Utilization of diabetes knowledge and glycemic control, a case of Butere Subcounty Hospital, Kakamega County, Kenya

ABSTRACT

Background: Lack of knowledge on diabetes and self care practices among diabetics are some of the important factors influencing the progression of diabetes and its complications.
Objective: To assess patients knowledge on diabetes and self care practices and relate this to achievement of satisfactory glycemic control.
Methodology: This was a cross sectional study at the outpatient clinic of Butere subcounty Hospital involving all diabetic patients. Data was collected using pretested structured questionnaires. Blood was drawn for random blood sugar testing. Data was analyzed for descriptive and inferential statistics using Microsoft excel 2007 and Statistical Package for Social Scientists version 22.
Results: A total of 71 patients participated in this study, 47.8% were males. Majority (29.6%) were aged between 46-55 years. Seventy three percent were married, 86.5% had secondary education and below with only 4.2% having university education. Majority (46.5%) were self employed while11.3% were retired. Forty eight percent of the patients had diabetes for more than 5 years and majorities (80%) were on oral medication. Diabetes patients had poor glycemic control with 87.3% having random blood sugar more than 8mmol/l with the mean random blood sugar of12.2 ±3.7 mmol/l. Majority of the patients (64.8%) had poor knowledge. The mean total knowledge score was 32 ± 4.3; diabetes knowledge score was 16 ± 4.2 and self care knowledge score was 15.6 ±3.9. Patients scored poorly on self care practices with more than 71% scoring less than 50% of the score. There was a negative correlation between random blood sugar and knowledge score($r = -0.340$, $p = 0.004$).Patients with good glycemic control had knowledge mean of 37.3 ± 0.9 while those with poor glycemic control had mean of 31.2 ± 0.7. The difference was statistically significant ($t = 2.999$, $p = 0.004$).
Discussion: It is evident from this study that diabetics at Butere Subcounty Hospital do not have adequate knowledge of the diabetes especially on the self care practices aspect as more than 80% of them scored poorly. Poor knowledge in these patients was associated with unsatisfactory glycemic control. There was a negative correlation between level of knowledge and glycemic control among these patients and the correlation was statistically significant
Conclusion: Diabetic patients at Butere subcounty Hospital had low knowledge on diabetes and self care practices and this was associated with unsatisfactory glycemic control.
Recommendation: There is need to find out if knowledge deficit in these patients is the cause of unsatisfactory glycemic control.

Key words: *Glycemic, insulin, Diabetes, Amputation, Butere,*

Introduction

Diabetes type 2 is a non communicable disease (NCD) caused by inadequate production of insulin by the body or by the body not being able to properly use the insulin((ADA), 2016) resulting in high blood glucose levels. Globally its estimated that 366 million people have diabetes and deaths are due to diabetes is about 4.6 million people(International Diabetes Federation, 2011). Data from the ministry of health (MoH) in Kenya indicates that an estimated over 1.2 million Kenyans live with diabetes, and the number is expected to rise to 1.5 million by the year 2025 (MoH, 2013). The International Diabetes Federation estimated the prevalence of diabetes in Kenya to be about 3.3% of the population in 2007. However, local studies have shown prevalence of 4.2% in the general population with a prevalence rate of 2.2% in the rural areas and as high as 12.2% in urban areas (International Diabetes Federation (IDF), 2017). Diabetes management requires the patient to be knowledgeable about the disease and be able to practice self care practices which are necessary in the management and control of diabetes and its complications. Healthy eating, health education, physical activity, adherence to medication, monitoring of blood glucose and reducing risks among others (Carolan-Olah, 2016) are some of the management practices advised. Control and prevention programs should be seen as an intervention structured toward providing patients with knowledge, attitude, and skills necessary for self care practices for them to achieve glycemic control and make behavioral changes, especially on diet and physical activity (Chawla & Todi, 2012). Knowledge is the greatest weapon in the fight against Diabetes Mellitus (DM). In view of this acquired knowledge will be utilized in day to day application so as to help mitigate the problem.

