

Diabetes Self-Care Activities and Glycaemic Control among Adults with Type 2 Diabetes in Sri Lanka: A Cross-Sectional Study

Meerigama Arachchige Rasoda Saumika¹, Thamara Dilhani Amarasekara², Rasika Jayasekara³

¹Department of Nursing, Faculty of Health Sciences, The Open University of Sri Lanka, Sri Lanka

²Department of Nursing & Midwifery, Faculty of Allied Health Sciences, University of Sri Jayewardenepura, Sri Lanka

³School of Nursing and Midwifery, University of South Australia, South Australia, Australia

Email: thamaraamarasekara@yahoo.com, thamara@sjp.ac.lk

How to cite this paper: Saumika, M.A.R., Amarasekara, T.D. and Jayasekara, R. (2019) Diabetes Self-Care Activities and Glycaemic Control among Adults with Type 2 Diabetes in Sri Lanka: A Cross-Sectional Study. *Journal of Biosciences and Medicines*, 7, 99-111.

<https://doi.org/10.4236/jbm.2019.75013>

Received: December 27, 2018

Accepted: May 14, 2019

Published: May 17, 2019

Abstract

The prevalence of Type 2 Diabetes Mellitus (T2DM) and its complications continue to rise across the globe including Sri Lanka. Diabetes Self-care activities (DSCA) are promising behaviors to reduce complications and to achieve good glycaemic control. There is a lack of data regarding DSCA and its association with glycaemic control among adults with T2DM in Sri Lanka. A descriptive cross-sectional study was conducted among purposively selected adults with T2DM (n = 300) in a teaching hospital, Sri Lanka to determine the association between DSCA and glycaemic control. A pre-tested interviewer-administered questionnaire which includes socio-demographic, diabetes-related information and Summary of Diabetes Self-care activities questionnaire was used to collect data. Data were analyzed by using descriptive statistics and Chi-square test. General diet (Healthy eating plan) (OR = 3.04, 95% CI = 1.04 - 8.88, p = 0.034), Physical activities (OR = 2.26, 95% CI = 1.29 - 3.97, p = 0.004), Medication adherence (OR = 2.87, 95% CI = 1.24 - 6.64, p = 0.011) were significantly associated with HbA1c. Medication adherence was significantly associated with poor fasting blood sugar (FBS) (OR = 1.90, 95% CI = 1.07 - 3.37, p = 0.028). The findings highlight the need for health professionals to implement health education programs on diabetes self-care activities for adults with T2DM to enhance their adherence to DSCA, as well as to maintain glycaemic control.

Keywords

Diabetes Self-Care Activities, Glycemic Control, Adults, Type 2 Diabetes Mellitus, Sri Lanka

1. Introduction

T2DM has become a global epidemic that affects over 377 million people worldwide, with estimated prevalence rates rising to an alarming 642 million people by 2040 [1]. Most people with diabetes live in low- and middle-income countries, and these countries will experience the highest increase in cases of diabetes over the next two decades [2]. Diabetes Mellitus (DM) is a group of illnesses characterized by high blood glucose levels that result from defects in the body's ability to produce and/or use insulin. T2DM is the most common form of diabetes in which the body is unable to produce adequately to overcome insulin resistance and affects various organs and systems [3]. In Sri Lanka, DM is a significant health problem; with an unprecedented current level of prevalence [4]. According to a recent study, the age-adjusted prevalence for T2DM was 20.3% for males and 19.8% for females in an urban cohort, and of those diagnosed with T2DM, only 23.8% were optimally controlled [5]. However glycaemic control has an effect on improving diet, exercise, medication, foot care efficacy and behaviors [6]. As there is no cure for diabetes, self-care activities are promising activities in blood sugar control among patients with T2DM. In Sri Lanka, the majority of the adults with T2DM did not involve recommended DM management strategies including restricting refined sugar, regular exercises or checking blood sugar regularly [7] and the majority of adults with T2DM did not achieve desired glycaemic control [8].

