CORRELATION OF DIABETES SELF-CARE ADHERENCE WITH GLYCEMIC MEASURES: A CROSS-SECTIONAL HEALTH FACILITY-BASED STUDY IN KATHMANDU, NEPAL

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ABSTRACT

Self-care plays a key role in prevention of complications, and improvement of the quality of life of persons with diabetes (PWDs). This study has assessed adherence to self-care behavior and its correlation with glycemic measures among PWDs attending private health care facilities in Kathmandu, Nepal. A cross-sectional study was carried out using a semi-structured questionnaire. Socio-demographic information and recent fasting (FBG) and 2-hr post-prandial blood glucose (2-hr PBG) levels were recorded. Self-care inventory (SCI) 12-item version was used to assess adherence to diabetes self-care over the preceding four weeks. Self-care practice was measured in five domains: glucose monitoring; diabetes medication; diet; exercise; and preventative care. The overall adherence score was obtained by computing the average of seven items (items 1, 2, 4, 5, 6, 7, 14). Scores more than or equal to median score were considered as higher levels of self-care efficacy. Univariate linear regression analysis of the subscale scores and individual item-wise score with age, duration of diabetes (years), FBG and PPBG levels was carried out. Pearson's coefficient (r) was reported for normally distributed variables. Among 385 PWDs, mean FBG was 146 mg/dl (±54.7), 2-hr PBG was 210 mg/dl (±82). Median score for overall adherence to diabetes self-care was 25 (IQR:21 to 29). Higher self-care efficacy was seen among 55% (n=212). Overall adherence to self-care was significantly and negatively correlated with age and glycemic measures. Self-care efficacy was mainly driven by adherence to diabetes medication. Adherence to preventative care, exercise and home monitoring of blood glucose was low. FBG was significantly and negatively correlated with glucose regulation (r=-0.16, P=0.001), diabetes medication and food regulation (r=-0.11, P=0.03), preventative care (-0.14, P=0.03) and overall adherence to treatment (-0.15, P=0.004). 2-hr PBG was significantly and negatively associated with all domains of self-care (r -0.14, P=0.04 to -0.21, P<0.0001). Elderly persons, may face difficulty with regular physical exercise, dietary recommendations and overall adherence to self-care. Continuing diabetes education is imperative to motivate PWDs and caregivers regarding importance of self-care efficacy in glycemic regulation and diabetes care.

KEYWORDS

Glycemic control, self-care, Type 2 diabetes

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INTRODUCTION

Diabetes care involves glycemic control, adherence to medications along with dietary and lifestyle modification. The International Diabetes Federation treatment guidelines for persons with diabetes (PWDs) recognize self-care as a vital aspect of diabetes care. PWDs are expected to follow self-care practices such as regular physical activity, making appropriate food choices, taking medications, monitoring blood glucose levels and managing episodes of low blood glucose levels. Poor glycemic control can be associated with complications such as cardiovascular disease, nephropathy, retinopathy, and neuropathy. These complications have been associated with a reduction in the quality of life due to disability and premature death.[1]

Self-care is the practice of taking action to preserve or improve one's own health.[2] There is consistent evidence for its role in early diagnosis, prevention and mitigation of complications, and improvement in the quality of life of affected individuals.[3] Several instruments have been designed for the assessment of self-care among PWDs.[4] The self-care inventory (SCI) was developed by LaGreca and colleagues as a self-reported questionnaire that defined self-care as 'the daily regimen tasks that the individual performed to manage diabetes'.[5] The revised inventory (SCI-R) has 15 items that address diet, medication, routine activities, self-monitoring of glucose, exercise, and management of hypoglycaemia. The 12-item version has been recommended for use among persons with type 2 diabetes which excludes items 3, 13 and 15 from SCI-R.[6] The psychometric properties of this tool have been demonstrated in diverse populations. The global score of self-care behaviour has made SCI-R a concise and practical measuring tool in clinical practice and research.

