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Original article

Self-efficacy and self-care behaviours among adults with type 2 diabetes

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ABSTRACT

Background: Type 2 Diabetes Mellitus (T2DM) has an impact on an individuals' health and is influenced by glycemic control.
Aim: To examine the relationship between glycemic control, demographic and clinical factors on self-efficacy and self-care behaviours among adults with T2DM.
Design: A correlational, descriptive study was used. One hundred and forty Omani adults with T2DM were recruited from a public hospital.
Methods: Data on self-efficacy, self-care behaviours and glycemic control were collected between April and July 2016. The study was approved by the College Ethics Committee and Hospital Board. Bivariate and multivariate analyses were conducted.
Results: Most adults had a fasting blood glucose >7.2 mmol/L (90.7%), with the majority demonstrating 'uncontrolled' or poor HbA1c of >8% (65%). Variance of self-care behaviour (20.6%) and 31.3% of the variance of the self-efficacy was explained by the age, duration of diabetes, medication, HbA1c and prevention of activities of living.
Conclusions: Adults with T2DM with poor glycemic control were more probable to have poor self-efficacy and self-care behaviours. Glycemic control has an effect on improving diet, exercise, medication, foot care efficacy and behaviours.
Clinical relevance: The study recommends using these findings to plan self-efficacy and self-care behaviour to improve glycemic control among adults with T2DM.

1. Introduction

Type 2 diabetes mellitus (T2DM) is caused by body's lack of ability to produce or use insulin and is related to aging, obesity, impaired glucose metabolism and physical inactivity. Uncontrolled diabetes mellitus (DM) is linked with long-term complications (Zhang, Chen, & Chen, 2008). Globally, it is projected that the number of adults with T2DM will significantly increase, with >80% of these adults from developing countries (Wild et al., 2004). In the Sultanate of Oman, the prevalence of T2DM increased from 12.2% of the population in 1991 to 16.1% in 2000 (Al-Lawati et al., 2012). The mortality due to diabetes complications in age group 20–79 years was 1213.75 in Oman (Guariguata et al., 2014; Whiting et al., 2011). The mean diabetes-related expenditure per person was high (863.21 USD) (Ministry of Health, 2014), yet the diabetes outcomes were poor in Oman as 2.4% of them achieved control of HbA1C (<7%) (Ministry of Health, 2014). Most studies in T2DM in Western countries have focused on improvements in glycated hemoglobin (HbA1c), fewer hospitalizations, lower healthcare costs, and quality-of-life (Foster et al., 2007; Lorig et al., 2009).

Adults with T2DM with limited knowledge were less likely to practice diabetes self-management (Ayele et al., 2012) and problem solving (Shim et al., 2012). However, adults who acquire knowledge about the disease are unlikely to alter behaviour (Sharoni & Wu, 2012; Shi, Ostwald, & Wang, 2010). Many factors may influence glycemic control including education status, employment (Ayele et al., 2012; Venkataraman et al., 2012; Yoo et al., 2011), health literacy (Jahanlou & Alishan Karami, 2011; Venkataraman et al., 2012), family and social

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support, positive mental attitude (Venkataraman et al., 2012), severity of diabetes and perceived barriers (Ayele et al., 2012; Chin, Huang, & Hsu, 2013; King et al., 2010), provider-patient communication (Gao et al., 2013) and social support (Osborn & Egede, 2010; Yoo et al., 2011). There is no documented study on the impact of glycemic control on self-efficacy and self-care behaviour among adults with T2DM in Oman. Secondly, understanding the factors that affect glycemic control among adults with T2DM in Oman will help to recommend tailored self-efficacy interventions.

It is hypothesized that glycemic control and demographic and clinical characteristics influence self-efficacy and self-care behaviours based on the self-efficacy model (Fig. 1). Perceived self-efficacy (confidence in ability) is 'an adult's beliefs about their capabilities to do what it takes to reach a specific goal' (Bandura, 1977). Self-efficacy and outcome expectation (belief that behaviour will have the desired effect) influence behaviour change (Bandura, 1995). Adults with T2DM may have adequate control over and adhere to self-management (Ott et al., 2000; van der Heijden et al., 2013). Understanding the relationships between demographic, clinical characteristics and glycemic control on self-efficacy and self-care behaviours among adults with T2DM is important to plan effective self-efficacy programs.

