

Associations between Diabetes Self-Management and Microvascular Complications Among Patients Living in Rural Areas, in Kenya

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Introduction: Diabetes is a major public health concern worldwide. Low and middle-income countries are the most affected. Diabetes self-management can significantly reduce the burden of diabetes complications and mortality.

Methods: This cross-sectional study was conducted at the outpatient department of a county referral hospital in Kenya, from 1st August 2022 to 30th October 2022. Patients with known type II diabetes of age ≥ 20 years visiting the hospital for routine follow-up visits were included. A 7-item Summary of Diabetes Self-care Activities (SDSAC) Questionnaire was used to assess Diabetes self-care activities. For data entry and statistical analysis, SPSS for Windows version 27.0 was used.

Results: There were 96 (39.2%) males and 149 (60.8%) females. Most of the participants were more than 61 years 148 (60.4%). Prevalence of Diabetes microvascular complications among the study participants was 56.78%, 25.3%, and 14.7% for neuropathy, retinopathy, and nephropathy respectively. significant association was found between the sum scale scores of dietary activities, blood glucose testing, physical activity, foot care, and neuropathy at 95% CI and ($P < 0.001$). Scores on the Blood glucose testing and foot care activities subscale were significantly associated with

Retinopathy ($p < 0.001$). Additionally, significant associations were found between the presence of nephropathy and dietary activities, foot care, and physical activity subscale ($p < 0.001$).

Conclusions: Diabetes self-management activities have an impact on microvascular complications in patients with diabetes.

Keywords: self-management activities, diabetes, Microvascular complications, Summary of diabetes self-care activities.

Introduction

Diabetes is a major public health concern that is approaching epidemic proportions worldwide(1). Levels of morbidity and mortality attributable to diabetes remain high. Though diabetes and its related complications is a global problem low and middle-income countries (LMICs) are the most affected(2). Diabetes treatment imposes a huge economic burden in developing countries and the costs are projected to rise further(3). Among the chronic complications of diabetes, microvascular complications of kidney, retina, and peripheral nerves are a significant cause of mortality and disability in patients with diabetes. This greatly affects their quality of life and care burden. the Diabetes self-management can reduce complications and mortality in patients living with diabetes(4).

Unlike previously believed that it is more of a problem of cities and towns, the rural communities have experienced an increase as well(3). The responsibility of providing preventive and therapeutic healthcare services falls on the healthcare workers in the primary health centers and dispensaries as there are not many private or tertiary-level

hospitals to care for the health demands of diabetic patients(5). The situation is worse because these communities are faced with multiple challenges, including a lack of access to diabetes education, clinical services, limited smart cellphone coverage, and internet access, limited transportation and long travel distances, as well as higher rates of poverty(6).

The needs of diabetic patients are not only limited to adequate glycemic control but also prevent complications and disability(7). One of the biggest challenges for healthcare providers is addressing the continued needs and demands of individuals with diabetes(8). The regular follow-up of diabetic patients by a multidisciplinary team is vital in averting long-term complications(9,10). This is met with difficulties as more than 80% of consultants in Kenya are found in Urban areas and tertiary hospitals, this in turn contributes to suboptimal diabetes management and higher rates of diabetes-related complications(11).

Diabetes Self-Management Activities

Self-care in diabetes is a process of development of knowledge or awareness by learning to survive with the complex nature of diabetes in a social context(12). The majority of daily diabetes care is handled by patients and/or families. Seven essential self-care behaviors in people with diabetes predict outcomes. They include; healthy eating, being physically active, monitoring of blood sugar, compliance with medications, good problem-solving skills, healthy coping skills, and risk-reduction behaviors(13–16). These measures can be useful for both clinicians and educators treating individual patients and for researchers evaluating new approaches to care(17). Self-report is an important practical and cost-effective approach for self-management assessment(18).

Diabetes self-management activities are behaviors undertaken by people with diabetes to successfully manage the disease on their own. All seven behaviors are positively correlated with good glycemic control, reduction of complications, and improvement in quality of life(9,19,20). In addition, it was observed that self-care encompasses not only performing these activities but also the interrelationships between them. Diabetes self-care requires the patient to make major lifestyle modifications enhanced with the supportive role of healthcare staff for maintaining a higher level of self-confidence leading to a successful behavior change(21–24).

Diabetes education is important but it must be transferred to action or self-care activities to fully benefit the patient. The American Association of Clinical Endocrinologists and WHO emphasize the importance of patients becoming active and knowledgeable participants in their care(10,25). Emphasis should be placed on; understanding the disease and the role of drugs, diet plans, foot, and eye care, role of continuous and sustained lifestyle modification, physical activities, and self-glucose monitoring(26).