A systematic review about diabetes care in Nepal has identified a lack of specific guidelines for prevention and treatment, poor awareness among PWDs, limited health care facilities and high cost of treatment as significant challenges.[7] This study has evaluated the self-care practice among PWDs and its correlation with blood glucose levels as a measure of adherence to care. This may be helpful to guide relevant public health efforts in the fight against diabetes, as well as improve diabetes self-care and education.

MATERIALS AND METHODS

A cross-sectional study was conducted in the out-patient department of two private health care facilities in Kathmandu, Nepal from February 2021 to September 2021. After ethical clearance obtained from NMC-IRC (Ref No. 039-077/078), administrative permission was obtained from the health care facilities for the study. Persons aged 18 years and above who were diagnosed with diabetes for more than a year by a registered clinician or those who were on anti-diabetic medication were eligible to participate in the study. Pregnant women were excluded from the study. An estimated sample size of 384 was calculated assuming 50% adherence to self-care practice among PWDs within 95% confidence limits and a 5% margin of error. After obtaining due written consent from the study participants, self-care behavior was assessed through a face-to-face interview using a 12-item version of SCI by the investigators. Along with demographic information, respondents' latest available fasting (FBG) and 2-hour post prandial blood (2-hr PBG) glucose levels were recorded from the patient's OPD records. Glycosylated Hb levels when available were recorded.

The 12-item version of SCI was used to assess their perceptions of adherence to diabetes self-care recommendations over the preceding four weeks. Items were rated on a five-point Likert scale, from 1 ("never do it") to 5 ("always do this") reflecting patients' rating for the degree to which they followed self-care recommendations during the prior month. Self-care was measured in five domains: two items for glucose monitoring (items 1, 2); two items for medication (items 4, 5); four items for diet (6, 7, 8, 9); one item for exercise (item 14); and three items for preventative and routine care (items 10, 11, 12). The sub-scales addressed three domains: glucose regulation (item 1+2+4), medication and food regulation (item 5+6+7) and preventative care (item 10+11). The sub-scale score was obtained by computing the sum of the items in the scale. The overall adherence score was obtained by computing the sum of seven items (items 1, 2, 4, 5, 6, 7, 14) because proper self-care in these areas has been shown to be related with better metabolic control in a previous validation study.[8]

Mean scores were reported for each item, subscale and overall adherence to self-care. Overall adherence scores more than or equal to median score was considered as higher levels of self-care efficacy. Univariate linear regression analysis was carried out for the overall adherence, subscale and individual item-wise score with age, duration of diabetes (years), FBG, and 2-hr PBG levels. Pearson's coefficient (r) was reported for normally distributed variables. The level of significance was set at 5% and a P value of <0.05 was considered significant.

RESULTS

Among 385 persons with diabetes (185 women), over two-thirds were on oral hypoglycemic medications (Table 1). Mean age of the study participants was 55.4 years (±12.6). Mean age at diagnosis was 46.03 years (±10.5) with a mean diabetes duration of 9.4 years (±7.9). The mean level of fasting blood glucose (FBG) was 146 mg/dl (±54.7), 2-hr prandial blood glucose (2-hr PBG) was 210 mg/dl (±82). HbA1C levels were available for less than half of the study respondents; mean HbA1C level (n=146) was 7.32 (±1.75) (Table 2).

Table 1: Baseline characteristics of respondents (n=385)

Variables	n	%	95% CL
Gender			
Female	182	47.2	42.3 to 52.3
Male	203	52.7	47.7 to 57.7
Co-morbidities			
Hypertension	215	55.9	50.9 to 60.8
CVD	30	7.8	5.5 to 10.9
Diabetes medication			
OHA	281	72.9	68.9 to 77.1
Insulin	78	20.3	16.5 to 24.6

(OHA-oral hypoglycemic agents, CVD-cardiovascular disease)