In Kenya, studies have been done targeting the general population where it was found that the level of knowledge of diabetes in all regions was low(World Health Organization, 2016). To reduce diabetes burden, it requires public health interventions aimed at delaying the onset of its complications and it encampus lifestyle modification of the risk factors for diabetes and aggressive treatment for those with the disease(World Health Organisation & International Diabetes Federation, 2006). For satisfactory glycemic control the patients should have knowledge on the disease and its management. Lack of knowledge on the disease and self care practices may leads to unsatisfactory glycemic control. Illiterate people cannot understand written and oral health care information. Studies show that inadequate knowledge about diabetes negatively affects behavior and self care practices(World Health Organization, 2016)and that majority of diabetics do not receive sufficient diabetes education (DiMeglio, Evans-Molina, & Oram, 2018). From the patient's medical records, despite the aggressive treatment of patients at Butere County Hospital, most of these patients are unable to achieve satisfactory glycemic control. This raises concerns as to whether this could be caused by the patients not adhering to medication, unable to access medication due to financial constraints or maybe that they are lacking knowledge on diabetes and self care practices that is essential in the management of the disease. However in Butere there are no documented studies on

Utilization of diabetes knowledge and glycemic control. There is need for such studies targeting diabetes patients in this area. This study aimed at assessing the level of knowledge on diabetes and self care practices.

Materials and Methods

Study area

The study was conducted at Butere sub-County referral Hospital in Kakamega County, Kenya. The hospital has a catchment population of over 40,000 in the year 2015. The hospital has three wards, Bed capacity of 55 and serves patients referred from 22 health centers and dispensaries. Services offered to diabetis Type 2 patients at the outpatient clinic include Random blood sugar testing, medication both insulin and oral medication. Butere is a commercial centre in Butere Sub County. Prevalent diseases in this sub county include diabetes, malaria, diarrhea, skin diseases and respiratory tract infections.

Study population

Study population consecuted all diabetic patients at the outpatient clinic at Butere County Hospital for diabetes management. Based on data at the outpatient clinic there were 76 registered diabetic patients attending clinic at the hospital with approximately 15 to 20 patients being attended weekly. Since the study population was small, all the diabetic patients were included in the study.

Research design

A cross sectional study was used.

Data collection tools

Data was collected using an interviewer guided structured questionnaire which consisted of mainly closed ended questions. The questionnaire consisted of three sections A, B and C. Section A consisting of information on socio demographic data, section B consisting of patient's diabetes clinical information and while Section C consisted of 17 questions testing the patient's knowledge on diabetes. Contents of the questionnaire were obtained from Diabetes Knowledge Test (DKT). DKT is a validated 23 test item developed by the Michigan Diabetes Research and Teaching Centre (MDRTC) to test general knowledge on diabetes (Doyle et al., 2014). It consisted of 23 questions testing on patients' general understanding of diabetes with respect to diet, blood glucose monitoring and foot care among others. The questions were modified and formulated in simple and clear language for ease of understanding with clear instructions to the subjects. The questionnaire consisted of 8 questions testing on general diabetes knowledge and 9 on self care practices. The questionnaire was written in English and translated to Kiswahili and local dialect (Marama). Translation to Kiswahili was done by a Kiswahili teacher while the translation from Kiswahili to Marama was done by a nursing officer at the outpatient clinic. The Marama and Kiswahili questionnaire were back translated to English with the help of other healthcare professional at the

outpatient clinic. The back translated versions and the original English versions of the questionnaire were compared and the discrepancies analyzed and reconciled to produce the three questionnaires.

Data collection

Data was collected during out patient's clinic days every Thursday of the week between 21st March and 25th April 2016. All diabetic patients were approached and an informed consent for the study obtained. Patients who met the inclusion criteria were picked and recruited into the study. Patients were sent to the laboratory department where blood samples for determination of RBS were collected by the laboratory technicians. Results were recorded in the laboratory request form and later transferred to the data collection form. Patient's clinic register was used to ensure that all diabetics were included in the study. The questionnaire was piloted on ten patients meeting the stated criteria at Matungu District Hospital outpatient clinic to assess the suitability and reliability of the questions. All queries from the pilot study were addressed before data collection.