The aim of the study was to examine the relationship between demographic, clinical factors, and glycemic control on self-efficacy and self-care behaviours among adults with T2DM.

2. Method

2.1. Participants

The Sultanate of Oman is located in the Middle East and has an estimated total population of 2,172,002 million (Ministry of Health, 2014). Adults with T2DM registered at the diabetes clinics at a public hospital, were invited to participate in the study across four months April–July in 2016. The sampling framework was obtained from the electronic patient records maintained in the hospital information system. All the participants who volunteered for the study were screened for the inclusion criteria. Adults aged 18 to 80 years, diagnosed with T2DM with a duration of >2 years, able to provide self-care, communicate and converse in Arabic or English language were included in the study. Adults who were newly diagnosed with T2DM, or known Type 1 Diabetes Mellitus, cognitive/speech impairment using mini-mental status examination, diagnosed mental and/or physical disabilities were excluded from the study.

2.1.1. Sample size

A power analysis was conducted using Cohen's power table for a two-group comparison (Cohen, 1992). A total of 160 adults were required to achieve 80% power to detect a medium effect size ($f = 0.25$), at the 5% level of significance (α) with a standard deviation of 1% (Amsberg et al., 2009). One hundred sixty participants were recruited using simple random sampling and random numbers among 1–2000 generated in Microsoft Excel software.

2.2. Research design

This is a descriptive, cross-sectional design used to assess glycemic control on self-efficacy and self-care behaviours among adults with Type 2 Diabetes.

2.3. Measures

Based on the conceptual framework and aims of the study standardized measurements were used to assess the person, efficacy expectations, outcome expectations and outcome.

2.3.1. Sample characteristics

According to the self-efficacy model, the 'Person' is measured in terms of demographic, clinical and psychological characteristics. *Demographic characteristics* included age, gender, years of formal education, and income. *Clinical characteristics* included duration of diagnosis, diabetes education, and compliance to medications (insulin and oral hypoglycemic agents). *Psychological factors* like diabetes (DM) prevention from doing normal activities of daily living, understanding of diabetes

