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

*Rajaa Al-Hadhrami,1 Omar Al-Rawajfah,2 Joshua Muliira3

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.
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 Omani 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.\(^5,10\) 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 Omani 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 Omani 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:

\[ n = \frac{N}{1 + N \epsilon^2} \]  

Where \( N \) is the population size and \( \epsilon \) 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. The “enter selection” method was used to exclude variables that were not significant.

**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% of the DSE scale’s total 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          |         |

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

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 ± 3.2| 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.
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 Omani with T1DM, previous studies of Omani 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 Omani with T2DM, representing 73% of the maximum possible DSM score.20 Similarly, Elliot et al. reported that, in a sample of 309 Omani 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 Omani 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 DM clinics as well as other specialty 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

| Variables | Unstandardised Coefficients | Standardised Beta | P value |
|-----------|-----------------------------|-------------------|---------|
| (Constant) | 4.685                        | 0.890             | <0.001  |
| Age       | 0.000                        | 0.016             | 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.
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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