Given the prevalence of DM and its complications in Nyeri county, there had been limited studies conducted to determine diabetes self-management among its population. Therefore, study aimed to assess the diabetes self-management practices among diabetes patients living in rural areas in Nyeri county, Kenya.

Materials and Methods

A facility-based, cross-sectional study was conducted at the outpatient department of Nyeri County referral hospital in Kenya. The study duration was from 1st August 2022

till 30th October 2022. In this study, patients of both genders, of age 20 years and above, known cases of type II DM visiting the hospital for routine follow-up visit were included. Patients being seen in the emergency or in-patient department, patients who did not have at least one available record of HbA1c from the last six months were excluded. All patients were included after attaining informed consent. A semi-structured questionnaire was used to record patient information. It included biodata information, Duration of DM and treatment and HbA1c record from the last six months.

In order to assess their status of self-care, Summary of Diabetes self-care activities (SDSCA) Questionnaire was used. The seven items of SDSCA are used to assess self-care activities. They are divided into 7 subscales – blood glucose testing subscale (item 7,8,3A), Diet sub scale (item 1,2,3,4,1A,5A), Physical exercise subscale (item 5,6, 2A), smoking subscale (item 11,12A,13A, 14A), foot care subscale (item 9,10,9A,10A,11A), medications subscale (item 6A,7A,8A) and self-care recommendations subscale (item 1A,2A,3A,4A). The questionnaire ask patient about their diabetes self-care activities during the past 7 days. If they were sick during the past 7 days, we went back to the last 7 days that they were not sick.

Scoring instructions were. Step 1: For items 1–10, use the number of days per week on a scale of 0–7. Step 2: Scoring Scales; General Diet = Mean number of days for items 1 and 2 and Specific Diet = Mean number of days for items 3, and 4 where the scale was (0=7, 1=6, 2=5, 3=4, 4=3, 5=2, 6=1,7=0); Exercise = Mean number of days for items 5 and 6; Blood-Glucose Testing = Mean number of days for items 7 and 8. Foot-Care = Mean number of days for items 9 and 10; Smoking Status = Item 11 (0 = nonsmoker,1 = smoker), and number of cigarettes smoked per day.

Scoring for Additional Items such as; Recommended regimen = Items 1A - 4A, and items 12A - 14A, no scoring required; Diet = Use total number of days for item 5A; Medications = Use item 6A - OR - 7A AND 8A, use total number of days for item 6A, use mean number of days if both 7A and 8A are applicable. Lastly; Foot-Care = Mean number of days for items 9A - 11A, after reversing 10A and including items 9 and 10.

For data entry and statistical analysis SPSS for Windows version 27 was utilized. Patient characteristics were presented as frequency and percentages and compared using Chi square test. For SDSCA overall and its subscales mean and standard deviation (SD) were calculated and for comparison independent sample t-test was applied. The p value ≤ 0.05 was taken as significant.

Ethics statement

Both written and verbal informed consent for participation was also obtained from all the participants. For written consent all participants signed the consent form in the questionnaire. Verbal consent was witnessed by the nurse or clinical officer in-charge of the clinic. The study was approved by the Ethical Review Committee of Jomo Kenyatta University of Agriculture and Technology, and the National Commission for Science, Technology and Innovation (NACOSTI/P/22/18990)

Results

Participants characteristics, both overall and according to the presence of the microvascular complications of diabetes

Two hundred and forty-five people with Diabetes (PWD) participated in the study. Among them, 96 (39.2%) were males and 149 (60.8%) were females. Most of the participants were more than 61 years 148 (60.4%). Prevalence of Diabetes microvascular complications among the study participants were 56.78%, 25.3% and 14.7% for neuropathy, retinopathy and nephropathy respectively. Significant association was found between age and level of education with all the three microvascular complications. Furthermore, marital status was associated nephropathy and neuropathy whereas Hb1Ac was associated with nephropathy (Table 1).