Data Analysis

The questionnaires were checked for any omission and corrected before the patient left the clinic. Data was cleaned, coded and entered into Microsoft excel spread sheet. Scores on the questionnaire were computed for each participant. General knowledge on diabetes was classified as <17= poor and > 17= good knowledge. Self care practices knowledge was classified as < 18= poor knowledge and >18= good knowledge. Knowledge gaps were then identified for questions that were incorrectly answered by more than 50% of the respondents. Patients were classified as those who had achieved glycemic control and those who did not based on RBS levels of less than or equal to 8mmol/l as stated by ADA diagnostic criteria for DM 2010. Demographic variables were expressed as frequencies and percentages and mean. Descriptive analysis was done using percentages, frequencies and measures of central tendencies. Inferential statistics were done using Pearson's correlation, independent sample t test and analysis of variance to identify association between knowledge, RBS levels and socio demographic factors. Analysis was done using SPSS version 22 and Microsoft excel for windows 2007.

Results

Socio demographic characteristics

Of the 76 patients found 71 consented and participated in the study. Socio-demographic characteristics of the respondents were as summarized in the table 1 below.

Table 1: Socio-demographic characteristics of the study patients (n=71)

Variables	Frequency, n (%)
Age	
25-35	3 (4.2)
36-45	17 (23.9)
46-55	21 (29.6)
56-65	18 (25.4)
66-75	12(16.9)
Gender	
Male	34 (47.9)
Female	37(52.1)
Marital status	
Single	3(4.2)
Married	52 (73.2)
Separated	6(8.5)
Widowed	10 (14.1)
Education level	
None	11 (15.5)
Primary	21 (29.6)
Secondary	23 (32.4)
Intermediate	13 (18.3)
University	3(4.2)
Occupation	
Self employed	33(46.5)
Employed	18 (25.4)
Retired	8(11.3)
Others	12 (16.9)

Clinical characteristics

Patients in this study had mean RBS of 12.7 ± 4.5. Majority (87.3%) had RBS values above 8mmol/l with 47.9% having had the disease for more than five years, 35.2% between one and five years whiles 16.9% had had the disease for less than one year.

Majority (80.3%) use oral hypoglycemic drugs, 15.5% utilized insulin while negligible proportion (1.4%) use combinations of insulin and oral hypoglycemic drugs as the rest just use diet for managing the disease.

Patient's level of diabetes knowledge

Most of the patients (64.8%) scored below 35 (50%) on total knowledge score with the mean of 32 ± 4.27. Patients scored better on diabetes knowledge than self care knowledge. Diabetes knowledge score mean was 16 ± 4.2 while the mean for self care score was 15.57 ± 3.88.The results are summarized below in table 2.

Table 2: Knowledge Score among the Respondents (n =71)

Variables	Frequencies n (%)
Total knowledge score	

More than 35	25 (35.2)
Less than 35	46 (64.8)
Diabetes knowledge score	
More than 17	42 (59.2)
Less than 17	29(40.8)
Self care knowledge score	
More than 18	20(28.2)
Less than18	51(71.8)

Knowledge gaps were apparent in questions on diabetes complications. Mean percentage of "don't know" responses per item was 10.44 ± 6.5 % (range: 1.4% - 22.5%). Knowledge ON causes of high blood glucose, complication of diabetes, symptoms of nerve disease, diet, physical exercise, medication, prevention of gum disease, foot problems and monitoring of blood glucose had less than 50% of the respondents getting them right.

Socio-demographic characteristics and knowledge score

Total knowledge score for diabetes and self care practices was compared among different socio-demographic characteristics of the respondent. Of those scoring below 35, 43.5% were male while 44% of those scoring less than 35 were female. The results are summarized in table 3 below.

