Original Article

A cross-sectional study on diabetes self-management practice and its association with glycemic control among type 2 Diabetes patients

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Abstract

Context: Diabetes has emerged as a major chronic public health problem throughout the world. Self-management by diabetes patients is very important for controlling blood sugar levels and preventing complications of diabetes. **Aims:** The present study was conducted to study self-management practices among diabetes patients and to analyse socio-demographic factors associated with them. **Methods and Materials:** A cross-sectional analytical study was conducted among 230 randomly selected diabetes patients in the Andaman and Nicobar Islands. The self-management practices were measured by the diabetes self-management questionnaire (DSMQ). **Statistical Analysis Used:** The association of the DSMQ score with socio-demographic factors and blood sugar level was analysed by statistical tests like the T-test, analysis of variance (ANOVA) test, Tukey's honestly significant difference, and Chi-square test. **Results:** The mean DSMQ score of the diabetes patients was 29.55 ± 5.98. There was a significant difference between the mean DSMQ score and the educational level (*P* value = 0.009), residential status (*P* value = 0.037), and duration of diabetes (*P* value = 0.006). The subcomponent analysis of the DSMQ score revealed that the glucose management score of rural people (9.38 ± 3.36) was significantly higher (*P* value = 0.006) than that of urban people (8.32 ± 2.46), and the diet control score was significantly higher (*P* value = 0.02) in patients with normal post-prandial blood sugar (PPBS) (7.64 ± 2.18) than in patients with raised PPBS (6.96 ± 2.12). **Conclusions:** Higher educational level, rural background, and long duration of diabetes were associated with better self-management practices. The patients with normal blood sugar levels showed higher diet control scores than the patients with raised blood sugar levels.

Keywords: Diabetes self-management questionnaire, glycemic control, self-management, type 2 diabetes

Introduction

Diabetes is now recognised as a major chronic public health problem throughout the world, affecting 537 million adults (20–79 years) worldwide.[1] However, it is estimated that low- and middle-income countries will bear the brunt of this epidemic in the 21st century, with 80% of all new cases of diabetes expected to appear in low- and middle-income countries by 2025

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including South Asian countries like India. The International Diabetes Federation (IDF) estimates that India has nearly 74.2 million diabetes patients which is expected to reach 92.9 million by 2030.[1] According to the National Family Health Survey 5 (NFHS-5), the prevalence of diabetes in India is 13.5% in women and 15.6% in men, whereas it is 17.5% in females and 17.9% in males in the Andaman and Nicobar Islands.[2] The primary care physician caters to the major burden of diabetes patients in the Andaman and Nicobar Islands as well as in India.

The rising prevalence of type 2 diabetes across the world is primarily attributed to rapid urbanisation and associated changes in lifestyle, such as sedentary lifestyles, higher calorie food intakes, and stressful lives. However, evidence suggests that lifestyle modification through self-management practices can either prevent or delay the onset of type 2 diabetes.[3,4] Lifestyle modification and health education are the main responsibilities of primary care physicians. The available literature shows that good self-management practices protect patients against complications of diabetes and help them an achieve optimal blood glucose level.[5-7] Self-management is probably the most important factor contributing to achieving euglycemia, and several self-report measures have been developed in the past for the assessment of self-care among patients with diabetes mellitus.[4,6,7] Hence, the self-management of diabetes can provide informed and activated patients, which will help in preparing a proactive health care team, especially at the primary level of health care.

Recently, a relatively new tool, that is, diabetes self-management questionnaire (DSMQ) has been developed to assess diabetes self-management. The scale covers several important domains including diet, medication adherence, blood glucose monitoring, physical activity, and contact with health care professionals which are activities related to glycemic control. The DSMQ is a reliable and valid instrument that enables an efficient assessment of self-care behaviours associated with glycemic control and shows favourable prospects compared to older measures.[8-10] Although this instrument has been thoroughly evaluated and used in Europe,[11,12] to our knowledge, no local study has investigated the use of DSMQ on the Indian and Andaman and Nicobar Island populations. Hence, the present study was conducted to study diabetes self-management practices and associated socio-demographic factors in type 2 diabetes patients in the Andaman and Nicobar Islands. The association between DSMQ score and blood sugar level in diabetes patients was also analysed in the study.

Subjects and Methods

The present study is a cross-sectional study that was conducted among type 2 diabetes patients residing in the field practice area of the community medicine department of a medical college in Andaman and Nicobar Islands. The study was conducted from February 2023 to August 2023. The known cases of diabetes mellitus or newly diagnosed cases of diabetes residing in field practice areas of urban and rural centres of the community medicine department were included in the study. The diabetes patients who were too ill to respond to questions were excluded from the study.