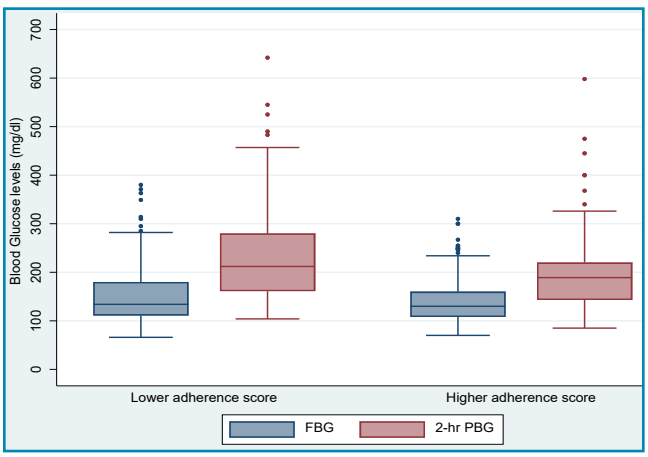

Fig 1: Box-plot summary of Fasting and 2-hour Prandial blood glucose levels among persons with lower and higher adherence to self-care activities (lower adherence n=173, higher adherence n=212) Median score was used to categorize higher adherence score (>=25) and lower adherence score (<25)

As seen in Table 3, the most practiced behaviors were taking diabetes medication followed by eating meals on time and visiting a clinic for diabetes care and regular exercise. The least practiced behaviors were keeping food records, reading food labels, testing and recording blood glucose levels at home, and carrying sugar or treating low blood glucose levels. Mean score for overall adherence to treatment among the persons with diabetes (n=374) was 24.87 (±5.15).

A significant negative correlation was seen between age of the PWDs and self-care behaviors such as eating correct food portions (r=-0.10, P=0.04), keeping food records (r=-0.19, P=0.0002), regular physical exercise (r=-0.30, P<0.0001) and overall treatment adherence (r=-0.12, P=0.03). Duration of diabetes was significantly and positively correlated with home-monitoring of blood glucose levels (r=0.10, P=0.04), preventative care such as carrying quick acting sugar (r=0.18, P=0.0003), and treating low blood glucose (r=0.13, P=0.04). Diabetes duration was negatively correlated with exercise (r=-0.19, P=0.0001). Regarding glycaemic measures, fasting blood glucose levels were significantly and negatively correlated with glucose regulation (r=-0.16, P=0.001), diabetes medication and food regulation (r=-0.11, P=0.03), preventative care (-0.14, P=0.03), and overall adherence to treatment (-0.15, P=0.004). Post-prandial blood glucose levels were significantly and negatively associated with all of the subscales (r ranging from -0.14, P=0.04 to -0.21, P<0.0001). Median score for overall adherence to diabetes care recommendations was 25 (IQR: 21 to 29). Higher adherence to self-care (overall adherence ≥25) was seen among 55% (n=212). Overall adherence to self-care was significantly and negatively correlated with age (r=-0.12, P=0.03), FBG (-0.15, P=0.004), and 2-hr PBG (r=-0.21, P<0.0001).

Table 2: Summary of biological characteristics of respondents (n=385)

Variables	N	Mean	SD	Min	Max
Age (years)	385	55.4	12.6	23	93
Age at diagnosis (years)	385	46.03	10.5	20	73
Duration of diabetes (years)	385	9.4	7.9	1	40
FBG (mg/dl)	385	146	54.7	66	380
2-hr PBG (mg/dl)	385	210	82	85	642
HbA1C	146	7.32	1.75	4.5	15