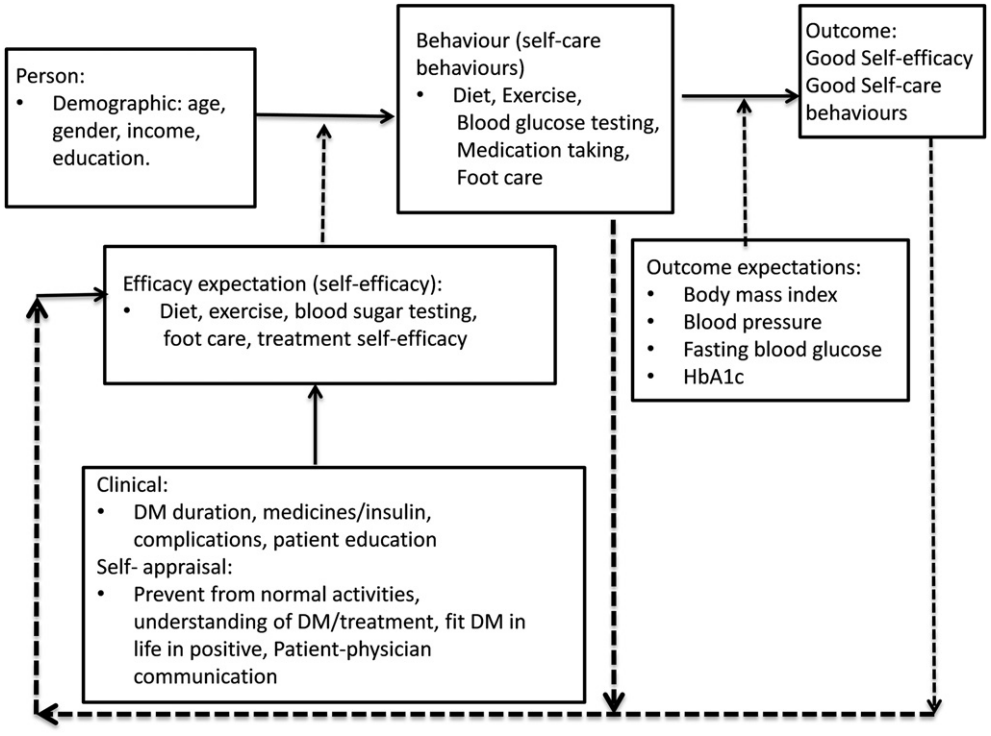

Fig. 1. Self-efficacy and self-care behaviours among adults with the type 2 diabetes. Measured in study (Bandura, 1995; Shortridge-Baggett & Van der Bijl 1996).

(DM) and its treatment, ability to fit diabetes (DM) into life in a positive manner, and patient-physician communication were included.

2.3.2. Efficacy expectations

They are measured in terms of perception of self-efficacy and self-care behaviours using validated tools. *Perception of Self-Efficacy* (*SE*) was measured using the Diabetes Management Self-Efficacy Scale (DMSES). It consists of a 20-item summated rating scale using a 5-point Likert response format to measure the perception of self-efficacy (SE) to control DM (Kara et al., 2006; Vivienne Wu et al., 2014). These five self-management subscales characterize diet or nutrition self-efficacy, exercise self-efficacy, blood glucose testing and control, foot care self-efficacy and medical treatment self-efficacy. Participants rate their confidence using a scale ranging from 0 (can't do at all) to 10 (certain can do). Possible total scores range from 0 to 200, with higher total and sub-scale scores reflecting higher self-efficacy. The internal consistency ($\alpha = 0.81$) and test–retest reliability ($r = 0.79$) of the DMSES English version was acceptable. Internal consistency reliability of the DMSE Arabic version was 0.91 (Al-Khawaldeh, Al-Hassan, & Froelicher, 2012). In this study the Cronbach (alpha) coefficients for the five sub-Scales of the SE were 0.76, 0.78, 0.81, 0.88 and 0.93 and the overall SE score was 0.84.

Perception of Self-Care Behaviour (*SCB*) was measured by the revised Summary of Diabetes Self-care Activities Scale (SDSCA) (Glasgow, Toobert, & Gillette, 2001; Toobert, Hampson, & Glasgow, 2000). It is a self-report of the frequency of performing 13 self-management behaviours with six subscales including diet, exercise, blood glucose testing, medication taking, and foot care. Scoring for the SDSCA Scale is calculated with, the mean number of days for each subscale; higher scores indicated a higher level of DSM performance. The internal consistency using Cronbach's alpha ($\alpha = 0.80$), test–retest reliability ($r = 0.75$–0.84) and has high validity for the SDSCA (Toobert et al., 2000). Internal consistency reliability of SDSCA–Arabic was 0.81 (Al-Khawaldeh et al., 2012). In this study Cronbach's (alpha) coefficients for the six sub-Scales SCA were 0.74, 0.77, 0.82, 0.87, 0.93 and 0.96 and the overall SCA score was 0.86.

2.3.3. Outcome expectations

They are measured as body mass index (BMI), blood pressure and fasting blood glucose. BMI is defined as underweight <18.5 (low), normal range 18.5–24.9 (average), overweight (≥25.0) and obese (≥30.0) (World Health Organization, 2014). Blood pressure categories are normal (<119/80 mm Hg), pre-hypertension (120–139/80–89 mm Hg), (140–159/90–99 mm Hg), high blood pressure stage 2 (>160/100 mm Hg) and hypertensive crisis (>180/110 mm Hg) (Alberti et al., 2009; Grundy et al., 2004). Fasting blood glucose (FBS) levels were measured as 'below 3.5 mmol/L' (or 70–130 mg/dL or 3.9–7.2 mmol/L), post-prandial < 180 mg/dL (10 mmol/L) and bedtime is 90–150 mg/dL (5–8.3 mmol/L) (American Diabetes Association, 2014). Glycemic control or glycosylated hemoglobin (HbA1c). HbA1c value was categorized into a dichotomous variable: 'controlled' defined as a (good glycemic control), if HbA1c value are less than or equal to 7% or 'uncontrolled' defined as HbA1c values of >7.01% (Rodbard et al., 2009). Blood was drawn at the clinic by the registered nurses at point of care testing. The HbA1c were analyzed using a high-performance chromatography (colorimetric) method (Bio-Rad).