2. Literature Review

Several previous studies have shown that high levels of patients adherence to diabetes self-care behaviors resulted in better metabolic control [9] [10] [11] [12] and self-care skills play a crucial role in optimal diabetes control [13]. Diabetes self-care Activities (DSCA) include a range of activities such as self-monitoring of blood glucose, eating a healthy diet, being physically active, taking the recommended medication and consulting health care professionals [14]. A Chinese study revealed that; effective-patient communication, social support, and higher self-efficacy were associated with performing diabetes self-care behaviors; that were directly linked to glycaemic control [15]. A study suggested that interactive health education programs should be introduced to increase patient adherence to the treatment, and the importance of family members' involvement in encouraging patients' glycaemic control [16].

According to studies, Sri Lanka is among the countries with the highest diabetes prevalence rates in the world [17]. Sri Lankan studies revealed that one in five adults has either diabetes or pre-diabetes condition [18]. A national survey conducted in 2005 to 2006, explored that the prevalence of T2DM was twice as high in persons from urban areas (16.4%) as compared to persons from rural areas (8.7%) [18]. In 2016, the number of deaths attributed due to the high blood glucose level in Sri Lanka was 4660 males and 2470 females of the age limit between 30 to 69 which is significantly higher compared to the universal figure of

2860 males and 1740 females [19]. In the same year, the prevalence of diabetes in Sri Lanka was among males 7.3% females, and 8.4% [19]. Further, the researchers revealed that the incidence of diabetes risk factors such as the prevalence of overweight among males was 18.9%, and females 32.9% [19]. Prevalence of obesity among men was 3.5% and among women was 10.0%. Prevalence of physical inactivity is higher in women (30.2%) compared with men (16.9%) [19]. There is an apparent deficiency in self-care practices; medication adherence, dietary practices, physical exercises, foot care practices and identification and prevention of complications among patients with diabetes; however the majority of the participants in their study preferred to learn more about how to control their DM [20]. Self-care activities are much crucial to glycaemic control among adults with T2DM. Hence it is important to determine the association between DSCA and the glycaemic control.

3. Method

3.1. Design

A descriptive, cross-sectional design was used and 300 purposively selected adults with T2DM were selected based on inclusion and exclusion criteria.

3.2. Participants and Setting

This study was conducted at a diabetic clinic at Sri Jayewardenepura General Hospital (SJGH), Colombo, Sri Lanka which provides care for the large number of adults with T2DM. The Diabetic clinic runs only 2 days per week (Wednesday and Thursday) and usually, 30 patients attend the clinic per day.

This study included adult participants (age 18 and above) with a diagnosis of T2DM, and a minimum duration of >6 months of diagnosis was required because the participants need some time to adapt to their illness and to practice diabetes self-care. Adults with T2DM who had physical or cognitive impairments, pregnant women, adults who have diagnosed with diabetes less than six months and adults who were severely ill were excluded from the study.

3.3. Data Collection

An Interviewer-administered questionnaire was developed by the researcher, using the revised version of the Summary of Diabetes Self-care Activities (SDSCA) that is used to measure self-care activities of diabetic patients [14]. The author permission was obtained to use the SDSCA for this study. The questionnaire used in this study contains three parts namely: Part-A sociodemographic information, Part-B Diabetes related information (duration of having diabetes, family history of diabetes, HbA1c investigations etc.) and Part C consisted of a validated summary of diabetes self-care activities (SDSCA). The SDSCA scale is a self-reporting measure of the DSCA: diet, exercise, blood glucose testing, medication taking, foot care, and smoking behaviour. The SDSCA asked the participants to report the frequency in which they perform the above-mentioned

DSCA over the past 7 days. If they were sick during the past 7 days, they were asked to reflect on the 7 days before they became ill. The questionnaire was pre-tested among 10 patients with T2DM to determine acceptability, feasibility, comprehensibility and appropriateness and these participants did not participate in this study.