The minimum sample size for the study was calculated as 224 by using the Cochran formula

$$n = \frac{z^2 p q}{d^2}$$

p= prevalence of diabetes in Andaman and Nicobar Islands = 17.7%[2]

$$q = 1 - p$$

for a 95% confidence interval

d = absolute error = 5%

However, considering the operational feasibility, a total of 230 diabetes patients were included in the study. The diabetes patients were selected by stratified random sampling. The diabetes patients were recruited for the study over two months from the field areas. The health centres at Haddo (urban), Garacharma (urban), Chouldari (rural), and Bambooflat (rural) were considered as strata for diabetes patients. The diabetes patients were selected from each centre randomly in proportion to the total diabetes population in the field area.

Data collection tools

Data were collected using a self-administered, pre-designed, pre-validated questionnaire. The patients' socio-demographic data, data on health status, duration of diagnosis, current management of diabetes, and presence of complications were collected using a data collection sheet. The DSMQ was used to assess self-management among the patients, and it was self-administered for participants who were literate and interviewer-administered for illiterate participants. The DSMQ questionnaire is a reliable and validated scale with Cronbach's alpha equal to 0.84.[8]

The DSMQ consists of 16 items spanning different domains of diabetes self-management. These items describe different behaviours related to diabetes self-care, reflecting five main areas – patients' dietary control, medication adherence, blood glucose monitoring, physical activity, and physician contact. Given their contents, the subscales were labelled 'glucose management' (items 1, 4, 6, 10, and 12), 'dietary control' (items 2, 5, 9, and 13), 'physical activity' (items 8, 11, and 15), and 'health-care use' (items 3, 7, and 14). One item (16) requests an overall rating of self-care and is to be included in the 'sum scale' only.[8]

Referring to the previous eight weeks, participants rate the extent to which each description applied to them on a four-point Likert scale, where 0= 'does not apply to me', 1= 'applies to me to some degree', 2= 'applies to me to a considerable degree', and

3= 'applies to me very much'. Item scores were transformed so that higher scores indicated more desirable self-management behaviour (requiring reverse scoring of negatively keyed items) and summed/transformed to five scale scores with ranges from 0 to 10. The DSMQ total scores were divided according to the mean into two groups. Participants who scored less than or equal to the mean were categorised as having 'poor' DSMQ, while those who scored more than the mean were categorised as having 'good' DSMQ scores.

The blood sugar level was measured using a capillary blood glucose test. Equipment used includes a lancet, test strip, and glucometer. Fasting venous blood sugar <126 mg/dL and postprandial venous blood sugar <200 mg/dL were taken as normal blood sugar, whereas fasting venous blood sugar ≥126 mg/dL and postprandial venous blood sugar ≥200 mg/dL were taken as raised blood sugar as per WHO recommendation for diagnostic criteria for diabetes 2019.[13] The usual period between blood sampling and filling out the questionnaire was less than one week.

Statistical analysis

The simple descriptive statistics analysis was performed by calculating the percentage, mean, and standard deviation. Statistical tests like Chi-square, unpaired T-test, one-way ANOVA, and Tukey's honestly significant difference (HSD) test were used to see the association between diabetes self-management and other variables. $P < 0.05$ and 95% CI were considered statistically significant.

Ethical considerations

Ethical approval for this study was obtained from the institutional ethical committee. Informed consent about the study aims, procedures, and risks was obtained from the patients before their inclusion in the study. Codes were used as participant identifiers to ensure privacy and confidentiality.

Results

In the current study, the age distribution of patients showed that 205 (89.1%) patients belonged to 30–69 years, whereas 24 (10.4%) patients belonged to ≥70 years. The females were 125 (54.3%), whereas males were 105 (45.7%). The patients from rural areas were 98 (42.6%), whereas the patients from urban areas were 132 (57.4%). The patients educated between 9th and 12th were 75 (32.6%), up to class eight were 68 (29.6%), and illiterate were 56 (24.3%). The monthly per capita income of the majority of patients (74.3%) was below Rs. 30,000 and 64 (27.8%) of patients were homemakers, whereas 52 (22.6%) patients were working in the service sector.