2.3.4. Outcomes

They are measured in terms of self-efficacy and self-care behaviours using validated tools.

2.4. Procedure

The standardized questionnaires were translated to Arabic language and back-translated into English by a bi-linguistic to check its semantic equivalence. These tools were pretested among 20 selected participants using the inclusion criteria in the hospital. Questionnaires were found to be adequate, feasible and appropriate for the participants in the final study. Study information was provided through invitation letters communicated to the diabetes clinic doctors and diabetes nurse. Recruitment of participants was completed with the nurse educator in the diabetes clinic who scheduled the visits after identifying the eligibility criteria. Each selected participant was given to a copy of the information sheet and informed written and verbal consent form and an appointment for the study. Data were collected between April and July in 2016 using face-to-face interview method by the research assistants. Two research assistants qualified with BSc Nursing and practicing as registered nurses in the hospital were selected and trained for two weeks in the study.

2.4.1. Ethical considerations

The study was approved by the College Ethics Committee and Hospital Board. Informed written and verbal consent was obtained from all participants. The risks to the participants were minimal. Study information packet explained the purpose of the study, risks and benefits of participation, protocol, and instructions for withdrawal from the study at any time. Participants were provided privacy and confidentiality. Data files were kept in locked cabinets in the research office. HbA1c was collected separately and double blinded at data entry. All data was stored in the computer required secure user identification and password. Results were shared only as summary data with no individual participants identified.

2.4.2. Analysis

The Statistical Packages for Social Sciences (SPSS version 22) was used for double data entry, data cleaning, coding and audited for accuracy. The level of probability of <0.05 was considered statistically significant. Collinearity checks were undertaken using a correlation matrix and examining Pearson coefficients. Descriptive summaries (for categorical variables) of demographic, clinical characteristics and psychological factors were done using frequencies, and percentages. ANOVA, Multivariate General Linear Model and General Linear Model were used to assess the relationship of HbA1c on self-efficacy and self-care behaviour.

3. Results

To examine the relationship between demographic-clinical factors, and glycemic control on self-efficacy and self-care behaviours and among adults with T2DM as described in the self-efficacy model. A response rate of 87.5% (N = 140) was obtained among the adults who met the inclusion criteria and consented to participate in the study.

3.1. 'Person': demographic and clinical characteristics (Table 1)

An equal proportion of the adults had primary/high school (45%) and university education (45.7%) (Table 1). Some of the participants had body mass index (>25 kg/m^2) of 41.4%. Majority of the adults had a fasting blood glucose >7 mmol/L (90.7%), and 65% of the adults had uncontrolled HbA1c (>7.01%).

3.2. 'Efficacy expectation and behaviour': self-care behaviours (Table 2)

The highest total mean (x) and standard deviation (sd) for the self-care behaviours among the adults with T2DM was for total foot care mean (x = 4.14, sd = 1.51) and total diet mean (x = 3.85, sd = 0.82) (Table 2).

Table 1
Demographic and clinical characteristics among adults with type 2 diabetes N = 140.

