya National Bureau of Statistics; MOPHS: Ministry of Public Health and Sanitation; OTP: Outpatient Therapeutic Program; SD: Standard Deviation; UNICEF: United Nation Children Fund; WHO: World Health Organization

Background to the Study

Type 2 diabetes mellitus accounts for over 90% of diabetes in Sub-Saharan Africa.

Mortality attributable to diabetes in 2010 was 6%.

Effective management of type 2 diabetes mellitus requires the patients to have knowledge and discipline to practice new and complex behaviors like blood glucose monitoring, taking medications, keeping tract of meal times, diet and exercise, besides dealing with their routine work, social and family life.

Patients knowledge on diabetes mellitus is vital in proper management of DM.

Patients with adequate understanding and knowledge of their medication have better glycemic control.

This study therefore is set out to determine association between knowledge and dietary practices among patients with type 2 diabetes mellitus, attending selected hospitals in Nandi county.

Problem statement

Prevalence in Nandi county is 4.6% which is a higher prevalence than the national level 4.2%.

DM is a chronic disorder that is not curable.

It relies heavily on proper management which includes hypoglycemic drug injections and all lifestyle changes.

Diabetes complications are common and are the major causes of morbidity and mortality among patients with DM.

Justification

Compliance to dietary recommendations is one of the important factors in management of type 2 DM.

It improves blood glucose control, reduces incidences of hyperglycemia and other complication of DM.

Research questions

1. The level of knowledge recommended dietary practices in management of type 2 DM among diabetic patients attending selected hospitals in Nandi county.
2. The attitude to recommended dietary practices among patients with type 2 DM attending selected hospitals in Nandi county.
3. Factors influencing compliance to recommended dietary practices among patients with type 2 DM attending selected hospitals in Nandi county.
4. The dietary patterns among patients with type 2 DM attending the selected hospitals in Nandi County.

Objectives of the Study

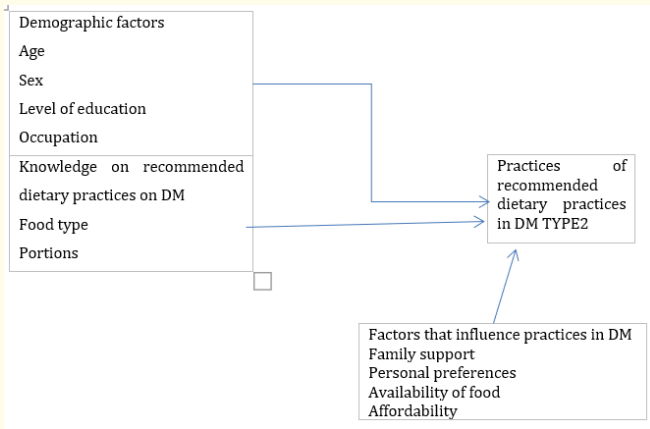
Main objective

To establish association between nutrition knowledge on diabetics and dietary practices among patients with type 2 diabetes mellitus.

Specific objectives

1. To establish level of knowledge of the recommended dietary practices among patients with type 2 diabetes mellitus.
2. To establish the dietary practices among patients with type 2 diabetes mellitus.
3. To establish factors that influence application of knowledge on the dietary practices among patients with type 2DM.

Conceptual framework



Figure

Significance of the study

Results of this study will add value to the policy makers in their work of developing policies and guidelines on dietary management of diabetes mellitus as well as compliance to recommended dietary practices.

The study will also benefit the people of Nandi county in understanding some of the challenges patients with type 2 DM face that

hinder compliance to recommended dietary practices on management of type 2 DM.

Literature Review

Background information

It is estimated by WHO that there is the association between the dietary pattern and mortality rate.

The dietary control is very important to control the diabetes it is considered by (65%) of diabetes patients.

Score for knowledge, attitude and practices overall were low, but scores for attitude were high.

Recommended dietary plan for all diabetes patients is an effective component of the overall treatment plan.

Factors that influence compliance and non-compliance to recommended dietary practices in management of type 2 DM

Education on diabetes management has been emphasized but compliance to these guidelines is still sub optimal.

Compliance to dietary guidelines is determined by factors such as lifestyle, self- consciousness, family support, good professional advice and quality of advice given.

