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Original Research Article

Predictors of dietary practices and nutritional status among diabetic type II patients in Kiambu County, Kenya

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ABSTRACT

Background: Diabetes type 2 has become a serious global health threat due to its increasing prevalence particularly among African countries. Numerous scientific evidence points out on the importance of an individual's dietary practices and nutritional status in its prevention and management. The objective of the study was to identify the predictors of dietary practices and nutritional status among diabetes type 2 patients.
Methods: This was a cross-sectional study and a total of 153 study subjects were recruited. A pretested researcher administered questionnaire was used to collect data. The data was analyzed using both bivariate and multivariate logistic regression.
Results: The study established significant associations ($p<0.05$, at 95% C.I) between participants' education level (AOR=4.72), occupation (AOR=2.41), monthly income (AOR=6.02) and level of dietary knowledge (AOR=2.33) and their dietary practices. Further, there was a significant association between nutritional status and education level (AOR=1.26), monthly income (AOR=1.72), level of dietary knowledge (AOR=1.11) and dietary diversity (AOR=1.62). Majority of the participants were obese (51%).
Conclusions: Majority of the participants were obese. Dietary knowledge, education level, occupation, monthly income and dietary practices were the factors associated with the patients' dietary practices and nutritional status. Up-scaling of interventions targeting these variables is thus crucial. Further, reinforcing the need for healthy dietary practices and optimal nutritional status is critical in the prevention and management of diabetes.

Keywords: Diabetes, Dietary practices, Nutritional status, Predictors

INTRODUCTION

Research evidence abounds to indicate that the prevalence of diabetes mellitus (DM) is increasing across the world at an epidemic rate and is posing a major concern to public health.[1] Regions, such as the developing world, that were considered safe haven to non- communicable diseases (NCDs) are now reporting alarming increase in diseases such as diabetes. In 2014, global prevalence was estimated at 422 million adults.[2] Diagnosed diabetic cases in Africa currently stands at 14.2 million with a projected rise to 43.2 million by 2040. By 2015, Kenya had 478,000 diagnosed diabetic cases while it is suspected that majority of cases remain undiagnosed.[3]

Diabetes is caused by diminished insulin excretion or diminished insulin action, or both.[4] Incidence and prevalence of type 2 diabetes mellitus which accounts for about 85% of diabetes cases worldwide are surged by

certain predisposing factors including lifestyle habits, diet and exercise all of which constitute modifiable risk factors in the control and/or management of the disease.[5] Medical nutrition therapy (MNT) which refers to dietary prescriptions in disease management has become an important pillar in diabetes care.[6]

Sound nutritional practices including healthy dietary habits and physical activity have been identified as one of the self-care behaviors that are critical for successful and effective diabetes self-management.[4,7] Prolonged dietary treatment of diabetes is the very baseline of all forms of anti-diabetic treatment.[8] Long-term and the gravity of complications of type 2 diabetes are significantly related to the diet quality and to the nutritional management of the disease.[5,9] In Kenya, there is scanty data on the factors associated with the dietary practices and nutritional status of diabetic patients which are critical in informing appropriate interventions. It is on this appreciation and role of nutrition on diabetes care/management, that this study undertook an investigation of the predictors of dietary practices and nutritional status of diabetic patients in Kiambu County. This would facilitate the optimization of nutritional interventions for enhanced care outcomes.

Objective

To identify the predictors of dietary practices and nutritional status among diabetic type II patients in Kiambu County, Kenya.

METHODS

Study design

Cross sectional analytical design

Study setting

The study, which Kenyatta National Hospital Ethics committee approved, was conducted at Kikuyu Mission Hospital in Kiambu County, Kenya.

Study participants

A sample of 153 diabetic patients, male (24.2%) and female (75.8%) participated in this study. Inclusion criteria allowed type 11 diabetic patients attending clinic at Kikuyu Mission hospital. All patients who were less than 18 years of age were excluded. Before embarking on the study, a written informed consent was obtained from each participant. Further, confidentiality during and after the study was assured to the study participants.