Table 1 depicts that the mean DSMQ score of the diabetes patients was 29.55 ± 5.98. The patients with a good DSMQ score were 101 (43.9%), whereas the patients with a poor DSMQ score were 129 (56.1%). Table 1 analyses the association of socio-demographic variables with the DSMQ score. The mean DSMQ score of patients with post-graduation was 38.66 ± 6.65, whereas the mean DSMQ score of patients educated up to class eight was 28.01 ± 6.11. A one-way ANOVA test revealed that there was a significant difference between the mean DSMQ score and the educational level of diabetes patients (P value = 0.009). Tukey's HSD test for multiple comparisons found that there was a significant difference between the mean DSMQ score of patients who were educated up to class eight and patients who were postgraduate with a P value of 0.019.

The mean DSMQ score among patients from rural areas was 30.50 ± 6.66, whereas the mean DSMQ score among patients from urban areas was 28.84 ± 5.33. The difference in the DSMQ score between these two groups was statistically significant (P value = 0.037). On subcomponent analysis of the DSMQ score, it was found that the glucose management score of rural people (9.38 ± 3.36) was significantly higher than that of urban people (8.32 ± 2.46) with a P value of 0.006. No significant difference was found between the mean DSMQ score and other socio-demographic variables like gender, age, monthly income, and occupation of participants.

Table 2 describes the clinical characteristics of diabetes patients. The patients having diabetes mellitus for less than five years were 121 (52.6%), whereas 76 (33%) patients had diabetes for 5–10 years. The duration of treatment was more than one year in 153 (66.5%) patients. There was no complication of diabetes in 165 (71.4%) patients, whereas one complication was observed in 47 (20.4%) patients. Hypertension was present in 118 (51.3%) diabetes patients, whereas hypertension was absent in 112 (48.7%). Most of the patients (82.6%) were taking oral medications, whereas 30 (13.1%) were taking oral medication along with insulin.

The mean DSMQ score of patients having diabetes for more than 10 years was 32.60 ± 5.92, whereas the mean DSMQ score of patients having diabetes for 5–10 years was 29.01 ± 5.97. One-way ANOVA test level revealed that there was a significant difference between the mean DSMQ score and duration of diabetes in patients (P value = 0.006). Tukey's HSD test for multiple comparisons found that there was a significant difference between the mean DSMQ score of patients with diabetes lasting more than 10 years and patients with diabetes lasting less than five years with a P value of 0.006. Tukey's HSD test for multiple comparisons also found that there was a significant difference between the mean DSMQ score of patients with diabetes duration of more than 10 years and patients with diabetes duration between 5–10 years with a P value of 0.010. No significant difference was found between the mean DSMQ score in relation to other clinical characteristics like treatment duration, number of complication, hypertension, and type of treatment including oral medications or insulin.

The mean fasting blood sugar (FBS) level of diabetes patients was 155.45 ± 50.38. Table 3 shows that the FBS were normal, that is, less than 126 mg/dl in 85 (36.9%) patients, whereas the FBS were

Table 1: The association of socio-demographic characteristics with the mean DSMQ score of the diabetes patients

Variable	*n* (%)	Mean±SD DSMQ score	*P* (unpaired *t*-test/ANOVA test)
Gender			
Male	105 (45.7)	30.2±5.73	0.13#
Female	125 (54.3)	29.0±6.13	
Age (in years)			
20–29	1 (0.4)	23.0000	0.44##
30–69	206 (89.1)	29.65±5.80	
≥70	24 (10.4)	28.66±7.34	
Residence			
Rural	98 (42.6)	30.50±6.66	0.037*#
Urban	132 (57.4)	28.84±5.33	
Level of education			
Illiterate	56 (24.3)	29.46±5.62	0.009**##
Up to class eight	68 (29.6)	28.01±6.11	
9th–12th class	75 (32.6)	30.21±5.68	
Graduate	28 (12.2)	30.67±6.01	
Postgraduate	3 (1.3)	38.66±6.65	
Monthly income			
<10,000	40 (17.4)	28.70±6.00	0.49##
10,000–20,000	82 (35.6)	30.00±5.75	
20,000–30,000	49 (21.3)	28.73±5.59	
30,000–40,000	23 (10.0)	29.34±7.52	
40,000–50,000	23 (10.0)	31.39±6.27	
>50000	13 (5.7)	29.46±5.18	
Occupation			
Business	21 (9.1)	30.19±6.77	0.31##
Farming/fishing	25 (10.9)	28.04±4.65	
Homemaker	64 (27.8)	28.57±6.24	
Job/service	52 (22.6)	30.30±6.05	
Retired/unemployed	31 (13.5)	30.90±6.51	
Others	37 (16.1)	29.67±5.08	

*Statistically significant at *P*<0.05, **P<0.01, #Indicates unpaired *t*-test, ##Indicates one-way ANOVA

Table 2: The associations of clinical parameters of the diabetes patients with the mean DSMQ score