	Variables	Categories	Frequency	Percent
Demographic	Gender	Male	91	65.0
		Female	49	35.0
	Age (years)	30–39 years	11	7.9
		40–49 years	37	26.4
		50–59 years	68	48.6
		>60 years	24	17.1
	Income (in Omani Riyals/OR)	<500 OR	60	42.9
		501–1000 OR	73	52.1
		1001–1500 OR	5	3.6
		1501–2000 OR	2	1.4
	Education	No schooling	13	9.3
		Primary/High school	63	45.0
		Bachelors/Master degree	64	45.7
Clinical	Duration of diabetes (years)	<4 years	52	37.1
		5 to 10 years	62	44.3
		10 to 15 years	18	12.9
		>15 years	8	5.7
	Diabetes education	No	81	57.9
		Yes	59	42.1
	Medication	Insulin and OHA	38	27.1
		Oral hypoglycemic (OHA)	102	72.9
	Body mass index (kg/m^2)	<18.5 kg/m^2	1	0.7
		18.5–24.9 kg/m^2	50	35.7
		>25 kg/m^2	58	41.4
		>30 kg/m^2	31	22.1
	Blood pressure (mm Hg)	<119/80 mm Hg	2	1.4
		120–139/80–89 mm Hg	91	65.0
		140–159/90–99 mm Hg	44	31.4
		>160/100 mm Hg	3	2.1
	Fasting blood glucose (mmol/L)	<7.2 mmol/L	13	9.3
		>7.2 mmol/L	127	90.7
	HbA1c (%)	≤7%	3	2.1
		7.01–7.99%	46	32.9
		≥8%	91	65.0
Psychological	Preventing normal activities of living	Low	13	9.3
		Moderate	120	85.7
		High	7	5.0
	Understanding diabetes and treatment	Low	9	6.4
		Moderate	125	89.3
		High	6	4.3
	Fitting diabetes into life in a positive manner	Low	5	3.6
		Moderate	127	90.7
		High	8	5.7
	Patient-physician communication	Low	1	0.7
		Moderate	129	92.1
		High	10	7.1

3.3. 'Efficacy expectation and behaviour': self-efficacy (Table 2)

The highest self-efficacy among the adults with T2D was for total foot care mean (x = 5.32, sd = 2.26) and medication taking mean (x = 5.29, sd = 2.14) (Table 2).

3.4. Association between demographic, clinical characteristics and self-care behaviours (Table 3)

H1. There is no significant difference on the level of self-care behaviours (SCB) and demographic and clinical characteristics.

Diet was significantly correlated with gender, fasting blood glucose, HbA1, ability to fit diabetes in life in a positive manner (p = 0.000) and patient-physician communication (p = 0.026) (Table 3). Exercise was significantly correlated with duration of diabetes, diabetes education program (p = 0.050), and fasting blood glucose.

3.5. Association between demographic-clinical characteristics and self-efficacy (Table 3)

H2. There is no significant relationship between self-efficacy (SE), demographic and clinical characteristics.

Fasting blood glucose, HbA1c, understanding diabetes and its treatment, prevention of normal daily activities, ability to fit diabetes life in a positive manner and patient-physician communication were highly significant (p = 0.000) with diet, exercise, blood glucose testing, foot care as well as medications self-efficacy.

3.6. Outcome and outcome expectations: effect on self-efficacy and self-care behaviours

3.6.1. Multivariate General Linear Model (Wilk's Lambda) (Table 4)

Age, duration of diabetes, prevention of activities of daily living, education, medication and HbA1c were highly influencing self-care behaviours and self-efficacy among adults with T2DM (Table 4).

3.6.2. General Linear Model (Table 5)

Age, duration of diabetes, prevention of activities of daily living, medication, and HbA1c were significantly correlated with self-efficacy and self-care behaviour scores (Table 4). Adults who perceived physical activity to be important were more likely to report increase exercise, compared to those adults who perceived that lack of importance to avoid fatty foods or eat less. Age, duration, prevention of activities of daily living, compliance with medication, ability to fit diabetes into life in a positive manner, patient-physician communication, and HbA1c are highly significant with self-efficacy scores. Twenty percent of the variance of self-care behaviour and 31.3% of the variance of the self-efficacy was explained by age, duration of diabetes, prevention of normal activities, education, medication, and HbA1c (Table 5).

4. Discussion

This study measured self-report of self-efficacy and self-care behaviours using a Likert-scale among a small sample size which raises reliability issues. It is difficult to infer that multi-factorial variables like self-efficacy and SCB scores.

4.1. Demographic and clinical characteristics

Low levels of perceived self-efficacy, a moderate understanding of diabetes and its treatment, moderate-level of prevention from doing normal daily activities and ability to fit diabetes into life in a positive manner have contributed to higher levels of glycemic control among adults with T2DM. Increased duration of diabetes increases exposure and experience for practicing SCB. Those adults with T2DM with higher age, education level, income, longer duration of diabetes (Xu, Pan, & Liu, 2010), and with increased attention to exercise, good patient-physician communication (Gao et al., 2013; Yoo et al., 2011) and higher understanding of diabetes (Zulman et al., 2012) were more likely to perform better self-care behaviours. Self-efficacy was influenced by the duration of illness, medication, education, exercise, positive attitude and family support (Venkataraman et al., 2012) and diabetes education (King et al., 2010; Mishali, Omer, & Heymann, 2011; Osborn & Egede, 2010).