Table 3: Socio Demographic Characteristics and Knowledge (n=71)

Variables		**Score n (%)**		**Variable**		**Score (%)**	
Gender		(n)<35	(n>35			(n)<35	(n)>35
	Male	43.5	56(56)	**Occupation**	self employed	50	40
	Female	56.5	44(44)		Employed	23.9	28
	Total	**100**	**100**		Retired	4.3	24
Marital status	Single	2.2	8		Others	21.7	8
	Married	71.1	76		**Total**	**100**	**100**
	Separated	8.7	8	**Age**	22-25	4.3	4
	Widowed	17.4	8		36-45	17.4	36
	Total	**100**	**100**		46-55	37	16
Education level	None	17.4	12		56-65	26.1	24
	Primary	37	16		66-75	15.2	20
	Secondary	23.9	48		**Total**	**100**	**100**
	Intermediate	17.4	20				
	University	4.3	4				
	Total	**100**	**100**				

Statistical relationship between diabetes characteristics and knowledge score

There was a negative correlation between RBS and total knowledge score (r = - 0.340 p = 0.004), and a positive correlation between RBS and diabetes score (r = 0.144, p = 0.230), RBS and self care knowledge score (r = 0.232, p = 0.052).

Patients were grouped according to their RBS values. Those with RBS less than 8 mmol/l were grouped as those with satisfactory glycemic control while those with Rbs > 8mmol/l were grouped as those with unsatisfactory glycemic control. The mean knowledge score was compared between the two groups, disease duration and type of treatment. The results were as summarized in table 4 below.

Table 4: Diabetes characteristics and total knowledge score

Variables	**Total mean knowledge**	**test**	**P value**
Disease duration			
Less than one year	28.4 ± 2.6		
One to five years	31.8 ± 0.9	F = 1.882	0.160
More than five years	33.7 ± 0.8		
Type of treatment			
Diet	30		
Oral drugs	32.3 ± 0.8	F = 0.788	0.505
Insulin	29.9 ± 1.40		
Insulin and oral drugs	35		
RBS			
< 8 mmol/l	37.3 ± 0.92	t = -2.999	0.004
>8mmol/l	31.20 ± 0.73		

Statistical relationships between patients' socio-demographic characteristics, clinical characteristics and knowledge

No significant correlation between sociodemographic characteristics and knowledge score was found. The variation in the mean total knowledge score among different socio demographic characteristics was not significant with the exception of occupation. The results are summarized in Table 5 below

Table 5: Mean total score among different patients socio-demographics

Variables	**Mean total knowledge score**	**Statistical test**	**P value**
Gender			
Male	33.12 ± 0.91	t = 1.002	0.320
Female	31.4 ± 0.98		
Marital status			
Single	31.5 ± 3.5		
Married	32.71 ± 0.85	F = 0.7770	0.188
Separated	30 ± 1.10		
Widowed	32.4 ± 3.5		
Education level			
None	32.7 ± 1.45		
Primary	31.35 ± 1.44		
Secondary	33.4 ± 1.44	F = 1.433	0.233

Intermediate	32.75 ± 2.15		
University	31.5 ± 4.5		
Occupation		F = 2.763	0.049
Self employed	30.9 ± 1.04		
Employed	33.8 ± 1.19		
Retired	35 ± 1.28		
Others	13.5 ± 1.4		

DISCUSSION

From the study diabetes type 2 knowledge was low with 64.8% of the patients scoring below 35 (50%) with the mean knowledge score of 32 ± 4.27. In Comparison of the study findings with study by Mcclear*yet al* (2011) which also used Michigans DKT, they found a higher knowledge score compared to this study. This could be due to the fact that their population received diabetes education and had higher literacy rates compared to this study which had 86.5% of the study population with secondary education or less (low literacy). The variation in knowledge scores is also expected since these studies were conducted on different ethnic groups and in different age groups. Patients scored better on general knowledge on diabetes compared to knowledge on self care practices. Major knowledge gaps were noted in nine questions related to diabetes complications, diet, exercise, medication adherence, prevention of gum disease, prevention of foot problems and monitoring of blood glucose level. The consequence of these knowledge gaps is that it affects the patient's ability of self management and hence impacting negatively on the outcomes of diabetes.

