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CLINICAL & BASIC RESEARCH

Diabetes Self-Management and the Associated Factors Among Adult Omanis with Type 1 Diabetes

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الإدارة الذاتية لمرض السكري والعوامل المرتبطة بها بين العُمانيين البالغين المصابين بمرض السكري من النوع الأول

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abstract: ***Objectives:*** This study aimed to assess and explore factors affecting diabetes self-management (DSM) among Omani adults with type one diabetes mellitus (T1DM). ***Methods:*** This cross-sectional study was conducted from May to November 2018. Convenience sampling was used to recruit participants from three referral hospitals in Oman. Data were collected using the Diabetes Self-Management Questionnaire, Empowerment Scale (short form), Medical Outcome Study Social Support Scale, Diabetes Knowledge Test and glycosylated haemoglobin test results. Linear multiple regression analysis was used to explore possible predictors of DSM. ***Results:*** A total of 210 people participated in the study (response rate: 87.5%). The majority of participants were female (70.5%) with a mean age of 26.82 ± 8.25 years. The mean score for DSM was 6.8 ± 1.4, which represents 68% of the total maximum score. More than one-third (36.2%) of the participants had poor glycaemic control. The predictors of high levels of DSM were being employed (P = 0.049), earning a low monthly income of less than 300 Omani rials (P = 0.014), having other chronic diseases (P = 0.029), a high diabetes self-efficacy (DSE; P = 0.003) and high social support (SS; P = 0.006). ***Conclusion:*** According to the findings of this study, Omanis with T1DM have suboptimal DSM levels. Factors such as diabetes knowledge, DSE and SS are modifiable factors that can be targeted by interventions from different healthcare professionals to enhance DSM.

Keywords: Diabetes Mellitus; Type 1 Diabetes Mellitus; Self-Management; Adult; Oman.

الملخص: الهدف: هدفت هذه الدراسة إلى تقييم الإدارة الذاتية لمرض السكري وتقصِّي العوامل المؤثرة عليها بين العُمانيين البالغين المصابين بالنوع الأول من مرض السكري. **الطريقة:** أجريت هذه الدراسة المقطعية في الفترة من مايو إلى نوفمبر 2018. تم استخدام تقنية أخذ العينات الملائمة لتعيين المشاركين في هذه الدراسة من ثلاثة مستشفيات مرجعية في عُمان. تم جمع البيانات باستخدام استبيان الإدارة الذاتية لمرض السكري ومقياس التمكين (نموذج قصير) ومقياس الدعم الاجتماعي لدراسة النتائج الطبية وإختبارالمعرفة بمرض السكري ونتائج اختبار الهيموجلوبين السُكَري. تم استخدام تحليل إنحدار خطي متعدد لتقصِّي العوامل المؤثرة على الإدراة الذاتية لمرض السكري. **النتائج:** شارك في الدراسة 210 شخصا (معدل الإستجابة 87.5%). كانت غالبية المشاركين من الإناث (70.5%) بمتوسط عمر 26.82 ± 8.25 سنوات. كان متوسط نقاط الإدراة الذاتية لمرض السكري 6.8 ± 1.4 والتي تمثل 68% من مجموع الحد الأقصى للنقاط. كان أكثر من ثلث المشاركين (36.2%) يعانون من ضعف التحكم بنسبة السكر في الدم. من العوامل المنبئة بمستويات عالية من الإدراة الذاتية لمرض السكري هي كون الشخص موظفا(P = 0.049) وجني دخل شهري منخفض أقل من 300 ريال عُماني (P = 0.014) والإصابة بأمراض مزمنة أخرى (P = 0.029) وإرتفاع الكفاءة الذاتية لمرض السكري (P = 0.003) والدعم الاجتماعي الكبير (P = 0.006). **الخلاصة:** وفقا لنتائج هذه الدراسة لدى العمانيين البالغين المصابين بمرض السكري من النوع الأول إدارة ذاتية لمرض السكري دون المستويات الأمثل. عوامل مثل المعرفة بمرض السكري والكفاءة الذاتية لمرض السكري والدعم الإجتماعي هي عوامل قابلة للتغيير ويمكن استهدافها من خلال التدخلات من مختلف المتخصصين في الرعاية الصحية لتعزيز الإدراة الذاتية لمرض السكري.

الكلمات المفتاحية: مرض السكري؛ مرض السكري من النوع الأول؛ الإدارة الذاتية؛ البالغين؛ عُمان.