Major influence to compliance was psychological factors such as burdening high cost of medication, frustration due to the dietary restrictions, limited spousal support and family conflicts, feelings of helplessness, feelings of inconvenience, unavoidable temptations, and difficulty to compliance in social gathering as well as difficulty in revealing status to hosts at parties.

Materials and Methods

Research design

The research will be a simple cross- sectional study employing qualitative and quantitative approaches to investigate knowledge, attitude and application of recommended dietary practices among patients with type 2 DM and possible factors that influenced compliance.

This design was chosen because the study was intended to provide an analysis of patients' knowledge, behaviors and decisions at one particular point in time.

Study variables

Independent variable will be the level of knowledge on recommended dietary practices in management of type 2 DM.

Dependent variable will practice recommended dietary practices among patients with type 2 DM attending selected hospitals in Nandi county; looking at whether patients compiled or will not apply the recommended dietary practices.

Aspects of compliance that will be investigated include self- reporting as well as consumption of ideal macro-nutrients (carbohydrates, proteins and fats), consumption of fiber and ideal meal frequency.

Location of the study

The study will be conducted in selected hospital in Nandi county which includes Kapsabet county referral hospital.

Diabetic patients will therefore receive a wide range of services including health education on recommended dietary practices.

The hospitals also target a large pool of patients who visit the hospitals regularly.

Nandi county being a semi cosmopolitan society with many Kenyan ethnic groups represented, it will provide a good representation of people's attitude and behaviors due to its diversity of people and culture.

Study population

The study population will be males and females of all ages attending selected hospitals in Nandi county who have been diagnosed with type 2 DM.

Inclusion criteria

Those who will be included in the study will be type 2 diabetes mellitus patients attending selected hospitals in Nandi county.

Exclusion criteria

Type 2 diabetic patients who are pregnant are too weak to respond to the questions will not be included in the study.

Sampling techniques

Random sampling will be employed in selection of 2 sub county hospital out of 6 hospitals in Nandi county.

Simple random sampling will be used since it will provide all the sub county hospitals with an equal chance of being selected.

The county Referral Hospital being only one in Nandi county was selected purposely.

Sample size

Nandi county has a total population of 703,365.

Target population of type 2 DM using the prevalence was 27,340.

A representative sample of 210 respondents will be used following the statistical formula:

$n = z^2pq/d^2$

Where n is the desired sample size, z will be the standard normal deviation (1.96) which corresponds to the 95% confidence interval. p the proportion of the target population estimated to have a particular characteristic.

Prevalence (P) of type 2 diabetes in the population may be known but that of the hospitals will not be known and hence 50% (0.5) will be used in this study. q will be determined by 1-p which will be 0.5 and d will be the degree of accuracy which will be 0.05. Therefore $n = Z^2pq/d^2 = (1.962)(0.5\ 0.5/0.052) = 200$.

In order to cater for non-response rate, the sample size will be increased by 5% to give a representative sample of 210 respondents. Eight respondents will be interviewed for key informant interviews.

Pre-testing

Pre-testing will be done in kabiyet sub county hospital in order to modify the instruments, test consistency and also assess if patients have difficulties addressing certain questions.

Validity

Properly designed research instruments will be used.

They will be checked carefully against the objectives giving clear instructions and minimizing errors caused by misunderstanding.

Reliability

Pretest to be conducted on 5% sample size (20 respondents) using test retest method.

Questions to be administered on the same respondents with a timeline gap of one week.

Data collection techniques

Data will be collected using the researcher administered questionnaires (with a 24-hour dietary recall).

Researcher administered questionnaires will be administered to type 2 diabetes mellitus patients.

A total target patients out of the target 210 will be reached in this study.

Twenty four hour dietary recall collected detailed account on what the patient consumed the previous day, from the time they woke up until the following morning.

The information obtained from the 24 hour dietary recall will give a proxy indication of the patients compliance to recommended dietary practices and supported the data obtained by self- reporting.

Hospitals take weight, height and blood glucose each time patients visit hospitals.

Ethical considerations

The study protocol will be reviewed, authorized and approved by the department of food science and nutrition and finally Karatina University Ethical Review Board.

Permission to undertake the study will be obtained from the relevant authority within the study area and the objectives of the research will be explained to the in charge.