Table 1: Participants socio-demographic characteristics association with the presence of the microvascular complications of diabetes							
Characteristic variable	Total (n=245)	Neuropathy (n= 139; 56.7%)	P value	Retinopathy (n= 62; 25.3%)	P value	Nephropathy (n= 36 ;14.7%)	P value
Age							
20-35	12 (4.9%)	1(0.7)	0.001	0 (0%)	0.009	2(5.6%)	0.02
36-45	21 (8.6%)	7(5.0%)		3(4.8%)		1(2.8%)	
46-60	64 (26.1%)	27(19.4)		11(17.7%)		3(8.3%)	
61 and above	148 (60.4%)	104(74.8)		48(77.4%)		30(83.3%)	
Sex							
Male	96 (39.2%)	51 (36.7%)	0.36	19 (30.6%)	0.11	14 (38.9%)	0.97
Female	149 (60.8%)	88 (63.3%)		43 (69.4%)		22 (61.1%)	
Marital status							
Single	23 (9.4%)	7 (5.0%)	0.003	3 (4.8%)	0.08	2 (5.6%)	0.007
Married	168 (68.6%)	93 (66.9%)		39 (62.9%)		20 (55.6%)	
Divorced/Separated	8 (3.8%)	4 (2.9%)		2 (3.2%)		0 (0%)	
Widowed	46 (18.8%)	35 (25.2%)		18 (29.0%)		14 (38.9%)	
Level of Education							
Primary	140 (57.1%)	83 (59.7%)	0.003	39 (62.9%)	0.003	19 (52.8%)	0.008
Secondary	64 (26.1%)	28 (20.1%)		7 (11.3%)		6 (16.7%)	
Tertiary	13 (5.3%)	5 (3.6%)		3 (4.8%)		1 (2.8%)	

No schooling	28 (11.4%)	23 (16.1%)		13 (21.0%)		10 (27.8%)	
Occupation							
Office job	9 (3.7%)	3 (2.2%)	0.17	3 (4.8%)	0.13	0 (0%)	0.06
Outdoor job	30 (12.2%)	13 (19.4%)		4 (6.5%)		5 (13.9%)	
Farmer	175 (71.4%)	104 (74.8%)		43 (69.4%)		22 (61.1%)	
Stay at home	31 (12.7%)	19 (13.7%)		12 (19.4%)		9 (25.0%)	
Duration of diabetes							
Below 5 years	76 (31.0%)	35 (25.2%)	0.05	19 (30.6%)	0.26	8 (22.2%)	0.44
5-10 years	89 (36.3%)	52 (37.4%)		18 (29.1%)		14 (38.9%)	
More than 10 years	80 (32.7%)	52 (37.4%)		25 (40.3%)		14 (38.9%)	
Diabetes treatment regimen							
Oral Hypoglycemics	165 (67.3%)	96 (69.1%)	0.73	41 (66.1%)	0.90	21 (58.3%)	0.27
Insulin	24 (9.8%)	12 (8.6%)		7 (11.3%)		6 (16.7%)	
Insulin plus oral hypoglycemics	56 (22.9%)	31 (22.3%)		14 (22.6%)		9 (25.0%)	
Hb1aC level							
Good control	101 (41.2%)	56 (40.3%)	0.73	21 (33.9%)	0.17	8 (22.2%)	0.01
Poor Control	144 (58.8%)	83 (59.7%)		41 (66.1%)		28 (77.8%)	
Values are presented as number (%) and P value for associations.							

Associations between Summary of diabetes self-care activities and the microvascular complications of diabetes

As shown in Table 2, a significant association was found between the sum scale scores of dietary activities, blood glucose testing, physical activity, foot care and neuropathy at 95% CI and ($P < 0.001$). Scores on the Blood glucose testing and foot care activities subscale were significantly associated with Retinopathy ($p < 0.001$). Additionally, significant associations were found between the presence of nephropathy and dietary activities, foot care and physical activity subscale ($p = < 0.001$) (Table 2).

Table: 2 Associations between Summary of diabetes self-care activities and the microvascular complications of diabetes							
SDSAC Variable	Total (n=245) mean and SD	Neuropathy OR (95% CI)	P value	Retinopathy OR (95% CI)	P value	Nephropathy OR (95% CI)	P value
Dietary Practice	4.44 ±1.51	0.07 (0.03,0.11)	<0.001*	0.04 (-0.001,0.07)	0.06	0.06 (0.03,0.08)	<0.001*
Blood glucose monitoring	1.52 ±2.15	0.06 (0.03,0.09)	<0.001*	0.03 (0.02,0.07)	<0.001*	-0.003 (-0.02,0.02)	0.76
Physical Activity	2.39 ±1.86	0.06 (0.03,0.09)	<0.001*	0.03 (0.003,0.06)	0.08	0.05 (0.03,0.08)	<0.001*
Foot care	4.99 ±1.63	0.08 (0.02,0.09)	<0.001*	0.06 (0.02,0.09)	<0.001*	0.06(0.03,0.08)	<0.001*
DM Medication Adherence	7.28± 1.55	-0.02(-0.07,0.02)	0.29	0.01 (-0.03,0.05)	0.55	0.007 (0.02,0.04)	0.62
SD, standard deviation; OR, odds ratio; CI, confidence interval. *p<0.05.							