Advances in Knowledge

- *This study assesses diabetes self-management (DSM) level among adult Omanis with type 1 diabetes mellitus (T1DM) and evaluates the factors influencing DSM.*
- *Good glycaemic control (HbA1c) among adult Omanis with T1DM was significantly associated with higher DSM.*
- *Diabetes knowledge, self-efficacy, social supports are key factors that influence DSM of adult with T1DM.*

Application of Patient Care

- *There is a need to assess, improve and evaluate DSM and associated factors during diabetes visits.*
- *Healthcare providers who are directly involved in managing diabetes must consider culturally sensitive programmes to enhance the DSM among diabetic Omanis.*

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Diabetes mellitus (DM) is one of the most common non-communicable diseases among adults globally, and its prevalence continues to increase.[1] In 2017, the worldwide prevalence was reported at approximately 424.9 million people for those aged 20–79 years and is projected to increase to 629 million by 2045.[2] In 2017, Oman's Ministry of Health reported the incidence of DM as 225 cases per 10,000 for men and 484 cases per 10,000 for women in the Omani population.[3] Due to the impact DM has on all body systems, it increases the risk of developing life-threatening problems and is therefore the leading cause of cardiovascular disease, blindness, and kidney failure.[4] The percentage of Omanis who had retinopathy, micro-albuminuria, amputation and nephropathy was approximately 14%, 27%, 47.3%, and 42.5%, respectively.[5–8] DM was the fourth leading cause of early death and the third leading cause of disability in Oman in 2010.[9]

Diabetes self-management (DSM) is an essential step to controlling or ameliorating the associated impact of and complications from DM. DSM is critical to effective management of both type one (T1) DM and type two (T2) DM. Research shows that DSM results in improved patient quality of life (QOL), reduces the incidence of complications and promotes glycaemic control.[4,10] The potential improvements to QOL are the rationale for considering DSM a cornerstone in DM care and management.[11] DSM requires the affected person to be actively involved in performing a set of daily planned activities that are essential to managing the disease including eating a healthy diet, getting regular physical exercise, monitoring blood glucose levels, seeking preventive healthcare or medical treatment and using prescribed treatments.[12,13] People affected by DM, therefore, must be equipped with adequate knowledge and have a clear understanding of each aspect of DSM because all of DSM's components are essential for daily living.[11]

Few studies have explored DSM among diabetic Omanis and to the best of the authors' knowledge, no study has focused on patients with T1DM.[4,14] Moreover, limited information is available on the factors that may affect DSM among Omanis with T1DM. Therefore, this study aimed to assess the levels of DSM among Omani adults with T1DM. Furthermore, this study aimed to explore the factors that may affect DSM among Omani adults with T1DM.

Method

This cross-sectional, descriptive study was conducted from May to November 2018. A convenience sample was recruited from the diabetic clinics at Sultan Qaboos University Hospital, Royal Hospital and Nizwa Hospital located in Muscat and Nizwa, Oman, respectively. The main variables measured were DSM, diabetic self-efficacy (DSE), social support (SS), diabetes knowledge (DK), glycosylated haemoglobin control (HbA1c) levels and socio-demographic characteristics.

All Omani adults with T1DM who came to receive follow-up care at the DM clinics were approached by a researcher during their visit. Patients with a T1DM diagnosis and were 18 years and above (data confirmed using patients' electronic records) were included in this study. All patients who had previously been diagnosed with mental or cognitive problems were excluded.

The English versions of all standardised tools used in this study were translated into Arabic following a standard procedure of translation and back translation. The final Arabic versions of the instruments were validated for content, clarity and readability by two bilingual nurse researchers.