3.4. Ethical Considerations

Ethical approval was obtained from the Ethics Review Committee of Faculty of Medical Sciences University of Sri Jayewardenepura, Sri Lanka and Ethics Review Committee of SJGH. Without disturbing to the clinic routines, the convenient time for participants was used for data collection. Informed written consent was obtained from all participants after a detailed explanation of the purpose and procedures used for the study. All the participants were informed that the privacy and confidentiality would be ensured during all steps of the study. Hence, all the participants had the right to avoid participation at any time of the study. All data collected were treated as private and confidential to maintain anonymity. Data were stored on password secure digital storage which could only be accessible for the investigators.

3.5. Data Analysis

Sample characteristics were analysed by using descriptive statistics, by using SPSS (Statistical Package for Social Sciences) 20.0 version. The association between level of self-care practices, HbA1c, FBS, BMI, and socio-demographic factors was tested by using Pearson's Chi-square test. Results were presented by using descriptive statistics including percentages and graphs. A confidence value of 95% and the probability of <0.05 were considered statistically significant for all tests.

4. Results

4.1. Socio-Demographic Characteristics of Adults with T2DM

As presented in **Table 1** the majority of participants were female (n = 206; 68.7%), and 253 (84.3%) were married. Nearly 48% (n = 143) participants belonged to the 50 - 64 age group. More than half (51.3%) were educated to Advance Level (high school) and above and 60% had an income more than Rs 40,000 (46.3%, 139) were housewives, and 84 (28%) were retired.

4.2. Diabetes-Related Information of Adults with T2DM

Clinical characteristics of adults with T2DM are presented in **Table 2**. Nearly half of participants (44.7%, 134) had been diagnosed with T2DM for 2 - 10 years. Most participants (73%) had a family history of diabetes. More than half (51.7%) had a normal BMI (18.5 - 24.99) with a mean of 24.66 (standard deviation [SD] = 4.51). Nearly half of participants (52.7%, 158) adults had a good fasting blood glucose level (≤ 126 mg/dl); however, 75.7% of participants demonstrated HbA1c

Table 1. Socio-demographic characteristics of adults with T2DM ($n = 300$).

Characteristics.	Frequency	Percent (%)
Gender		
Female	206	68.7
Male	94	31.3
Age (years)		
18 - 29	8	2.7
30 - 49	59	19.7
50 - 64	143	47.7
65 - 70	67	22.3
≥71	23	7.7
Ethnicity		
Sinhala	273	91.0
Tamil	13	4.3
Muslim	12	4.0
Burgher	2	0.7
Educational status		
Not attained to the school	1	0.3
Grade 1 - 5	3	1.0
Grade 6 - 10	40	13.3
Ordinary level	102	34.0
Advanced level	99	33.0
Higher education	55	18.3
Marital status		
Single	10	3.3
Married	253	84.3
Other	37	12.3
Occupation		
Professional	21	7.0
Technical & clerical	13	4.3
Vendors & sellers	21	7.0
Skilled manual workers	12	4.0
Unskilled manual workers	5	1.7
Retired	84	28.0
Unemployed	5	1.7
Housewife	139	46.3
Average monthly income for the family (In Sri Lankan Rupees)		
Less than 29,999Rs	25	8.3
30,000Rs - 40,000Rs	95	31.7
40,001Rs - 60,000Rs	109	36.3
60,001Rs - 80,000Rs	48	16.0
More than 80,001Rs	23	7.7

Table 2. Diabetes related information of adults with T2DM ($n = 300$).