In this study, although female patients scored less by 32.1% in literacy level compared to male counter parts, the difference was not significant. This would however imply that women were less knowledgeable than men in diabetes management. A study by Gulabani *et. al,* (2008) also showed the same results with the mean score of diabetes knowledge being higher in male than female. The study also showed that female gender is predictor for lower diabetes knowledge. Al-Sarihin et al (2012), reported contrasting findings regarding gender difference by Gonzalez et al (2009) and Modeley et al (2007) that men were significantly less informed of the diabetes but here the study found out that women were less knowledgeable than men. The differences in these studies might be attributed to the differences in the patients' populations.

Age group 36 – 45 had the highest score while age group 56 – 65 had the lowest knowledge score. Studies have showed that increasing patient age ("Education and mind in the knowledge age," 2013; Tipton, 2012) also a predictor of knowledge score. The studies also showed that older patients and those with less education had less knowledge on diabetes and self care practices. This may be contributed by the fact that older people rarely participate actively in meeting with experts in disease management and also that they less often get up to date

information regarding their disease and also rarely could they access current published information's. The younger patients are most likely to retain what they were thought and majority of them were of school age, they remember and recall faster than older groups(Bain et al., 2009). From these studies it was evident that educational interventions should be designed t
From the study diabetes knowledge was low with 64.8% of the patients scoring below 35 (50%) with the mean knowledge score of 32 ± 4.27. In Comparison of the study findings with study by Mcclear*yet al* (2011) which also used Michigans DKT, they found a higher knowledge score compared to this study. This could be due to the fact that their population received diabetes education and had higher literacy rates compared to this study which had 86.5% of the study population with secondary education or less (low literacy). The variation in knowledge scores is also expected since these studies were conducted on different ethnic groups and in different age groups. Patients scored better on general knowledge on diabetes compared to knowledge on self care practices. Major knowledge gaps were noted in nine questions related to diabetes complications, diet, exercise, medication adherence, prevention of gum disease, prevention of foot problems and monitoring of blood glucose level. The consequence of these knowledge gaps is that it affects the patient's ability of self management and hence impacting negatively on the outcomes of diabetes.

Female patients scored poorly compared to male counter parts in this study. Women were less knowledgeable than men due to low literacy rates among women in this population. A study by Gulabani *et. al*, (2008) also showed the same results with the mean score of diabetes knowledge being higher in male than female. The study also showed that female gender is predictor for lower diabetes knowledge. Age group 36 – 45 had the highest score while age group 56 – 65 had the lowest knowledge score. Studies have showed that increasing patient age ("Education and mind in the knowledge age," 2013; Tipton, 2012) also is a predictor of knowledge score. The studies also showed that older patients and those with less education had less knowledge on diabetes and self care practices. Older persons with diabetes tend to have less education, worse cognitive function, and more barriers to practicing appropriate self care than their younger counterparts with diabetes. The younger patients are most likely to retain what they were thought and majority of them were of school age, they remember and recall faster than older o meet the needs of the aged patients.

Patients with secondary education in this study had the highest knowledge score while those with primary education had the lowest score. Other studies have also shown that higher school education has a positive effect on diabetic knowledge (Al-Qazaz et al., 2011).While study by Odili et. al., 2011 showed that the group of respondents with no formal education had the highest average diabetes knowledge score compared to their counterparts who had primary to post graduate education.

Married patients had better scores while separated patients had the least score in this study. The married having highest knowledge score could be attributed to high proportion (73.2%) of this group respondents and a majority of them might be men who had shown to be more knowledgeable. The separated had the least knowledge which is likely to be associated with psychosocial traumas that are usually associated with divorce of partners.

Patients in this study had poor glycemic control with 87.3% having RBS > 8mmol/l. The mean RBS was 12.2 ±3.7 mmol/l. Poor glycemic control in these patients could be attributed to poor diabetes knowledge and self care practices as the correlation between knowledge and RBS was negative in this study. In this study a negative relationship between knowledge and glycemic control was realized and it is consistent with other studies (Kirkman, Mahmud, & Korytkowski, 2018). However a positive relationship between diabetes knowledge and glycemic control has been reported in previous studies(Imran, Rabasa-Lhoret, & Ross, 2016; Ismail-Beigi, 2012) A study by Julie et al, (2002) did not find any association between patients' diabetes knowledge scores and their glycemic control.