The Diabetes Self-Management Questionnaire, which consists of 27 items with a four-point Likert scale, was used to assess DSM levels. The original English version of the tool was reported to be reliable with a Cronbach's alpha of 0.84.[15] Total DSM scores were categorised as good (8–10), poor (4–7) or very poor (<4).[4] In the current study, the reliability Cronbach's alpha of the Arabic version was 0.83. DSE was assessed using the Diabetes Empowerment Scale—Short Form which consists of eight items with a five-point Likert scale.[16] The original English version has a reliability Cronbach's alpha of 0.84 and the Arabic version in the current study was found to have the same reliability.[10] The Medical Outcome Study Social Support Survey (MOS-SS) was used to assess participants' SS. The survey consists of 19 items with a five-point Likert scale. The reliability Cronbach's alpha of the original English version was above 0.91 and, in the current study, the Cronbach's alpha for the Arabic version was 0.94.[17] DK was assessed using the Diabetes Knowledge Test (DKT) which consists of 23 multiple choice items and is appropriate for patients on insulin treatment.[16] The reliability Cronbach's alpha of the original English version was 0.77, and was found to be 0.63 for the Arabic version; scores were categorised as low (1–11), moderate (12–18) or high (19–23).[18,19] Patients latest HbA1c in percentage results were obtained via electronic patient records to determine level of glycaemic control. HbA1c result was categorised into good glycaemic control (HbA1c <7%), medium glycaemic control (HbA1c 7–9%) and poor glycaemic control (HbA1c >9%).

The standardised Yamane's formula was used to estimate the sample size needed for this study:

$$n = N/1+N (e) 2 \qquad \text{[Equation 1]}$$

Where N is the population size and e is the alpha level. Based on the number of patients recorded in the study's settings, the accessible population was estimated to be approximately 700 patients. The required sample size, therefore, was calculated as 254 participants. A confidence level of 95% and error margin of 5% was adequate to achieve a minimum power of 80%.

Data were analysed using Statistical Package for the Social Sciences (SPSS), Version 23 (IBM Corp., Armonk, New York, USA). Frequencies, means ± standard deviation and percentile quartiles were used to describe the study sample as well as the outcome variables. Pearson's correlation and t-test were used to determine the relationship between DSM and DSE, SS and DK scores and participants' glycaemic control based on HbA1c values. A multiple linear regression analysis was conducted to examine the potential predictors of DSM. Variables initially entered into the model were age, gender, marital status, level of education, employment status, income, period of DM diagnosis, number of hospital admissions in the last year, the presence of other chronic disease and levels of DK, SS and DSE. The "enter selection" method was used to exclude variables that were not significant. Multicollinearity was tested using variance inflation factor and tolerance; the variables included demographic characteristics, period of DM diagnosis, admission during the last 12 months, the presence of other chronic diseases and levels of DK, SS and DSE. Variable or data sheets missing more than 10% of their data were excluded from the final analysis.

This study was approved by the Research and Ethics Committees of all participating hospitals as well as by the principal investigators' affiliated university (MoH/CSR/18/8997, MREC 1664). All participants received a clear, detailed explanation of the study procedures and their rights before being enrolled in the study. Additionally, participants voluntarily signed an informed consent form prior to data collection.

Result

A total of 240 individuals who met the eligibility criteria were approached. However, four participants were excluded because they had been diagnosed with mental retardation, 26 refused to participate and four did not complete the questionnaires. Therefore, the final sample size was 210 participants (response rate: 87.5%). The majority of participants were female (70.5%) and unemployed (64.8%). The mean age was 26.82 ± 8.25 years and the majority (65.2%) were 18–28 years old. About half of the participants were single (52.8%), living in Muscat Governorate (49.0%) and had a secondary school education or lower (51.4%). Most of the participants (69.0%) had had a DM diagnosis for more than five years (range: 5.1–32.0 years) and had not been admitted to hospital in the last 12 months (71.4%). The majority of the participants had a family history of DM (74.8%) but had no history of other chronic diseases (77.1%). In addition, most (36.2%) had poor glycaemic control [Table 1].

The DSM mean score was compared across different sociodemographic characteristics. The mean DSM of participants who reported having other chronic diseases along with their DM was higher (7.2 ± 1.1) than in those without other chronic diseases (6.7 ± 1.4; $P = 0.02$). The DSM mean scores were also higher among participants who had more than one family member working as a healthcare professional (7.5 ± 1.3) compared to participants who had just one family member working in healthcare (6.5 ± 1.4; $P = 0.03$) or who did not have any family members in healthcare (6.8 ± 1.3; $P < 0.01$). Furthermore, DSM levels were statistically significant across HbA1c categories; the DSM mean score for participants with good glycaemic control (7.2 ± 1.3) was higher compared to those with poor glycaemic control (6.5 ± 1.4; $P = 0.02$). There were no statistically significant differences in mean DSM across other sociodemographic characteristics [Table 1].