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Discussion

152 In this study, we sought to assess associations between diabetes self-care activities and
153 the microvascular complications of diabetes in patients with diabetes living in rural
154 area. In our study, Prevalence of Diabetes microvascular complications among the
155 study participants were 56.78%, 25.3% and 14.7% for neuropathy, retinopathy and
156 nephropathy respectively. The proportion is higher as compared to other
157 studies(27,28). This study mainly focused on participants living in the rural area unlike
158 other studies. This difference could be because rural populations with diabetes
159 experience unique challenges and substantial inequities in the achievement of diabetes
160 care(29).

161 In the present study, participants were further categorized into strata according to their
162 various demographic characteristics. It was observed that patients who were older than

sixty-one years were more likely to have Neuropathy, Retinopathy compared to those who were younger ($p < 0.05$). This finding is consistent with other studies that have shown age is an important factor that affects the increased risk of prediabetes and diabetes (30). Additionally, microvascular events occur more commonly in populations with diabetes and the risk of these events are predominantly related to duration of diabetes(31).

Level of education was associated with all the MVCs. This study agrees with other studies that have revealed educational status influences the awareness about diabetes self-care, compliance to drugs and the health seeking behavior of an individual (32). Studies have observed that lower the education higher is the risk of developing diabetes complications(33).

In the present study, it was observed that dietary practices and physical activity was significantly associated neuropathy and nephropathy complications. This can be explained by a consistent healthy dietary pattern is associated with a reduced risk of microvascular complications in patients with diabetes. In this study we also assessed carbohydrate spacing and fats intake; studies have shown that high carbohydrate and high monounsaturated fat diets improve insulin sensitivity (34–36). These findings provide a reasonable basis for dietary recommendations aimed at preventing diabetic microvascular complications.

Physical activity such as walking, gardening, leisure activity, exercise, or movement for transportation or an occupation among other aerobic and resistance exercise are known to improve insulin sensitivity. Additionally, it improves the lipid profile, BMI and blood

pressure. This study is consistent with other study findings that have reported that; physical activity improves glycemic control and better disease control(37–39).

Foot care practices was significantly associated with all the three microvascular complications. Others studies have demonstrated that patients with peripheral neuropathy presented with significantly higher rates of development of DR, macroalbuminuria and the existence of macrovascular complications (40–42). The results suggest that neuropathy, nephropathy and retinopathy are signs of a generalized diabetic microangiopathic process whose progression may be influenced by factors other than diabetes duration and metabolic and therefore when a patient takes measures to prevent one micro vascular complication it has direct impact to prevent of the similar complications (43,44).

The findings of association between blood glucose testing and neuropathy and retinopathy in this study are in agreement with previous literature. Blood glucose monitoring is an essential part of management in patients with diabetes mellitus (45). It helps to identify patterns in the fluctuation of blood glucose levels that occur in response to diet, exercise, medications, and pathological processes. It enhances early intervention in case of hypoglycemia or hyperglycemia which impacts on various body system such as the retina and neurons (46,47). It supports improvement of patient outcomes because critical decision can be made in time.

Study Limitations

This study is a cross-sectional study hence cannot establish causal inferences but rather associations. Nonetheless, this study provides the extent of association between diabetes self-management and MVCs to inform development of interventions.

Conclusion

The present study indicates that the diabetes-related self-care activities was directly linked with diabetes microvascular complications. Foot care, dietary practices, physical activity, blood glucose testing, Age, marital status, Hb1Ac and level of education were significantly associated with MVCs among patients. It is essential to promote Diabetes self-care education related to DM as a strategy to improve self-management and improve the overall patient outcome.

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Conflict of Interest

None to Declare

Authors' contributions

Rachael Ireri contributed to the conception of the research idea, design data analysis and interpretation, paper drafting and revision. Gideon Kikuvi contributed to the

conception of the research idea, design and revision of the final draft. Susan Mambo contributed to the conception of the research idea, design, and revision of final draft. Besty Cheriro contributed to the conception of the research idea, design, and revision of final draft. All authors approved the final manuscript before publication and agree to be accountable for all aspects of the work.

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