The nature of the study will also be successfully explained to the study participants to obtain their oral consent.

No resistance will be made if a mother wants to withdraw at any time from participating in the research.

Data management and analysis

The instruments will be checked for completeness and consistency of information.

Quantitative data collected using researcher administered questionnaire will be cleaned, coded and analyzed using the statistical package for social sciences (SPSS).

Level of knowledge on recommended dietary practices and compliance will be analyzed by scoring a set of questions from the researcher administered (patient) questionnaire (17 for knowledge and 10 for compliance) which will be summed up and converted to a percentage per each respondent.

Factors that influence compliance to recommended dietary practices will be found out using a set of questions from researcher administered questionnaire.

Data will be presented using pie charts, graphs, tables of frequencies and percentages.

Results

Socio-economic and demographic characteristics of the participants

Most of the respondents (72.5%) were between the ages of 51 - 70 years. Majorities were females (75.8%) and were married (67.4%). Furthermore, only about 37.9% of the participants had formal education up to secondary level. A significant proportion of the respondents were self-employed and reported to be earning a monthly income of more than Ksh 10, 000. Nutritional Knowledge. The mean nutrition knowledge score was 32 ± 13 and the median was 30. The minimum score was 15 percent while the maximum score was 68 percent.

Distribution of Respondents by Nutritional Knowledge From the study finding, majority of the respondents (69.3%) had low nutritional knowledge (< 40). About 30.7% had average nutritional knowledge (40 - 69) (Table 2).

Demographic characteristic's		N	%
Age in years	31 - 40	6	3.9
	41 - 50	13	8.5
	51 - 60	53	34.6
	61 - 70	58	37.9
	71 - 80	7	4.6
	81 - 90	16	10.5
Sex	Male	37	24.2
	Female	116	75.8
Marital status	Single	25	16.3
	Married	103	67.4
	Widowed	58	10.5
	Divorced	27	5.9
Level of education	No formal education	18	11.8
	Primary	50	32.7
	Secondary	58	37.9
	Post-secondary	27	17.6
Occupation	None	14	9.2
	Self employed	73	47.7
	Formal employment	34	22.2
	Farmer	32	20.9
Income in Kenyan shillings	Below 10,000 ksh	61	40
	10,000 - 20,000 ksh	43	28
	20,000 - 30,000 ksh	10	6.5
	30,000 - 40,000 ksh	15	10
	40,000 - 50,000 ksh	11	7
	> 50,000 ksh	13	8.5

Table 1: Socio-economic and demographic characteristics of the study population demographic characteristics.

Nutrition Knowledge	(N = 200)	Percentage
10 - 19	60	30
20 - 29	45	22.8
30 - 39	33	16.3
40 - 50	38	19
50 - 69	24	11.8

Table 2: Distribution of respondents by nutritional knowledge scores.

Health status and diabetes related characteristics of the respondents

The weight status for the 200 patients was analyzed against BMI standards and only 33.5% of the respondents had the ideal weight (BMI: 18.5 - 24.9) as shown in table 3. Majority of the patients were diagnosed with type 2 DM between 45 - 64 years of age, where by 50.4% of the patients interviewed were diagnosed at this age. Only 20.2% respondents were diagnosed at 65 years old and above. Those who were diagnosed with type 2 DM between 20 - 44 years and 0 - 19.9 years were 25.6% and 3.9% respectively. A total of 60 patients had not taken any food and hence they were

tested for fasting blood glucose while the rest (140) were tested for random blood glucose. As presented in table 3, most respondents recorded high blood glucose during the day of data collection; both FBG (77%) and RBG (75%) (Ministry of Public Health and Sanitation, 2015).

Practice of recommended dietary practices in management of Type 2 DM

In order to determine the practice of recommended dietary practices, respondents were asked to report on their compliance to various aspects of dietary recommendations. Each respondent's responses were scored and a percent was obtained. This indicated the compliance level of each respondent. An average percent from all the respondents was calculated to give an overall compliance level. Table 4 shows compliance level as reported by the respondents.