Characteristics.	Frequency	Percent (%)
Duration of diabetes		
6 - 12 months	11	3.7
1 - 2 years	30	10
2 - 10 years	134	44.7
>10 years	125	41.7
Family history of Type 2 diabetes mellitus		
Yes	219	73
No	80	26.7
Don't know	1	0.3
BMI (body mass index)		
Under weight < 18.50	23	7.7
Normal 18.50 - 24.99	155	51.7
Overweight 25 - 29.99	85	28.3
Obese ≥ 30	37	12.3
HbA1c value.		
Good Control < 7%	73	24.3
Poor control. $\geq 7\%$	227	75.7
Fasting blood sugar value.		
Good Control ≤ 126 mg/dl	158	52.7
Poor control > 126 mg/dl	142	47.3
Medication		
Oral pills only	216	72.0
Oral and Insulin	71	23.7
Insulin only	13	4.3

value ($\geq 7\%$). Majority of participants (72%) controlled their blood glucose levels using oral hypoglycaemic agents.

4.3. Summary of Diabetes Self-Care Activities of Adults with T2DM

According to the results, 262 (87.4%) of the adults with T2DM followed General Diet (Healthy eating plan) and 170 (56.6%) not followed a specific diet (fruits and vegetables, less meat and dairy products), 3 or more than 3 days from 7 days. Exercise regimen (30 minutes and specific exercise) was followed by 166 (55.3%) participants on 3 or more than 3 days in the past 7 days, and 71 (23.7%) did not follow exercise regimen in even a single day. More than half (60.3%) of the participants did not perform self-monitoring of blood glucose (SMBG) even a single day while 59 (19.7%) performed SMBG 3 or more than 3 days in the past 7 days. Nearly half (49.7%) did not perform foot care (Checked feet, wash feet, soak feet, dry between toes after washing) even a single in the past seven days.

Only 131 (43.7%) followed foot care 3 or more than 3 days in the past 7 days. Majority of the participants (80%) reported adhering to medication regularly. A small percentage of the participants smoked at least 1 puff (4.7%) in the past 7 days.

Socio-demographic characteristics are not significantly associated with HbA1c, FBS, Diet, SMBG and Medication adherence. Associations of socio-demographic characteristics with physical activity are presented in **Table 3**. People; age ≤ 49 years had good physical activity when compared to people ≥ 50 years. Age was significantly associated with physical activity (OR = 2.46, 95% CI = 1.37 - 4.44, $p = 0.002$). As shown in **Table 4** female participants showed good foot care practices when compared to male participants. Gender was significantly associated with foot care (OR = 1.68, 95% CI = 1.01 - 2.78, $p = 0.043$).

4.4. Associations of DSCA with Glycemic Control

Associations of DSCA with Glycemic control are presented in **Table 5**. Participants who have followed the general diet and specific diet showed good glycemic control when compared to adults with poor self-care activities in general diet and specific diet. General diet was significantly associated with HbA1c (OR = 3.04, 95% CI = 1.04 - 8.88, $p = 0.034$). Physical activities also significantly associated with HbA1c (OR = 2.26, 95% CI = 1.29 - 3.97, $p = 0.004$). Both general diet (OR = 3.64, 95% CI = 1.70 - 7.79, $p = 0.000$) and specific diet (OR = 2.37, 95% CI =

Table 3. Associations of socio-demographic demographic characteristics with physical activity (n = 300).

	Good (3 - 7 days)	Poor (0 - 2 days)	OR	95% CI	
				Lower	Upper
Age					
18 - 49 (Years)	48*	19	2.46	1.37	4.44
≥ 50 (Years)	118	115			
Gender					
Female	121	85	1.55	0.95	2.53
Male	45	49			
Education Level					
\leq Ordinary level	75	71	0.73	0.46	1.16
$>$ Ordinary level	91	63			
Monthly income					
$\leq 40,000$ Rs	66	54	0.98	0.61	1.56
$\geq 40,001$ Rs	100	80			
Marital status					
Married	141	112	1.108	0.59	2.07
Single and Other	25	22			

* $p < 0.05$, ** $p < 0.001$ level of significance.

Table 4. Associations of Socio-demographic demographic characteristics with Foot care (n = 300).