4.1.1. Diet efficacy

Some adults with T2DM who had high ability to fit diabetes into life in a positive manner, high patient-physician communication (PPC) and

Table 2
Description of self-care behaviours and self-efficacy among adults with type 2 diabetes N = 140.

Self-care behaviours	Mean (standard deviation)	Self-efficacy	Mean (standard deviation)
1. Followed a healthful eating plan	3.33 (1.29)	Check my blood sugar if necessary	4.56 (2.39)
2. Followed eating plan	3.41 (1.34)	Correct my blood sugar when the sugar level is too high (e.g. eat different food)	4.76 (2.33)
3. Have 2 to 3 servings of fruits	4.01 (1.45)	Correct my blood sugar when the blood sugar level is too low (e.g. eat different food)	4.81 (2.31)
4. Eat five or more servings of vegetables	4.50 (1.41)	Total Blood sugar testing and control self-efficacy	4.7119 (2.13)
5. Eat high fat foods such as red meat or full-fat dairy products	4.01 (1.60)	Choose the correct foods	4.81 (1.960)
6. Total diet self-care behaviours	3.85 (0.82)	Choose different foods and stick to a healthy eating pattern	4.75 (2.03)
7. Participate in at least 30 min of physical behaviour? (continuous behaviour, walking).	3.09 (1.62)	Keep my weight under control	4.35 (1.92)
8. Participate in a specific exercise session (swimming, walking, biking) other than what you do around the house or as part of your work	2.75 (1.54)	Adjust my eating plan when ill	4.74 (2.19)
9. Total Exercise self care behaviours	2.92 (1.36)	Follow a healthy eating pattern most of the time	4.56 (1.96)
10. Test your blood sugar	2.41 (1.69)	Follow a healthy eating pattern when I am away from home	4.40 (1.68)
11. Test your blood sugar the number of times recommended by your health care provider	2.58 (1.48)	Follow a healthy eating pattern when I am away from home	4.43 (1.75)
12. Total blood sugar testing and control	2.50 (1.48)	Follow a healthy eating pattern when I am on holiday	4.35 (1.72)
13. Check your feet	3.48 (1.91)	Follow a healthy eating pattern when I am eating out or at a party	4.30 (1.54)
14. Inspect the inside of your shoes	3.69 (1.88)	Adjust my eating plan when I am feeling stressed or anxious	4.57 (1.81)
15. Wash your feet	4.73 (1.77)	Total Diet or nutrition self-efficacy	4.5257 (1.44)
16. Dry between your toes	4.67 (1.79)	Examine my feet for cuts (foot care self-efficacy)	5.32 (2.26)
17. Total Foot care behaviours	4.14 (1.51)	Take enough exercise, e.g. walking the dog or riding a bicycle	4.39 (2.12)
18. Take your recommended insulin injections	1.98 (2.35)	Take more exercise if the doctor advises me to	4.51 (2.09)
19. Take your recommended number of diabetes pills	2.38 (2.63)	When taking more exercise I am able to adjust my eating plan	4.47 (2.08)
20. Total medication taking behaviours	2.18 (2.25)	Total exercise self-efficacy	4.4571 (1.96)
21.		Take my medication as prescribed	5.40 (2.395)
22.		Visit my doctor once a year to monitor my diabetes	5.34 (2.23)
23.		Adjust my medication when I am ill	5.15 (2.31)
24.		Total medical treatment self-efficacy	5.2952 (2.13)

moderate blood pressure had strong significance with diet self-care behaviour. Most regularly performed self-care behaviours were medication taking and dietary adherence (Al-Khawaldeh et al., 2012), and physical activity (King et al., 2010). Hence increased duration of diabetes (>15 years), patient education, regular intake of medication (insulin/OHA), normal body mass index (18.5–24.9 kg/m^2) have high significance for diet self-efficacy.