Practice of recommended dietary practices as reported by the respondents was 59.6% (Table 4). In order to confirm the compliance results and get an in-depth understanding on practice level, a section of the respondents (10%) was followed to their homes and information on the previous day meal consumption was collected. This is also referred to as a 24 hour dietary recall. Patients provided information on all the food they consumed the previous day; the food type, ingredients, cooking method and the amounts consumed.

Dietary guidelines	%
Consuming complex carbohydrates (as opposed to refined e.g. whole meal maize flour, arrow roots)	88.9
Consuming low fat diet- e.g. avoiding deep fried foods, skinning chicken, removing cream in milk	48.3
Consuming 2 - 4 portions of fruits a day 38.0	38.0
Consuming 3 - 5 servings of vegetables a day 69.0	69.0
Consuming controlled portions of proteins-i.e. 2-3 servings a day 37.2	37.2
Number of meals consumed/minimum of 3 96.9	96.5
Observing meal timings 44.4	44.4
Carrying candy at all times 41.3	41.3
Taking at least 6-8 glasses of water a day 38.5	38.5
Avoiding alcohol intake 93.0 360	93.0

Table 4: Compliance to recommended dietary practices in management of type 2 DM (self-reported).

Using nutrients intake (Carbohydrates, proteins, fats and fibre) and meal frequency score, the overall, compliance to recommended dietary practices in management of type 2 DM was 57.5%.

Further analysis was conducted in order to determine association between various social demographic characteristics and recommended dietary practices as shown in table 5.

Age group	Compliance level	
	< = 50%	> = 50%
< 20 years	0	100
20 - 49.9 years	49	51
45 - 64.9 years	53	47
> 66 years	50	50

Table 5: Compliance to recommended dietary practices in management of type 2 DM (self-reported)-Stratified by age.

Meal frequency was also considered in this study.

Number of meals consumed in a day (meal frequency)

All respondents (100%) consumed the minimum recommended number of meals which is 3. Majority of the respondents consumed 4 - 5 meals in the previous day. Figure 1 illustrates this information.

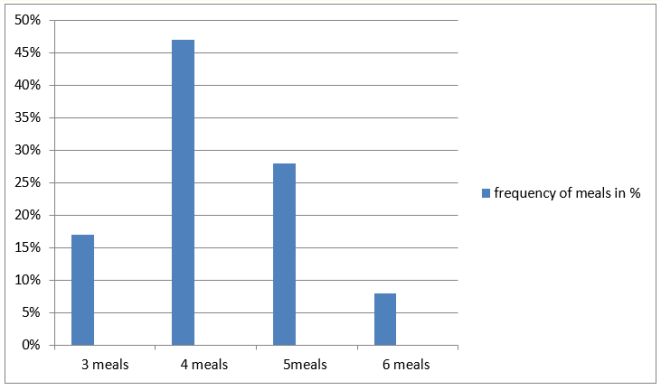


Figure 1

Level of knowledge on the recommended dietary practices in management of type 2 DM

In an effort to determine the level of knowledge on recommended dietary practices, the study established that majority of the re-

spondents (97.1%) were educated on dietary recommendations in management of type 2 diabetes mellitus. Level of knowledge was determined using a series of questions and those who answered correctly in each of the questions, earned a point for each. Those who gave the wrong answer or did not know the answer for one or more of the questions scored a zero (0) in those specific questions. A response of a Yes was not necessarily the correct response. Response to the questions is presented in table 6 and the correct answers are in bold.

Definition of diabetes type 2	**Correct Incorrect**	**62.1% 37.9%**
Meals a diabetic patient should consume	< 3meals	4.2%
	> 3 meals	95.8%
Whether a diabetic patient should consume cabbages regularly	Yes	80.3%
	No	18.4%
	Don't know	1.3%
Can I a diabetic patient consume biscuits regularly	Yes	9.1%
	No	89..6%
	Don't know	1.3%
Can I a diabetic patient consume mandazi on a regular basis	Yes	11.2%
	No	87.9%
Whether a patient with type 2 diabetes mellitus should carry candy, sweets or sugar at all time	No	473.1%
	Yes	47.5%
	Don't know	9.4%
A patient with type 2 diabetes mellitus consumes at least 1 drink of alcohol per day in order to regulate blood sugar	Yes	1.0%
	No	72.7%
	Don't know	26.3%
A patient with type 2 diabetes mellitus should skip one or two meals a day	Yes	4.9%
	No	91.7%
	Don't know	3.4%

Table 6: Level of knowledge based on a series of questions knowledge assessment questions classification.