Data collection tools and procedure

Researcher administered questionnaire was used to solicit information on potential predictors (demographic and socioeconomic) and dietary practices of the participants. Dietary practices information was determined using the patient's dietary diversity, food frequency and meal consumption frequency. Nutritional status of the patients was assessed using body mass index which was computed from the patient's weight and height (BMI; in kg/m^2). The weight was measured to the nearest 0.1 kg using a calibrated portable weighing scale while height was measured to the nearest 0.1 cm using a stadiometer.

Statistical analysis

Statistical analysis was performed using SPSS version 22 software. Data is expressed as means±SDs, frequencies and percentages. Binary logistic regression model was employed to identify factors associated with dietary practices (minimum acceptable dietary diversity of ≥4 food groups) and nutritional status (normal BMI of 18.6-24.9 kg/m^2). The two outcome variables for dietary practices were coded as "1" for having minimum acceptable dietary diversity and "0"for not having minimum acceptable dietary diversity. Similarly for nutritional status, code"1"was used for normal BMI where as "0"was used for any value outside the normal BMI (18.6-24.9 kg/m^2). Any variable with a p value of < 0.02 in the binary logistic regression {Crude Odds Ratio (COR)} was fitted in the multivariate regression analysis to identify the predictors of dietary practices and nutritional status of the diabetic patients {(adjusted Odds Ratio (AOR)}. This was done to control for confounding variables. A p value of <0.05 was set as the criterion for statistical significance within a Confidence Interval (CI) of 95%.

RESULTS

Demographic and socioeconomic profile of the study subjects

Majority (72.5%) of respondents were between 51 and 70 years. Most (67.4%) were married while the remaining 32.6% were single, divorced or widowed. Only 17.6% had attained post-secondary education while majority (37.9%) had attained secondary level of education. About 11.8% of the participants had no form of formal education and most of them earned a monthly income of less than KSh20, 000.In respect to the participants' occupation, majority (68.6%) were self-employed, 22.2% were engaged in formal employment, while the rest were not in any gainful employment (Table 1).

Dietary practices of the participants

The main aspects of dietary practices that were considered were food frequency, dietary diversity and the number of meals consumed per day.

Food frequency

A variety of fruits and vegetables were consumed by the respondents. Generally the main staple food was Ugali with most of the participants consuming it twice a week

(52.9%).The main sources of protein were beans, meat and eggs. Cooking fat and oils were consumed by almost all respondents on a daily basis (82.4%) attributable to its role in the cooking of foods (Table 2).

Table 1: Demographic and socioeconomic profile of the study subjects.

Characteristic (n=153)	n	%
Age category		
31-50	19	12.5
51-70	111	72.5
71 and above	23	15.0
Total	153	100
Sex		
Male	37	24.2
Female	116	75.8
Total	153	100
Marital status		
Married	103	67.4
Single	25	16.3
Widowed/divorced	25	16.3
Total	153	100
Level of education		
No formal education	18	11.8
Primary school	50	32.7
Secondary school	58	37.9
Tertiary	27	17.6
Total	153	100
Occupation		
Unemployed	14	9.2
Self employed	105	68.6
Formal employment	34	22.2
Total	153	100
Monthly income (KSh)		
0-20,000	104	68.0
20,001-40,000	25	16.3
Above 40.000	24	15.7
Total	153	100

Dietary diversity

Dietary diversity scores (DDS) of the participants were established based on their consumption of the different food groups. The majority of the participants had a moderate dietary diversity scores (82.5%) (Table 3).

Meal frequency

The results showed that majority had three meals (51.6%) and two meals (45.1%) per day (Table 4).

Participants' dietary knowledge

Dietary knowledge of the participants based on aspects of diet and diabetes was assessed. The aspects assessed included; knowledge on foods that help control diabetes, factors considered when choosing foods and the characteristics of a balanced diet. In that regard, dietary knowledge categories were formulated where majority of the participants had low dietary knowledge (69.3%) (Table 5).

Participants' nutritional status

Over and under-nutrition may deteriorate the health status of diabetic patients. In this study, majority of the respondents were obese (51.0%) (Table 6).