4.1.2. Medication efficacy

Higher mean scores in medication self-efficacy were found among adults with Bachelor/Master degree level of education, longer duration of diabetes (>15 years), compliance with medication (insulin/oral hypoglycemic agents) and low blood pressure (<119/80 mm Hg). Adherence to medications is freely available, easy, and accessible with confirmed effects. Medication, dietary adherence and self-efficacy were significantly associated with glycemic control (Venkataraman et al., 2012). Taking medications as prescribed had the highest adherence (Mashburn, 2012) and is associated to decrease insulin resistance or increase amount of insulin that the body produces (Rhee et al., 2005).

4.1.3. Exercise efficacy

Exercise efficacy was significantly correlated with duration of diabetes, diabetes education, and FBS among adults with T2DM. Exercise is a challenging as it requires higher awareness of types of exercise, access to gym, and walk-ways, time, energy, discipline and commitment. Higher exercise self-efficacy is associated with higher mean for age, high income or prior patient education. Adherence to moderate exercise increases glucose intake, oxygen consumption and decreases insulin resistance (Umpierre et al., 2011). Exercise levels increased with age, and education level (Xu et al., 2010), diabetes education (Yoo et al., 2011), duration of diabetes (Gao et al., 2013) and empowered with exercise, blood glucose testing, and medication taking (D'Souza et al., 2015a).

4.2. Effect of glycemic control on self-efficacy on self-care behaviours

Older adults with T2DM who had higher education, income and duration of diabetes had better self-efficacy and SCB. These older adults may give high priority for SCB indicating that duration of illness, education have adequate understanding of the illness for SCB. Adults with low self-efficacy in the self-care behaviours were younger than the other groups. Older men were more likely to follow diet; exercise and foot care higher education, income and social support reported better self-efficacy (Xu et al., 2010).

In this study increased duration of diabetes led to increased self-efficacy with medication, diet, exercise, because they have had a long history of practicing self-care behaviours. Adults with T2DM perceived stronger diet SE, blood glucose testing SE, and exercise SE and were most likely to have lower values of HbA1c. Adults with T2DM have to adjust medication to blood glucose, titrate insulin levels, manage dietary intake, levels of activity when making life-style behaviours and choices to achieve glycemic control. Most important predictors were diet efficacy, dietary SCB, lower HbA1c (Al-Khawaldeh et al., 2012), higher education, confidence in blood testing and control, diet, exercise, foot care, medications (Choi et al., 2011) were consistent with other studies indicated higher SE (D'Souza et al., 2015b). High self-efficacy is achieved through monitoring and adjustments in insulin delivery, dietary intake, and physical exercise (Ayele et al., 2012; Chiu & Wray, 2011; French, Wade, & Farmer, 2013; Wu et al., 2013), self-care behaviours (Sharoni & Wu, 2012; Shi et al., 2010; Venkataraman et al., 2012;

Table 3
Association between demographic-clinical characteristics and self-care behaviours as well as self-efficacy N = 140.