Questions presented in table 6 were used to compute the level of knowledge per a percent for each person which in turn provided the overall mean level of knowledge. The mean level of knowledge on dietary recommendations in management of type 2 DM was 76.2%. Generally, patients with type 2 DM knew what they were meant to eat or avoid "a person with our condition (type 2 DM) should eat a balanced diet that has proteins, carbohydrates and a lot of fruits and vegetables, especially traditional vegetables like amaranth" -reported a diabetic woman of middle age in kapsabet county refferal hospital County Hospital also reported "we should eat meat whose fat has been trimmed and we should avoid alcohol, ugali number 1 (made from refined maize floor), biscuits, tea with sugar and limit amount of white rice".

Discussion

Socio-demographics characteristics

The study assessed several demographic characteristics of the respondents. These were sex of the respondents, age and highest education level, occupation and age at which respondents were diagnosed with type 2 DM. Half of the respondents were diagnosed with type 2 DM at the age of 45 - 64 years. This compares well with a study conducted by CDC [1] whereby majority of new type 2 DM cases were diagnosed within 45 - 64 years' category. This study however had noted a decrease in age of diagnosis whereby there was a higher percent diagnosed between 20 - 44 years as opposed to the CDC study. Consequently, there were other studies that found a decrease in the age of diagnosis. For instance, a study that was conducted in the United States by Weng., *et al*. (2016) found the age of newly-diagnosed type 2 DM patients decreased by 3 years from 2007 (57.7 years) to 2012 (54.8 years).

Body mass index is one of the indicators of nutrition status which is calculated using weight and height. A BMI of 25 and above is an indication of overweight and obesity. This predisposes an individual to cardiovascular diseases. A high BMI also put diabetic patients at a risk of developing complications of DM. The study found overweight and obesity was prevalent (61.1%) among diabetes patients. The main source of livelihood for 50% of the respondents was farming. Other respondents were business traders while others had formal employment and casual labors. Blood glucose level is often used as an indicator of poor management of type 2 DM. Novo Nordisk Inc. (2013) stated that one of the leading causes of hypoglycemia was eating too little carbohydrates or skipping or delaying a meal. The study sought to determine prevalence of hyperglycemia and hypoglycemia among diabetes patients. Hyperglycemia is defined as a state of high blood glucose, with a plasma glucose exceeding 10 mmol/l (Ministry of public health and sanitation, 2010). Hyperglycemia is often caused by either consumption of a heavy meal with high glycemic index, less activity, coupled with missed insulin injection or drug resistance (Novo Nordisk Inc., 2013). High blood glucose can lead to hyperglycemia and diabetic ketoacidosis. High blood glucose was more prevalent among type two diabetic patients attending selected hospitals in Nandi County.

In addition, one in every two patients reported to having an episode of hyperglycemia at least once in the previous year. Some patients reported to having more than one episode up to 9 episodes in the previous year. This correlated well with the results of blood glucose samples that were collected on the day of data collection where by 77% and 75% of the respondents' recorded high levels of Fasting blood glucose (FBG) and random blood glucose (RBG) respectively. The results on prevalence of hyper/hypoglycemia compared well with a study that sought to determine prevalence of hyperglycemia and hypoglycemia by Wexler (2017). In this study, persistent hyperglycemia was recorded among 38% of the respondents and hypoglycemia was recorded in < 5% of the respondents. Hyperglycemia is damaging in the long run as it can lead to other complications and hence highly associated with mortality (Wexler, 2007). However, it poses less risk of immediate death as compared to hypoglycemia [2,3].

Level of knowledge on dietary recommendations among type 2 DM patients

Dietary recommendations are broad in nature and majority of the respondents reported to being educated on food choice and food composition which entailed information on the type of food diabetic patients should consume and which they should not as well as the form in which they should consume the food. Fewer cases were educated on the importance of meal frequency in management of type 2 diabetes mellitus as gathered in a patients Focused Group Discussion (FGD). Only half of the respondents reported to have been educated on the number of meals a diabetic patient should consume in a day and only a quarter of the diabetic patients reported to being educated on meal timings (Patients questionnaire). This was a knowledge gap in management of diabetes mellitus type 2.