Predictors of dietary practices and nutritional status among the participants

Predictors of dietary practices (dietary diversity)

Participant's education level (AOR=4.72, 95% CI: 2.12, 8.73), occupation (AOR=2.41, 95% CI: 1.60, 4.75), monthly income (AOR=6.02, 95% CI: 4.22, 9.44) and level of dietary knowledge (AOR=2.33, 95% CI: 1.02, 3.82) were significantly associated ($p<0.05$) with their dietary practices (Table 7).

Table 2: Frequency of consumption of various foods by participants frequencies in percentages (N=153).

Type of food	Everyday	Once a week	Twice a week	Once a month	Seasonally	Never consumed
Vegetables						
Spinach	26.8	24.2	34	6.5	3.9	4.6
Pumpkin leaves	2.6	9.2	12.4	20.9	28.1	26.8
Carrots	77.8	12.4	1.3	0	2.6	5.9
Tomatoes	90.2	1.3	3.3	0.7	2.6	2
Cabbage	27.5	20.9	32	2.6	3.9	13.1
Kales	15.7	12.4	52.9	5.9	0.7	12.4
Fruits						
Ripe bananas	30.7	10.5	32.7	6.5	7.2	12.4
Oranges	10.5	8.5	34	11.8	18.3	17
Pineapple	0.7	1.3	22.2	24.2	30.1	21.6
Mangoes	1.3	7.2	12.4	16.3	47.7	15
Pulses and legumes						
Beans	7.8	26.1	52.9	0	0.7	12.4
Ndengu	2	11.8	49	17	10.5	9.8

Continued.

Type of food	Everyday	Once a week	Twice a week	Once a month	Seasonally	Never consumed
Animal products						
Beef	5.9	23.5	43.1	8.5	8.5	10.5
Poultry	0	22.9	22.2	30.1	16.3	8.5
Fish	0	0	11.1	24.2	0	64.7
Milk	45.5	20.2	10.5	12.8	4.5	6.5
Cereals and cereal products						
Ugali	14.4	13.7	52.9	2	5.2	11.8
Chapati	0	24.2	54.2	8.5	3.3	9.8
Maize	12.4	21.6	20.3	13.7	10.5	21.6
Whole meal bread	70.6	5.9	9.8	2.6	1.3	9.8
Roots and tubers						
Sweet potatoes	3.3	7.2	62.1	9.2	5.2	13.1
Irish potatoes	5.2	11.8	58.8	4.6	6.5	13.1
Arrowroot	6.5	21.6	55.6	5.9	2.6	7.8
Fats and oils						
Margarine	10.5	6.5	5.9	2	12.4	62.1
Cooking oils	82.4	0.7	2	0	0	15
Sugar and honey						
Cake	2	1.3	2.6	6.5	20.3	67.3
Biscuits	0	0	1.3	8.5	5.9	84.3
Honey	0.7	0	3.3	9.2	7.2	79.7

Table 3: Dietary diversity scores.

Category by DDS	(N=153) n (%)
Low (<4)	14 (9.2)
Moderate (4-8)	126 (82.4)
High (>8)	13 (8.4)

Table 4: Frequency of meal consumption.

Number of times (n=153)	n	%
One	1	0.7
Two	2	1.3
Three	79	51.6
Four	69	45.1
Five	2	1.3

Table 5: Participants distributed according to dietary knowledge.

Dietary knowledge category (n=153)	n (%)
Low dietary knowledge (<40%)	106 69.3
Moderate dietary knowledge (40-69%)	47 30.7
High dietary knowledge (≥70%)	00
Total	153 100

Table 6: Participants distributed according to nutritional status.

BMI (n=153)	n (%)
≤18.5 (underweight)	21 13.7
18.6-24.9 (normal)	30 19.6
25-29.9 (overweight)	24 15.7
≥30 (obese)	78 51.0
Total	153 100

Table 7: Factors associated with dietary practices of the participants (dietary diversity of ≥4 food groups).