	Foot care				
	Good (3 - 7 days)	Poor (0 - 2 days)	OR	95% CI	
				Lower	Upper
Age					
18 - 49 (Years)	28	39	0.91	0.52	1.57
≥50 (Years)	103	130			
Gender					
Female	98*	108	1.68	1.01	2.78
Male	33	61			
Education Level					
≤Ordinary level	56	90	0.66	0.41	1.04
>Ordinary level	75	79			
Monthly income					
≤40,000Rs	53	67	1.03	0.65	1.65
≥40,001Rs	78	102			
Marital status					
Married	108	145	0.78	.42	1.45
Single and Other	23	24			

*p < 0.05, **p < 0.001 level of significance.

1.48 - 3.79, p = 0.000) were highly significant with FBS. Medication adherence was significantly associated with both HbA1c (OR = 2.87, 95% CI = 1.24 - 6.64, p = 0.011) and FBS (OR = 1.90, 95% CI = 1.07 - 3.37, p = 0.028). Other DSCA outcomes are not significantly associated with Glycemic control.

5. Discussion

Even though this study findings clearly indicate more than half of the participants had good FBS level; the majority of the participants had poor HbA1c value. Results from other studies have also reported poor glycaemic control among adults with T2DM. According to another Sri Lankan study, most participants did not achieve the recommended fasting blood glucose level (<126 mg/dL) [8]. Iranian study also indicated 42.9% did not reach the target FBS level [21]. In this study, the majority of the participants had a family history of diabetes. Another cross-sectional national survey which was conducted among 5000 adults in Sri Lanka have also shown, the prevalence of diabetes was significantly higher in patients with a family history (23.0%) than those without (8.2%) family history (p < 0.001) [22]. The current study findings also revealed that more than half (51.7%) had a healthy BMI (18.5 - 24.99). This finding is consistent with another study that showed nearly half (48.3%) of the study participants had a healthy BMI (18.0 - 24.9) [8].

Table 5. Association of DSCA with glycemic control (n = 300).

	Glycemic control (HbA1c)					Glycemic control (FBS)				
	Good Control <7%	Poor control ≥7%	OR	95% CI		Good Control ≤126 mg/dl	Poor control >126 mg/dl	OR	95% CI	
				Lower	Upper				Lower	Upper
General Diet										
Good (3 - 7 days)	69*	193	3.04	1.04	8.88	148**	114	3.64	1.70	7.79
Poor (0 - 2 days)	4	34				10	28			
Specific Diet										
Good (3 - 7 days)	36	94	1.38	0.81	2.34	84**	46	2.37	1.48	3.79
Poor (0 - 2 days)	37	133				74	96			
Physical activities.										
Good (3 - 7 days)	51*	115	2.26	1.29	3.97	90	76	1.15	0.73	1.81
Poor (0 - 2 days)	22	112				68	66			
SMBG										
Good (3 - 7 days)	10	49	0.58	0.28	1.21	32	27	1.08	0.61	1.92
Poor (0 - 2 days)	63	178				126	115			
Foot Care										
Good (3 - 7 days)	36	95	1.35	0.80	2.30	72	59	1.18	0.75	1.86
Poor (0 - 2 days)	37	132				86	83			
Medication adherence										
Good (All 7 days)	*66	174	2.87	1.24	6.64	*134	106	1.90	1.07	3.37
Poor (0 - 6 days)	7	53				24	36			

*p < 0.05, **p < 0.001 level of significance.

In the present study, even though the majority (87.3%) of the adults followed General Diet 3 or more than 3 days in the past 7 days (Healthy eating plan), 56.7% not observed specific diet 3 or more than 3 days in the past 7 days. As the Sri Lankan diet is high in calories from carbohydrates, the main message for dietary change should focus on the reduction of rice consumption with supple-

mentation of more portions of vegetables and green leaves [23]. However, a Sri Lankan study has shown the majority of participants (71.7%) practised some dietary control [8]. According to another Sri Lankan study, among the participants, 56.7% had poor dietary practices in relation to T2DM [21].