Variable	*n* (%)	Mean±SD DSMQ score	*P* (unpaired *t*-test/ANOVA test)
Treatment duration			
<6 months	22 (9.6)	28.86±6.72	0.19##
6 months to 1 year	55 (23.9)	28.41±6.44	
More than 1 year	153 (66.5)	30.05±5.65	
Duration of diabetes			
<5 years	121 (52.7)	29.04±5.78	0.006**##
5–10 years	76 (33.0)	29.01±5.97	
>10 years	33 (14.3)	32.60±5.92	
Number of complications###			
0	165 (71.4)	29.52±6.01	0.78##
1	47 (20.4)	29.29±5.69	
≥2	8 (3.5)	31.50±7.23	
Hypertension			
Yes	118 (51.3)	29.82±6.10	0.45#
No	112 (48.7)	29.23±5.87	
Type of treatment			
Exclusive insulin	10 (4.3)	29.60±9.17	0.80##
Combined with oral medication	30 (13.1)	28.58±4.65	
Oral medication	190 (82.6)	29.67±5.98	

*Statistically significant at *P*<0.05, **P<0.01, #indicates unpaired *t*-test, ##indicates one-way ANOVA test, and ###indicates complications including peripheral neuropathy, DM retinopathy, peripheral artery disease, DM nephropathy, glaucoma, and cataract

raised, that is, equal to or greater than 126 mg/dl in 145 (63.1%) patients. There was no significant difference between the DSMQ score and the FBS level of patients (*P* value = 0.07). The mean post-prandial blood sugar (PPBS) level was 243.53 ± 67.66. The

PPBS was normal, that is, less than 200 mg/dl in 93 (40.4%) patients, whereas the PPBS was raised, that is, equal to or greater than 200 mg/dl in 137 (59.6%) patients. There was a significant difference between the DSMQ score and the PPBS level of patients (*P* value = 0.03).

Table 4 shows the comparison of mean scores of glucose management, physical activity, diet control, health care utilisation, and self-care with the blood sugar level of patients. The diet control score was higher in patients with normal PPBS (7.64 ± 2.18) than in patients with raised PPBS (6.96 ± 2.12). The unpaired T-test revealed that there was a significant difference between the diet control score of patients with normal PPBS as compared to those with raised PPBS (*P* value = 0.02). Similarly, the diet control score was higher in patients with normal FBS (7.58 ± 2.31) than in patients with raised FBS (7.03 ± 2.06). The difference between these two groups was not significant (*P* value = 0.06). There was no difference in the mean glucose management score, physical activity score, diet control score, health care utilisation score, or self-care score in both categories of patients.

Discussion

The current study aims to study the association between the self-management activities of diabetes patients and socio-demographic factors. It was found that there was a significant association between diabetes self-management scores and the education status of diabetes patients. Various other studies from Nigeria, Saudi Arabia, and Pakistan also observed that diabetes patients with higher education showed better glycemic control.[14-16] In contrast, other studies reported that diabetes patients with low educational status had better self-management.[17] The high DSMQ in educated patients was observed because the educated patients were more aware of complications and were more motivated towards exercise and drug adherence.

In the current study, no difference was found in self-management of diabetes among patients with different socioeconomic statuses, as most of the diabetes patients accessed government hospitals/health centres for the management of diabetes in the Andaman and Nicobar Islands, and all the diagnostic tests and medicines for the management of diabetes were provided free of cost in government hospitals/health centres in the Andaman and Nicobar Islands. Similar findings were also observed in other studies from Nigeria and Carolina, USA.[14,18] In contrast, another study observed that poor glycemic control was observed in diabetes patients belonging to lower socioeconomic status, as poor patients had depressive symptoms and adopted avoidance coping.[19]

Similarly, there was no significant difference between DSMQ scores between male and female diabetes patients. Similarly, no difference was found in self-management practice and glycemic control in Texas (USA).[20] In contrast, the self-management of diabetes and glycemic control among females was poorer in comparison to males in other studies.[21,22] These findings in the present study were observed because the women had accessibility to good education and health care similar to men in Andaman and Nicobar Islands.