Characteristic (n=153)	n (%)	COR (95% CI)	AOR (95% CI)	P value
Level of education				
Tertiary	27 (17.6)	4.33 (2.36,6.68)	4.72 (2.12,8.73)	0.034
Secondary school	58 (37.9)	2.22 (0.93,5.90)	1.96 (0.54,6.24)	
Primary school	50 (32.7)	1.36 (0.41,3.69)	1.22 (0.97,4.18)	
No formal education	18 (11.8)	1	1	
Occupation				
Formal employment	34 (22.2)	0.64 (0.11,3.31)	0.76 (0.28,3.81)	
Self employed	105 (68.6)	2.56 (1.72,4.88)	2.41 (1.60,4.75)	0.047
Unemployed	14 (9.2)	1	1	
Monthly income (KSh)				
Above 40.000	24 (15.7)	6.29 (3.96,7.46)	6.02 (4.22,9.44)	<0.001
20,001-40,000	25 (16.3)	1.94 (0.87,2.54)	1.88 (1.01,3.86)	
0-20,000	104 (68.0)	1	1	
Level of dietary knowledge				
Moderate knowledge	47 (30.7)	2.46 (1.29,4.31)	2.33 (1.02,3.82)	0.026
Low knowledge	106 (69.3)	1	1	

Table 8: Factors associated with nutritional status of the diabetic participants (normal BMI of 18.6-24.9 kg/m^2).

Characteristic (n=153)	n (%)	COR (95% CI)	AOR (95% CI)	P value
Level of education				
Tertiary	27(17.6)	1.47(0.35,4.89)	1.26(0.21,5.00)	0.029
Secondary school	58(37.9)	1.14(0.02,3.90)	1.19(0.21,3.63)	
Primary school	50(32.7)	1.10(0.58,2.22)	1.05(0.69,2.01)	
No formal education	18(11.8)	1	1	
Monthly income (KSh)				
Above 40.000	24(15.7)	1.54(1.23,3.56)	1.29(1.01,3.06)	
20,001-40,000	25(16.3)	2.48(1.41,3.06)	1.72(1.26,2.86)	0.048
0-20,000	104(68.0)	1	1	
Level of dietary knowledge				
Moderate knowledge	47(30.7)	1.02(0.93,2.60)	1.11(0.88,3.17)	0.036
Low knowledge	106(69.3)	1	1	
Dietary diversity				
High	13(8.4)	0.22(0.13,2.73)	0.36(0.17,2.05)	
Moderate	126(82.4)	1.78(0.56,3.03)	1.62(0.63,4.11)	0.018
Low	14(9.2)	1	1	

Predictors of nutritional status

Participants education level (AOR=1.26, 95% CI: 0.21, 5.00), monthly income (AOR=1.72, 95% CI: 1.26, 2.86), level of dietary knowledge (AOR=1.11, 95% CI: 0.88, 3.17) and dietary diversity (AOR=1.62, 95% CI: 0.63, 4.11) were significantly associated (p<0.05) with their nutritional status (Table 8).

DISCUSSION

Predictors of dietary practices

Education level

Dietary practices constitute an important factor in diabetes control since individual dietary habits have been shown to either increase or reduce the risk of the disease.[10,11] In this study, participants with post-secondary education were 4.72 times more likely to attain the minimum acceptable dietary diversity (≥4 food groups) than those who had no formal education. This could be due to their level of exposure to nutritional information at different levels of education attainment. Education among other factors has been shown to affect diet quality of individuals which is an important consideration in the management of diabetics.[12] Higher prevalence of type 2 diabetes among individuals with lower educational attainment has been reported. This could also be due to the association between education and other aspects of healthy lifestyle including physical exercise which play a role in the prevention and the management of diabetes (Hwang and Shon).[13] Generally, lower educational attainment is considered a predictor of poor nutrition and healthoutcomes.[13,14] Other studies

however have not found significant association between education and nutritional practices: Al-Rasheedi, reported no significant impact of education levels on the glycemic control of patient while Kemunto, found no significant difference in the dietary diversity scores of the pregnant women with regard to their level of education.[15,16]