The mean DSM score across the sample was 6.8 ± 1.4, which is 68% of the DSM scale's total maximum score of 10. The mean DSE score was 27.6 ± 4.5, which is 69% of the DSE scale's total maximum score of 40. The mean score for SS was 53.0 ± 15.7, which is 53% of the MOS-SS maximum score of 95. The mean score on the DKT was 16.0 ± 3.2, which is 69.6% of the DKT's maximum score of 23. Of the total number of participants, 53 (25.2%) scored ≤14 on DK. Finally, participants' mean glycaemic control value was 8.6 ± 2.5 [Table 2].

A statistically significant positive correlation was found between participants' DSM and DSE ($r = 0.265$; $P < 0.01$), SS ($r = 0.268$; $P < 0.01$), DK ($r = 0.151$; $P < 0.05$) and glycaemic control values ($r = -0.190$; $P < 0.01$) [Table 3].

Finally, a model testing multicollinearity was statistically significant with five predictors of DSM ($F[13,196] = 3.857$; $P < 0.001$) with an R^2 of 0.20 and an adjusted R^2 of 0.15 with no evidence of multicollinearity within the variables in the model. The results suggest that after controlling other variables in the model, participants who were employed had

Table 1: Characteristics of patients with type one diabetes mellitus in Oman (N = 210)

Variable	n (%)	Mean DSM value ± SD	*P* value
Gender			
Male	62 (29.5)	6.5 ± 1.3	0.07
Female	148 (70.5)	6.9 ± 1.4	
Employment status			
Employed	74 (35.2)	6.7 (1.4)	0.06
Unemployed	136 (64.8)	7.1 (1.4)	
Age in years			
18–28	137 (65.2)	6.7 ± 1.4	0.40
29–39	52 (24.8)	7.0 ± 1.4	
40–48	21 (10)	6.8 ± 1.3	
Marital status			
Single	111 (52.8)	6.7 ± 1.4	0.20
Married	97 (46.2)	7.0 ± 1.3	
Widowed	2 (1.0)	6.9 ± 1.2	
Level of education			
Secondary or less	108 (51.4)	6.8 ± 1.4	0.90
Diploma or higher	102 (48.6)	6.8 ± 1.4	
Monthly income in OMR			
<300	30 (14.3)	7.0 ± 1.3	0.41
300–1000	122 (58.1)	6.8 ± 1.3	
>1000	58 (27.6)	6.6 ± 1.5	
Time since DM diagnosis in years			
0–3	39 (18.6)	6.6 ± 1.5	0.90
3.1–5	26 (12.4)	6.8 ± 1.4	
5.1–32.0	145 (69.0)	6.9 ± 1.4	
Reason for hospital admission in the last 12 months			
No admission	150 (71.4)	6.9 ± 1.4	0.72
Hyperglycaemia	42 (20.0)	6.7 ± 1.3	
Hypoglycaemia	6 (2.9)	6.3 ± 1.6	
Other	12 (5.7)	6.9 ± 1.1	
Other chronic diseases			
No	162 (77.1)	6.7 ± 1.4	0.02
Yes	48 (22.9)	7.2 ± 1.1	
DM complication			
None	143 (68.1)	6.8 ± 1.4	0.8
Vision	52 (24.8)	7.0 ± 1.3	
Kidney	4 (1.9)	6.8 ± 0.7	
Other	11 (5.2)	6.6 ± 0.9	
Family member with DM			
No	53 (25.2)	6.7 ± 1.6	0.70
Yes	157 (74.8)	6.8 ± 1.3	
Family member(s) who are healthcare professionals			
None	126 (60.0)	6.8 ± 1.3	<0.01
One	58 (27.6)	6.5 ± 1.4	
More than one	26 (12.4)	7.5 ± 1.3	
Glycaemic control*			
Good (<7%)	64 (30.5)	7.2 ± 1.3	0.02
Medium (7–9%)	70 (33.3)	6.8 ± 1.3	
Poor (>9%)	76 (36.2)	6.5 ± 1.4	

DSM = diabetes self-management; SD = standard deviation; OMR = Omani riyal, DM = diabetes mellitus.