The diabetes patients selected from rural areas showed better self-management scores as compared to patients selected from urban areas. The patients from rural areas showed better glucose management scores which meant that rural patients had better glucose monitoring and medical adherence. It happened due to better acceptance of self-management practices by patients in rural areas. The health staff in urban areas should also motivate diabetes patients for regular glucose monitoring and medication adherence. Further, another study also emphasised that medication adherence and self-management of diabetes should be enhanced among patients by adopting digital solutions.[23]

There was a significant association between the DSMQ score and the duration of diabetes. The patients who have had diabetes for more than ten years showed better diabetes self-management scores. The patients with a long duration of diabetes had better knowledge of self-management of diabetes. Such patients had

Table 3: The association of DSMQ scores with the blood sugar level of diabetes patients

DSMQ	Fasting blood sugar		*P*	Post-prandial blood sugar		*P*
	Normal	Raised		Normal	Raised	
Poor	41 (31.8%)	88 (68.2%)	0.07	44 (34.1%)	85 (65.9%)	0.03*
Good	44 (43.6%)	57 (56.4%)		49 (48.5%)	52 (51.5%)	
Total	85 (36.9%)	145 (63.1%)		93 (40.4%)	137 (59.6%)	

*Statistically significant at *P*<0.05 in the Chi-square test

Table 4: The comparison of different components of self-management of diabetes with blood sugar level of diabetes patients

Variable	Fasting blood sugar		*P*	PPBS		*P*
	Normal mean±SD	Raised mean±SD		Normal mean±SD	Raised mean±SD	
Glucose management	9.14±3.20	8.55±2.73	0.14	8.87±3.02	8.70±2.86	0.67
Physical activity	5.24±2.29	5.24±2.08	0.98	5.27±2.26	5.21±2.10	0.83
Diet control	7.58±2.31	7.03±2.06	0.06	7.64±2.18	6.96±2.12	0.02*
Health care utilisation	5.67±1.58	5.59±1.51	0.71	5.63±1.54	5.61±1.53	0.91
Self-care	1.88±0.91	1.89±0.81	0.95	1.91±0.86	1.87±0.84	0.69
DSMQ (total)	30.35±6.39	29.07±5.68	0.11	30.17±6.14	29.12±5.84	0.19

*Statistically significant at *P*<0.05 in the unpaired *t*-test, PPBS=post-prandial blood sugar

better knowledge of diet, physical activity, blood glucose control, and foot care. Other studies also observed that patients with good knowledge about diabetes (i.e. diet, physical activity, and medication) showed better self-care management.[24-26]

In the current study, there was a significant association between diabetes self-management scores and blood sugar levels. Similar findings were observed in another study, which showed that diabetes patients with good self-care management had good blood sugar.[7,27,28] On analysis of the individual subscales, it was found that the diet control score had a significant association with the PPBS score (P value = 0.02), as non-following of dietary instructions could significantly raise the blood sugar level post-prandially. Other components of DSMQ did not show a significant association with PPBS and FBS levels. Similarly, a significant relationship was observed between the diabetes knowledge score and diet, whereas physical activity, blood sugar testing, and foot care did not show significant results in another study.[29] Hence, special emphasis should be given to diet control and nutrition education for diabetes patients so that diabetes patients can better take care of themselves and the complications of diabetes can be prevented. A recent study from Delhi emphasised the importance of diabetes self-medication education by developing training kits for diabetes self-medication education.[30]

Limitations

The current study has a few limitations. The DSMQ score was analysed with blood sugar level; however, the association of the DSMQ score with HbA1C could not be analysed due to resource constraints as it was a self-funded study. Secondly, the study had a small sample size from the South Andaman district. However, a large sample size from multiple sites would have increased the power and generalizability of the study.

Conclusion

Self-management of diabetes is very important for the control of diabetes and the prevention of complications. Patients with better self-management practices showed a significant association with glycemic control among diabetes patients in the Andaman and Nicobar Islands. Among the different components of DSMQ, diet control showed a significant association with blood sugar levels. Hence, diabetes patients should be provided education about healthy dietary practices along with other self-care practices like physical exercise, glucose management, and health care utilisation so that they can do better self-care and prevent complications of diabetes. Higher educational level, rural location, and long duration of diabetes were associated with better self-management practices among diabetes patients in Andaman and Nicobar Islands. Hence, newly diagnosed and less educated diabetes patients should be given health education about self-management practices for control of their illness. In urban areas, diabetes patients should be educated about regular glucose monitoring and medicine adherence. These measures would lead to improvements in diabetes care at the primary level of health care.

Ethical approval

Ethical approval for this study was obtained from the institutional ethical committee (ANIIMS/IEC/2022-23/09).

Abbreviations

Abbreviation	Full Name
FBS	Fasting blood sugar
PPBS	Post-prandial blood sugar
DSMQ	Diabetes self-management questionnaire
IDF	International Diabetes Federation
NFHS	National Family Health Survey
ANOVA	Analysis of variance
Tukey's HSD	Tukey's honestly significant difference

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Conflicts of interest

There are no conflicts of interest.

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