Dietary knowledge

Participants who had higher dietary knowledge were found to have a higher dietary diversity score. This is consistent with the findings of Kinyua, who also reported a significant association ($p<0.05$) of dietary knowledge and dietary practice particularly the frequency of consumption of various foods by her study participants. In the current study, majority (69.3%) of participants had low nutrition knowledge.[17] This could be due to poor attendance of the nutrition education sessions: Majority (52.3%) indicated that they did not attend the trainings, while 37.9% indicated that they attend occasionally, while the rest attended either weekly, once fortnight or once a month. Tan et al reported that not getting diabetic nutrition education at hospitals was a major factor implicated in the poor dietary practice of the patients.[18] In another study in Addis Ababa, Ethiopia, Worku et al found that patients who did not receive diabetes nutrition education were 4.47 times more likely to have poor dietary practices than those who received.[19]

Occupation

In this study, those self employed were 2.41 times more likely to have a higher dietary diversity score than those unemployed. Socioeconomic status is mainly evaluated among other things, by income, and occupation of the subject and is reportedly linked to dietary habits, exercise patterns, and health behavior.[20] At a macro-level, type 2 diabetes epidemic has been attributed to lifestyle transitions, including changes in work patterns from heavy labor to sedentary occupations consequent to increased computerization and mechanization.[10] Perceived time constraints for healthful eating, in some forms of employment/occupations, is cited as a common reason for eating fast food and convenience foods and has been found to be associated with lower fruit and vegetable and greater fast food consumption. Lengthy work hours may undermine engagement in healthful dietary practices. Working long hours constrains time available, to engage in other things such as shopping and food preparation.[21] Self-employment would offer more flexibility in time schedule and the likelihood of healthier dietary practices. Notwithstanding, an Ethiopian study did not however, find any significant relationship between dietary practices and occupation of diabetic patients.[19]

Income

Income has been regarded as a strong predictor for dietary practices and nutritional status as it determines both food access and range of options. Higher incomes are associated with better access to healthy food choices and thus the ability to operate a healthy diet.[22] In this study, those participants having a monthly income of above KSh 40,000 were 6.02 times more likely to achieve minimum dietary diversity than those earning below KSh 20,000. People with higher incomes are better placed to practice better dietary diversity than those with limited incomes. Sound nutritional practices is an important factor in prevention and slowing down the progression of type 2 diabetes.[23]

In his study among patients attending a rural Kenyan hospital, Chege, found that the estimated monthly income for the diabetics was lower than that of the non-diabetics although the difference was not statistically significant.[24] A Korean survey found that a higher household income was associated with a higher energy and fat intake, higher BMI and waist circumference. However, in contrast to men, women who had higher house hold incomes and education levels had lower BMI and waist circumference.[20] In some settings, living in lower-income neighborhoods has been associated with lower consumption of fruit, vegetables, and fish.[12] Another study also reported that thinking about the high cost of foods was an important factor affecting dietary practices of type 2 diabetic patients.[19]

Predictors of nutritional status

Maintaining a good nutritional status is crucial in the management of diabetes. Poor nutritional status is associated with poor diabetes outcomes.[25] Successful and sustainable outcomes of nutritional interventions in the management of diabetes, requires specific predictors to be identified and addressed. The current study investigated the association between the nutritional status of patients and their dietary practices, education, nutrition knowledge and income.

Over 80% had unsatisfactory BMI either too high or too low. The key informants indicated that most diabetic patients were obese because of low physical inactivity, poor eating habits and over reliance to starchy foods. These results vary from those of Begum et al whereby in their study majority of the patients had normal nutritional status (64.1%) while 31.7% were overweight and only 4.3%were underweight.[23] Excess adiposity reflected by higher body mass index (BMI) is the strongest risk factor for diabetes mellitus. The risk of diabetes tends to rise with an increase in excessive body fat, beginning from the lower end of a healthful BMI or waist circumference.[10]