Socio-demographic factors and diabetes specific information had correlation with knowledge score though the correlation was not significant. As age increased according to this study knowledge score decreased. From the study by Julie et al 2002 it was found out that as patient age increased by 10 years, the diabetes knowledge test score decreased by 3% ($p = 0.02$). (Julie et al 2002). Education level had a positive correlation with knowledge score with Pearson coefficient of 0.233 and $p = 0.213$. In other studies patients with formal education and primary education had statistical significance knowledge score with higher diabetes knowledge score among respondents with no formal education being attributed to many years of experience with diabetes care(Al-Qazaz et al., 2011). This was not the same as the results from this study since there was no statistical significance between knowledge score and education level. Some studies showed that the higher the educational level, the higher the diabetes knowledge score ($p = 0.01$)(Hu, Gruber, Liu, Zhao, & Garcia, 2013).

It is evident from this study and other studies (Dolna & Ciok, 2005) that certain patient characteristics are correlated with glycemic control. Therefore, socio-demographic characteristics should be taken into consideration when developing educational programs for diabetics and health care providers should identify potential barriers to learning. Attention should be given to improving knowledge and understanding in older patients and women as there may be barriers to effective learning. It is also important for health care providers to assess each specific area when determining people’s needs and DSME must be adjusted to the literacy level and cultural needs of different populations(Al Sayah, Majumdar, Williams, Robertson, & Johnson, 2013). It is essential to understand the individual’s socio-demographic characteristics, beliefs and attitudes, motives, demands and priorities in order to understand their compliance behavior. Disease duration and knowledge had a positive correlation ($r = 0.050$ at $p =$

0.680.This is contrary to the study by Odili et, al,(2011) where they found a significant correlation between duration of disease and level of knowledge.

This study also found a negative correlation between knowledge score and type of treatment. In another study patients who used insulin and those who had had diabetes for a longer period had higher ratings of their knowledge of diabetes self-care practices. Poor knowledge among diabetics at Butere subcounty Hospital may be due to lack of communication between the health care providers and the patients. Improving these patients' knowledge of diabetes and self-care practices will allow them improve their care and this is an investment with benefit to the health care system(Hu et al., 2013). Regular assessment of patients' knowledge and skills is critical in the management of diabetes and its complications ((ADA), 2016). Health education on Diabetes and self care practices is necessary and should be incorporated into the routine care of patients with diabetes. There must be education sessions during routine clinic checkups. The study has been able to determine the level of knowledge among diabetics at Butere and the association between knowledge on diabetes, self care practices and glycemic control in diabetes patients at Butere County Hospital.

Conclusion

It is evident from this study that diabetics at Butere Subcounty Hospital do not have adequate knowledge of the diabetes especially on the self care practices aspect as more than 80% of them scored poorly. Poor knowledge in these patients was associated with unsatisfactory glycemic control. There was a negative correlation between level of knowledge and glycemic control among these patients and the correlation was statistically significant.

Recommendations

A prospective cohort study should be conducted in these patients to find out if knowledge deficit in these patients is the cause of unsatisfactory glycemic control.

There is need for a structured education programe for these patients to be able to understand their disease and the complications associated with it. Health education program should be done routinely during regular clinic days. Socio demographic characteristics should be considered when developing education program for these patients with much attention to the women and the aged as they scored poorly. There is need for regular assessment of the diabetic patients' knowledge and self care skills at Butere subcounty hospital.

Ethical considerations and Consent

Permission to carry out the study was obtained from the hospital administration after Institutional Research Ethics Committee (IREC) of Moi University's approval. Patients consented before being asked to complete the questionnaire. Study objectives and data collection procedure was explained to the patients in local language. Patients were assured of no risk involved except slight pain from needle pricks.

There was no use of names on the questionnaire and at any time of data presentation to maintain confidentiality. Patient's information was not disclosed to third party without patient's approval. Scientific honesty was maintained as the researcher recorded truthfully the answers given by the illiterate subjects. There was no manipulation of data as researcher and the statistician entered data from the questionnaire into SPSS computer soft ware program. Results were produced independently by the biostastician to avoid subjective collaboration.

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