The level of knowledge to recommended dietary practices in management of type 2DM compared well with a study that was conducted in Bangladesh which recorded 82% knowledge level (Selah., *et al* 2012). However, knowledge inadequacy was recorded in a question that prompted respondents to state whether a DM patient should carry candy at all times. Only 47.5% of the respondents reported the correct answer, which is yes. Studies have reported that it is important that a patient with type 2 DM carry a candy or a highly dissolving sugary substance like glucose, which should be taken whenever the patient begin to notice signs of hypoglycemia. It is a lifesaving first aid in the event of hypoglycemia. Most respondents had a perception that a high protein and low carbohydrates diet was the ideal (as reported in the patients FGD and patient's questionnaire) which is not correct.

Majority of the patients reported that the ideal number of meals a diabetic patient should consume in a day is between 3 to 6 meals (96%). Most of the respondents (92%) reported that it was not advisable for a patient with type 2 DM to skip meals. This was in line with Kenya National Clinical guideline that recommends a minimum of 3 meals a day among diabetics. Skipping meals is often associated with episodes of hypoglycemia. While diabetes guidelines [2,3] recommend that a diabetic patient should consume 3 main meals and at least 1 - 2 snacks in a day, a study by Kahleova (2014) reported that taking only two main meals a day was better in management of type 2 DM. This kind of management however requires further research owing to the risk of hypoglycemia that is often associated with taking less number of meals or skipping meals, especially among patients who inject with insulin.

A group of patients (39%) felt that adhering to drugs alone (with no other interventions) might be enough in managing DM condition. This was misinformation or knowledge gap since management of diabetes mellitus is dependent on various aspects which include drugs, dietary modification, physical activity and other lifestyle changes (Ministry of Public Health and Sanitation, 2010). About 72.7% of the respondents reported that drinking alcohol on a daily basis was harmful to the health of a diabetic person. Center for Disease Control [1] reported that drinking alcohol adds calories to the body without other additional nutritional benefits. The same article reported that drinking alcohol on an empty stomach could lead to hypoglycemia.

Level of knowledge was inversely proportional to age whereby younger respondents had higher level of knowledge and as age advanced, respondents reported lower level of knowledge. There was also a difference in means in level of knowledge to recommended dietary practices and level of formal education. Respondents who attained tertiary education had the highest mean in knowledge. Mean knowledge decreased with each level of education. There was also a difference in means in level of knowledge to recommended dietary practices in comparison to whether respondents were educated on recommendations or not. Those who reported to have been educated on dietary recommendations in management of type 2 DM reported a high mean in knowledge level (76.5%) while compared to those who reported to never been educated on the same (63.5%) [4-15].

Conclusion

- There was a relatively good knowledge (76.16%) among patients on dietary recommendations in management of type 2 DM. Older patients had lower level of education on recommended dietary practices. Consequently, knowledge on need to carry candy as a first aid when one is hypoglycemic was low. In addition, knowledge on the need for patients with type 2 DM to keep the times one consume their meals (meal timings) as well as consume snacks in between main meals in order to reduce incidences of hypoglycemia was low. Level of formal education of patients with type 2 DM influenced strongly the assimilation of information provided by healthcare providers. Age was also strongly associated with how much a patient was able to grasp information and remember. Continuous education on recommended dietary practices was noted as important.
- Compliance to recommended dietary practices was 59.6%. Unlike the level of knowledge which was influenced by various demographic characteristics like age and level of formal education, compliance was not influenced by any of the assessed demographic factors. While the level of knowledge was high at 76.2%, this was found not to directly translate to compliance to recommended dietary practices in management of type 2 DM.
- Compliance to recommended practices was not influenced by level of knowledge on recommended dietary practices in management of type 2 DM. Support by those related/ living with the patients was reported as one of the strong facilitator towards compliance. Management of type 2 DM was reported to be resource intense; financially and time wise. It was therefore sometimes difficult for patients to balance all aspects of recommendations.

Recommendation

There is need for comprehensive education at the health facility on management of type 2 DM, including those aspects that are often neglected for instance the need to observe meal times, need to carry candy at all times and also take snacks in between main meals for better blood glucose control.

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