Dietary practices

Dietary diversity score is one of best indicators of both macronutrient and micronutrient intake. Dietary diversity is crucial in ensuring nutrient adequacy and the nutritional status of individuals.[26] In this study, those

patients who had a moderate dietary diversity were 1.62 times more likely to have a normal BMI than those with low dietary diversity **(**AOR=1.62, 95% CI: 0.63, 4.11). It is critical in diabetic patients to ensure adequate supply of both macro- and micro-nutrients. Uncontrolled diabetes is often associated with micronutrient deficiencies. American Diabetes Association recommends that diabetic patients should be aware of the importance of getting daily vitamin and mineral requirements from natural food sources and a balanced diet.[4] It further recommends that health care providers ought to focus on nutrition counseling instead of micronutrient supplementation towards achieving metabolic control of their patients. The nutrition recommendations for healthy lifestyle for the general population are also appropriate for type 2 diabetic patients.[4]The link between dietary practices and nutritional status has been widely reported in literature.[27-29] A study among Ethiopian adolescent girls revealed that girls with higher dietary diversity score were more likely to have normal BMI-for age Z score than those with low dietary diversity score**.**[30] It has further been reported that poor dietary diversity during childhood characterized by overconsumption of starchy staples is associated with childhood malnutrition and triples the risk for diabetes mellitus in rural Kenya.[24]

Education level

Participants with higher education levels were more likely to have a better nutritional status (normal BMI) than those without any formal education. This could be due to the influence of formal education in the uptake of nutritional information. People with higher educational attainment are more likely to understand and apply the nutritional information and dietary recommendations they receive from the clinics.[31] Education has also been shown to positively influence food choices and intake of specific nutrients.[16,32] In a Korean national health and nutrition examination survey**,** lower educational attainment was found to be a predictor of poor health outcomes and management of chronic diseases including type 2 diabetes.[13] Formal education can thus be considered a mitigating factor in the incidence and progression of Type 2 diabetes with a potential to improve the outcomes.

Level of dietary knowledge

Good nutritional knowledge is likely to impact positively on the dietary practices which is crucial for good nutritional status. Contrary to these findings, Kinyua, found no significant association (p=0.549) between the nutritional knowledge and nutritional status of female undergraduate students in Nairobi (Kenya) universities.[17] Further, Waithaka reported that there was no significant association between a higher level of nutrition knowledge and dietary practices of adult diabetic patients in Nakuru provincial hospital, Kenya.[33]

Income

Income has been reported to affect many aspects of food consumption including dietary diversity and meal frequency due to its influence on the purchasing power and food budget allocation within the family.[34] These ultimately influence the nutritional status of an individual. In the present study, income was associated with nutritional status of the patients (AOR=1.72, 95% CI: 1.26, 2.86). Low income is associated with a higher prevalence of diabetes.[35] Having low income can hinder access to the foods required for a healthy diet and good nutritional status. Even if healthier foods aren't necessarily more expensive, a person may need to cap the food budget to accommodate the cost of their medications.[36] Impact on income on nutritional status may however be region specific. In some settings particularly the western world, nutritional problems such as obesity, a known risk factor for diabetes are associated with people in low income range. In the developing world however, unhealthy eating habits such as snacking, high consumption of processed foods and high intake of soft drinks may be rampant in higher income groups. In a recent study among children in Kisumu Kenya, Omondi and Kirabira, found that low income was significantly associated with stunting.[37] Childhood malnutrition increases the risk for diabetes.[28]

CONCLUSION

According to the results generated from this study, dietary knowledge, level of education, occupation, monthly income and dietary practices were the predictors of the patients' dietary practices and nutritional status. The study revealed the crucial role of these variables in the prevention and management of diabetes. The results further affirm overweight/obesity as a risk factor in diabetes.

Recommendations

Nutrition education and counseling strategies need to be strengthened or reviewed to increase uptake of nutritional information by diabetic patients in the attempt to improve their dietary practices and nutritional status. The study also re-emphasizes the importance of promoting formal education as a broad-based intervention in ensuring healthy living and wellbeing of the general population as well as disease control and management. Introduction of diabetes education at primary and secondary level would be productive in prevention of diabetes type 2.

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