The current study also revealed more than half of participants (55.3%) followed exercise regimen on 3 or more than 3 days in the past 7 days. Even though adults with T2DM have poor knowledge regarding exercise, the majority had an adequate level of physical activity during their daily activities, and they have a positive attitude towards physical activity [24]. In a Sri Lankan study, among the participants, 34.56% followed the recommended exercise [21]. However, a Sri Lankan study has shown the majority of participants (85.2%) did not practice any form of exercise [8]. In this study more than half of the participants not performed SMBG even a single day. According to another Sri Lankan study of 146 adults with T2DM, only 5 (3.6%) have practised SMBG (at least monthly) [25].

Nearly half (49.7%) did not perform foot care even a single day in the past seven days. Only 43.7% followed foot care 3 or more than 3 days in the past 7 days. In similar to the present study another Sri Lankan study also showed a large proportion (75.3%) of the participants have not engaged in foot care adequately [21]. However, in the current study, a majority of the participants who participated in foot care were women. This may be due to, females more concern of their body and as most of the women in the sample are housewives as they have more time to engage foot care practices. In Oman, of 350 adults with T2DM, 73.9% followed foot care practices and Omani adults' foot care practices were high when comparing to the current study [26]. This may be due to lack of foot care clinics in Sri Lanka. As similar to the present study, the same Omani survey has shown, significant associations between gender and foot care [26].

Even though the present study showed the majority of the participants (80%) adhered to medication regularly, in contrast to these results another Sri Lankan study revealed, among the participants, 59.73%, showed poor medication practices [21]. According to the Omani study medication adherence was 77%, 3 or more than 3 days in the past 7 days [26]. The Omani study further revealed, less than half percentage (45.5%) of the adults smoked at least 1 puff in the past 7 days [26]. In contrast to this study, among the Omani adults smoking was high. This may be due to the Sri Lankan government's new legislation that enforced to include graphic warnings covering 60% of the surface area of packets of cigarettes. A Sri Lankan study also revealed 71.93% of the 119 participants were of the view that the demonstrated pictorial warnings would persuade the smokers to give up smoking [27]. In this study, general diet, physical activity and medication adherence were significantly associated with HbA1c. According to the results of a cross-sectional study; its bivariate analysis indicated the same three variables were significantly associated with HbA1c: adherence to diet, physical exercise, and medication-taking regimen [16].

This study had some limitations in the assessment of glycaemic control, in that FBS and HbA1c were done in different laboratories. In Sri Lanka, such testing might not have uniform standards. The study was conducted in a Colombo based teaching hospital, and there is reduced the ability to generalize findings to the whole country. As weight and height also recorded by patient's medical records, inconsistency may be high.

6. Conclusion and Implications for Practice

According to the findings, the majority of the participants followed the General Diet and more than half not followed a specific diabetic diet. A considerable amount of adults did not pursue an exercise regimen for even a single day. More than half of the participants did not perform SMBG even a single day. Nearly half of the participants did not perform foot care even a single in the past seven days. Majority of the participants, (80%) reported adhering to recommended medication regularly. Nearly half of the participants had a good fasting blood glucose level (≤ 126 mg/dl) while the majority (75.7%) demonstrating poor HbA1c value ($\geq 7\%$). Both general Diet and specific diet were highly significant with FBS. Physical activities were significantly associated with HbA1C. Female participants showed more adherence to foot care practices compared with male participants. Age was associated with considerably physical activities. Thus all these findings indicate that adults with good control of HbA1c and FBS reported better adherence to DSCA.

The findings prove that there is an urgent need for improving DSCA among adults with T2DM. This study can guide diabetes nurse educators to understand the extent to which different self-care behaviors that affect glycaemic control. Health educational interventions are necessary to improve glycaemic control. Most of the adults' SMBG practice was poor. This may be due to financial cost. Therefore health policies should introduce to facilitates SMBG. We suggest further improvement into this model with a prospective and longitudinal study to observe the association between SDSCA and HbA1c in the long term.

Acknowledgements

Deep gratitude is expressed to the study participants for their participation and support to this study.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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