Table 3: Descriptive statistics of SCI-R item and subscale scores

SCI-R Item	N	Mean	SD	Skewness	Kurtosis
1: Check blood glucose with monitor	385	2.95	1.43	-0.14	1.63
2: Record blood glucose results	385	2.68	1.41	0.22	1.69
4: Take correct dose of diabetes pills or Insulin	374	4.42	0.95	-1.99	6.77
5: Take diabetes pills or Insulin at the right time	374	4.39	0.91	-1.91	6.90
6: Eat correct food portions	385	3.58	1.02	-0.34	2.43
7: Eat meals on time	385	3.65	0.94	-0.33	2.52
8: Keep food records	385	1.82	1.21	1.47	4.10
9: Read food labels	385	2.02	1.20	0.89	2.72
10: Treat low blood glucose with recommended amount of carbohydrate	212	2.55	1.25	0.31	2.1
11: Carry quick acting sugar to treat low blood glucose	385	2.50	1.48	0.47	1.80
12: Come in for clinic appointments	381	3.40	1.17	-0.49	2.50
14: Exercise	385	3.23	1.34	-0.22	1.89
Glucose regulation (1+2+4)	374	10.02	2.95	-0.03	2.03
Medication and Food regulation (5+6+7)	374	11.63	2.32	-0.51	2.96
Preventative care (10+11)	212	5.35	2.3	0.25	2.24
Overall adherence to self-care (1+2+4+5+6+7+14) Median score: 25 (IQR: 21 to 29)	374	24.87	5.15	-0.15	2.4

Table 4: Correlation of mean SCI-R item and subscale scores with age, duration of diabetes and glycemic measures

SCI-R Item	N	Age	DD	FBG	2-hr PBG
1: Check blood glucose with monitor	385	-0.008	0.10*	-0.17***	-0.13**
2: Record blood glucose results	385	-0.08	-0.01	-0.008	-0.04
4: Take correct dose of diabetes pills or Insulin	374	0.03	0.01	-0.28***	-0.26***
5: Take diabetes pills or Insulin at the right time	374	0.06	0.02	-0.25***	-0.22***
6: Eat correct food portions	385	-0.10*	0.04	-0.03	-0.17**
7: Eat meals on time	385	-0.08	0.04	-0.006	-0.11**
8: Keep food records	385	-0.19***	-0.03	0.08	-0.02
9: Read food labels	385	-0.05	0.005	-0.005	-0.04
10: Treat low blood glucose with recommended amount of carbohydrate	212	0.04	0.13*	-0.04	-0.03
11: Carry quick acting sugar to treat low blood glucose	385	-0.05	0.18***	-0.04	-0.11*
12: Come in for clinic appointments	381	-0.06	0.05	-0.05	-0.18***
14: Exercise	385	-0.30***	-0.19***	-0.02	-0.14**
Glucose regulation 1+2+4	385	-0.02	0.05	-0.16**	-0.16**
Diabetic medication and food regulation 5+6+7	374	-0.06	0.01	-0.11*	-0.21***
Preventative care 10+11	211	0.03	0.18**	-0.14*	-0.14*
Treatment adherence 1+2+4+5+6+7+14	374	-0.12*	0.001	-0.15**	-0.21***

*Correlation significant at 0.05 level (two-tailed test), ** Correlation significant at 0.01 level (two-tailed test)
*** Correlation significant at 0.001 level (two-tailed test)

DISCUSSION

The study findings reflect that just over one-half of persons with diabetes had higher self-care efficacy. However, self-care was mainly driven by adherence to diabetes medication rather than lifestyle modification. Adherence to self-care activities including monitoring of glucose levels, diet, exercise, and preventative care was low. These findings are in concordance with those of a study carried out in Pakistan, where adherence to medication and visiting a physician were the most pertinent behaviors among PWDs.[8] A study carried out in Saudi Arabia among 385 PWDs, using the summary of diabetes self-care activities-arabic scale[9] also found that adherence to medication was the most practised behaviour. Glucose monitoring and foot care were at an average level, and adherence to the diet plan and exercise was found to be less practised.[9]