**Glycaemic control as a measurement of percentage glycosylated haemoglobin.*

Table 2: Descriptive statistics of participants' levels of diabetes self-management, self-efficacy, social support, diabetes knowledge and glycaemic control (N = 210)

Variable	Mean ± SD	Q1	Median	Q3
DSM	6.8 ± 1.4	6.0	6.9	7.7
DSE	27.6 ± 4.5	25.5	28.5	30.5
SS	53.0 ± 15.7	45.8	57.0	66.0
DK	16.0 ± 3.2	14.0	16.0	18.0
Glycaemic control*	8.6 ± 2.5	6.5	8.2	9.9

SD = Standard Deviation; Q1= 25th percentile; Median = 50th percentile; Q3= 75th percentile; DSM = diabetes self-management; DSE = diabetes self-efficacy; SS = social support; DK = diabetes knowledge.

**Glycaemic control as a measurement of percentage glycosylated haemoglobin.*

Table 3: Pearson's correlation between diabetes self-management and other continuous variables

Variable	DSM	DSE	SS	DK	Glycaemic control‡
DSM	-	-	-	-	-
DSE	0.265*	-	-	-	-
SS	0.268*	0.319*	-	-	-
DK	0.151†	0.187*	0.179*	-	-
Glycaemic control‡	−0.190*	−0.086	0.039	−0.153†	-

DSM = diabetes self-management; DSE = diabetes self-efficacy; SS = social support; DK = diabetes knowledge; HbA1c = glycosylated haemoglobin.

**Pearson correlation significant at P <0.01; †Pearson correlation significant at P <0.05; ‡Glycaemic control as a measurement of percentage glycosylated haemoglobin.*

Table 4: Multiple linear regression analysis for various potential predictor of diabetes self-management

Variables*	Unstandardised Coefficients		Standardised Beta	*P* value
	Beta	SE		
(Constant)	4.685	0.890		<0.001
Age	0.000	0.016	-0.003	0.979
Gender	0.354	0.202	0.117	0.082
Marital status	0.133	0.255	0.048	0.602
Level of education	0.145	0.195	0.053	0.522
Employment status	0.476	0.241	0.166	0.049†
Middle income	–0.366	0.277	–0.132	0.188
High income	–0.780	0.315	–0.254	0.014†
Time since DM diagnosis	0.014	0.017	0.062	0.419
Admission to hospital in last 12 months	0.010	0.203	0.003	0.963
Other chronic diseases	0.475	0.216	0.145	0.029†
DK	0.058	0.030	0.135	0.056
SS	0.489	0.175	0.192	0.006†
DSE	0.063	0.021	0.209	0.003†

SE = standard error; DM = diabetes mellitus; DK = diabetes knowledge; SS = social support; DSE = diabetes self-efficacy.

**Gender = male versus female; marital status = married versus single; employment status = employed versus unemployed; level of education = secondary or less versus diploma or higher; middle income = monthly income of 301–1000 Omani Rial (OMR); high income = monthly income of >1000 OMR; chronic disease = no versus yes; †Statistically significant predictors of DSM at P <0.05.*

significantly higher DSM compared with those who were unemployed (B = 0.166; *P* = 0.049). Participants with incomes of more than 1,000 Omani Rial per month demonstrated lower DSM compared to those with middle or low incomes (B = –0.254; *P* = 0.014). Furthermore, participants with other chronic diseases demonstrated significantly higher DSM (B = 0.145; *P* = 0.029) after controlling for other variables. Participants with high SS also demonstrated significantly higher DSM (B = 0.192; *P* = 0.006) compared to those with lower levels of SS after controlling for other variables. Lastly, participants with high DSE demonstrated significantly higher DSM (B = 0.209; *P* = 0.003) after controlling for other variables [Table 4].

Discussion

The goal of DSM is to achieve optimal glycaemic control, hence preventing or delaying the onset of DM complications and improving QOL.[20] This study's findings suggest that a significant number of Omanis with T1DM may have suboptimal levels of DSM. Although no previous studies have been done among Omanis with T1DM, previous studies of Omanis with T2DM reported similar findings.[4,20] For example, Alrahbi found a mean DSM score of 174.5 ± 22.4 (out of a possible score of 240) among Omanis with T2DM, representing 73% of the maximum possible DSM score.[20] Similarly, Elliot *et al*. reported that, in a sample of 309 Omanis with T2DM, the DSM and education mean score was 5.0 ± 2.3 out of 10.4 The findings from the current study and previous studies suggest that the issue of DSM for both T1DM and T2DM patients in Oman needs more attention because DSM in Oman continues to be suboptimal across potentially large swaths of the country's population.