The present study has found that higher self-care efficacy was significantly correlated with a decrease in FBG (r -0.15, P=0.004). There was a higher correlation with 2-hr PBG levels (r-0.21, P <0.0001). There is similar evidence in studies carried out in China and Malaysia[10-12] where higher self-efficacy score was shown to be correlated with lower HbA1c levels (r −0.41, P <0.001). However, the self-care assessment was carried out using different tools. Moreover, the glycaemic measure used in these studies was glycosylated hemoglobin.[10–12] A study in Pakistan also found that health literacy and monitoring of blood glucose levels were associated with good glycaemic control. A strong positive correlation was seen between diabetes knowledge (DKQ) and diabetes self-management (DSMQ) scale (r=0.63, p<0.001), and with glucose regulation (r=0.61, p<0.001), dietary regulation (r=0.65, p<0.001), and health-care visits (r=0.55, p<0.001).[13] According to a cross-sectional study done in Iran, 80% of the variation in the HbA1c was determined by health literacy, self-care behaviours, and demographic variables (R= 0.804%; p-value<0.05).[14] However, a study among 325 PWDs in Ethiopia, Africa showed that a higher proportion (50.8% vs 45%) had poor self-care efficacy with a low level of adherence to medications.[3]

Looking at studies carried out in Nepal, a cross-sectional study carried out among 139 PWDs in Tanahun District of Nepal that used another tool (diabetes self-care activities) found that less than half (46%) had desirable self-care practice for diabetes management. However, regular exercise (89.9%) and preventative foot care (74.8%) was found to be widely practiced.[15] Another cross-sectional study was conducted among 480 PWDs in Nepal found that 65.4% had poor glycaemic control with mean HbA1C of 8.0% (± 1.1%). Higher HbA1c levels were significantly associated with duration of diabetes, a number of drugs used, patient-physician relationship and knowledge about diabetes. Poor glycaemic control was significantly associated with low adherence to following a meal plan, regular medication, and physical exercise.[16]

A recent qualitative study in Nepal has identified that lack of knowledge about diabetes self-care behaviours, cultural practices, insufficient counselling, lack of guidelines and protocols for counselling, and financial problems were significant barriers in diabetes care. However, support from family, peers, and health professionals and community networks were facilitators for improved care. These findings may help to guide strategies that impart knowledge and skills to improve self-care behaviour among PWDs.[17]

Diabetes self-care is known to be an evolutionary process of knowledge or awareness growth through learning to survive in a social context with the complex nature of diabetes. Culture specific variations have been observed among persons with diabetes. However, self-monitoring or home monitoring of blood glucose level remain a neglected practice. The addition of home blood glucose monitors to diabetes self-care has transferred more responsibility to the patient. Most of the recommendations for home monitoring are unequivocal about offering it only to persons with diabetes who are willing to perform it, maintain records, have the skills to perform the test, are taught how to interpret readings and take suitable actions regarding lifestyle changes and therapy.[18–20] For the patient to understand their blood glucose fluctuations with an effective self-care intervention, the role of the health care provider in diabetes education is imperative. [21]

Moreover, elderly persons with diabetes may face difficulty in following self-care and may need family support. Given the complexity of behavioural change, a community and family-based approach may help to improve diabetes self-care.[15,21] In the context of low-resource settings, use of social media platforms and mobile phone-based interventions may offer an opportunity for PWDs and care-givers to learn, manage and improve self-care behaviours.[22]

Limitations: Glycosylated haemoglobin may have been a more robust measure to assess glycaemic control among the respondents,

however it was available for less than half of the study participants. Hence, we have used glycaemic measures that were readily available such as fasting and 2-hr blood glucose levels. We did not carry out or advise any further assessment of glycaemic status during the study.

In conclusion, among persons with diabetes in an urban setting in Nepal adherence to self-care was significantly correlated with a decrease in FBG and 2-hr PBG levels. However, self-care efficacy was mainly driven by adherence to diabetes medication rather than lifestyle modification. Adherence to preventative care, exercise and home monitoring of blood glucose was low. Elderly persons in particular, may face difficulty with regular physical exercise, dietary recommendations, and overall adherence. Continuing diabetes education is imperative to motivate PWDs and caregivers regarding importance of self-care efficacy in glycemic regulation and diabetes care.

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