The current study suggests that Omanis with T1DM who have been diagnosed with other chronic diseases have higher levels of DSM than those without other chronic disease. This may be due to individuals with DM who are affected by other chronic diseases become afraid of the progression or worsening of their condition and become more aware of the required lifestyle modifications. Broadbent *et al*. reported that having one or more diseases significantly influenced the individual's lifestyle and improved behavioural changes.[21] Furthermore, a study by Abubakari *et al*. showed that diabetic individuals with kidney problem perceived greater consequences and threats as well as greater understanding and adherence to diabetes management than those without kidney disease.[22] In addition, diabetic individuals with other chronic diseases will have more follow-up in diabetes as well as other speciality clinics, which means those patients will be closely monitoring and enforcing their self-management behaviours.[23] The literature shows that individuals with DM and other chronic illnesses tend to pursue more follow-up in DM clinics and other specialty clinics; healthcare professionals must pay closer attention to their monitoring and self-management behaviours.[23]

The current study also revealed a positive significant relationship between DSM and DSE, SS and DK. Participants with higher DSE were more likely to have optimal DSM. This finding is congruent with those of other studies which have shown that diabetics with high DSE are more likely to optimise DSM.[22,24–27]

Self-efficacy is a cognitive concept that reflects an individual's propensity and motivation to activate, perform and persist in performing certain behaviours even in the event of difficulties.[28] The relationship between DSM and self-efficacy is reciprocal. A previous study revealed that people with DM who adhere to DSM activities become more confident in performing the required activities, leading to better glycaemic control.[29] The results of the current study also suggest that participants with high SS have better DSM; similar findings have been reported among Omanis with T2DM.[14] This finding is not surprising as other studies have shown that involving partners, friends and couples in a person's DM care is associated with better DSM.[30–32] A previous study of Omanis with T2DM reported that they received various forms of support and assistance from family members and relatives including help with daily DM management, reminders about glucose monitoring and medications and companionship on walks.[20]

The current findings show that participants with higher levels of DK report higher DSM. Effective self-management requires people with DM to be equipped with the relevant knowledge and skills to enable them to perform required daily self-care such as blood glucose monitoring, exercise, diet and medication preparation and administration.[11,31] A previous study of Omanis with T2DM found that participants who received DM education had greater knowledge of DM and a higher DSM score; in addition, they had higher compliance levels with glycaemic control activities than those who did not receive the same education.[4]

The results from the current study indicate that employed participants had better DSM compared to unemployed participants. Similar results have been reported among Omanis with T2DM.[14] Alrahbi explained that employed Omanis have higher levels of education which mediates DSM behaviours.[14] This explanation is also valid for the current study as 66% of the employed participants had higher educational levels compared to 39% of unemployed participants.

This study also found monthly income to be a significant predictor of DSM. Interestingly, after controlling for other variables, high monthly income was associated with lower levels of DSM compared to individuals with low incomes. This finding was inconsistent with a previous study which found higher income to be associated with better DSM.[13] In the Omani context, higher incomes may increase the chance and frequency of eating in public restaurants including fast food chains and participating in leisure activities that may negatively affect DSM behaviours. Finally, the present study found that DSE and SS were both significant predictors of DSM. These findings were similar to those of other studies.[22,33]

Although the current study can be considered a pioneering study of Omani adults with T1DM, it was subject to certain limitations. For example, this study utilised a cross-sectional design and participants had a wide range of time since their T1DM diagnosis (range: 1–48.0 years). Studying DSM using a longitudinal approach could lead to a better understanding of how DSM develops and evolves as the disease progresses. Although the participants from the current study were from different regions in Oman and most likely were representative of the Omani population, sampling bias could have occurred because some of the sample subgroups were not equally distributed. Future studies, therefore, should take into consideration the fact that comparisons of DSM across different subgroups were made in the current study but the subgroups were likely not equally distributed; selection bias at the subgroup level may exist and may have affected the results. Finally, although this study utilised the clinical marker HbA1c as an outcome indicator of DSM, this study was unable to link HbA1c with DM complications. Future research should consider the association of DSM and short- and long-term complications.

Conclusion

This study explored DSM as a critical aspect of DM care and found that Omanis with T1DM have suboptimal DSM levels. This study provides insight to clinicians, researchers and healthcare educators about factors that are associated with DSM among Omanis with T1DM. Modifiable factors such as DK, DSE and SS should be targeted by interventions from different healthcare professionals to enhance DSM. Awareness of such factors is likely to improve patient care and offer further direction for future DM research in Oman.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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