Characteristics	ANOVA	Self-care behaviours					Self-efficacy				
		Diet	Exercise	Blood sugar	Foot care	Medication	Diet	Exercise	Blood sugar	Foot care	Medication
1. Gender	F	3.507	0.039	3.376	1.538	0.280	0.112	0.209	1.511	8.457	0.120
	Sig.	0.050*	0.844	0.050*	0.217	0.598	0.738	0.649	0.221	0.004*	0.729
2. Age	F	1.817	1.327	0.997	1.470	0.453	1.241	2.777	2.670	1.155	1.745
	Sig.	0.147	0.268	0.396	0.225	0.716	0.297	0.044*	0.050*	0.329	0.161
3. Income	F	0.582	0.247	0.789	0.930	0.214	0.807	3.393	0.843	3.119	0.337
	Sig.	0.628	0.863	0.502	0.428	0.886	0.492	0.020*	0.473	0.028*	0.798
4. Education	F	0.711	1.220	1.760	0.518	10.140	0.131	1.538	1.394	0.598	0.897
	Sig.	0.493	0.298	0.176	0.597	0.000*	0.877	0.218	0.252	0.551	0.041*
5. Duration	F	1.787	2.411	2.128	2.489	3.516	2.793	1.319	0.219	3.267	2.763
	Sig.	0.153	0.050*	0.100*	0.050*	0.017*	0.043*	0.271	0.883	0.023*	0.044*
6. Diabetes education	F	0.262	2.975	0.358	0.414	0.213	4.834	4.841	1.579	0.701	2.489
	Sig.	0.770	0.050*	0.700	0.662	0.809	0.009*	0.009*	0.210	0.498	0.050*
7. Medication	F	0.711	1.220	1.760	0.518	10.140	6.280	1.426	3.203	2.507	7.496
	Sig.	0.493	0.298	0.176	0.597	0.000*	0.01*	0.234	0.050*	0.116	0.007*
8. Body mass index	F	0.737	1.617	0.197	0.236	0.766	3.222	1.613	1.345	1.561	0.535
	Sig.	0.532	0.188	0.898	0.871	0.515	0.025*	0.189	0.263	0.202	0.659
9. Blood pressure	F	2.005	1.758	1.690	1.056	3.091	1.309	0.827	1.992	1.995	3.476
	Sig.	0.116	0.158	0.172	0.370	0.029*	0.274	0.481	0.118	0.118	0.018*
10. Fasting blood glucose	F	2.849	3.013	6.908	3.910	26.572	22.348	22.528	49.494	31.990	20.533
	Sig.	0.050*	0.050*	0.010*	0.050*	0.000*	0.000*	0.000*	0.000*	0.000*	0.00*
11. HbA1c	F	0.344	0.927	0.312	0.334	0.572	22.348	22.528	49.494	31.990	20.533
	Sig.	0.040*	0.398	0.050*	0.717	0.566	0.000*	0.000*	0.000*	0.000*	0.000*
12. Understand diabetes treatment	F	0.952	0.489	0.558	2.938	10.135	10.215	7.490	9.753	16.227	10.531
	Sig.	0.389	0.615	0.573	0.050*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
13. Prevent from doing normal daily behaviours	F	1.829	0.396	3.680	4.458	16.236	24.116	15.735	23.279	29.599	24.750
	Sig.	0.165	0.674	0.028*	0.013*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
14. Ability to fit diabetes into life in a positive manner	F	10.612	1.679	3.765	4.804	5.117	10.551	4.265	14.430	22.455	11.187
	Sig.	0.000*	0.190	0.026*	0.010*	0.007*	0.000*	0.000*	0.000*	0.000*	0.000*
15. Patient-physician communication	F	3.731	1.799	0.449	3.676	0.413	1.315	5.439	3.527	8.307	0.495
	Sig.	0.026*	0.169	0.639	0.028*	0.662	0.000*	0.000*	0.000*	0.000*	0.000*

* $p < 0.05$.

Yoo et al., 2011), understanding diabetes care (Zulman et al., 2012), and confidence in ability to manage illness (King et al., 2010).

The major predictor of self-efficacy and self-care behaviours are demographic (age, interruption to activities of daily living, ability to fit diabetes into life in a positive manner, patient-physician communication) and clinical characteristics (duration, medication, and HbA1c a), accounting for 20.6% of the total variance explained in self-care behaviour and 31.3% of the variance of the self-efficacy. 26% variability in HbA1c was explained by self-efficacy and 19% of the variability was explained in self-care behaviours (Gao et al., 2013). Higher self-efficacy is linked with self-care behaviours in determining regulated glycemic control and lower HbA1c levels (D'Souza et al., 2015c; Johansson et al., 2010). This study shows that an adult's moderate ability in self-efficacy and self-care behaviours is reflected in outcomes and reduced risk of diabetes-related complications. This indicates that the adults perceived higher self-efficacy helps to achieve satisfaction by freedom and responsibility in self-care behaviours.

Table 4
Multivariate General Linear Model (Wilk's Lambda).

Effect	Value	F	Hypothesis df	Error df	Significance
Intercept	0.975	1.552[a]	2.000	123.000	0.216
Age	0.938	4.098[a]	2.000	123.000	0.019*
Duration of diabetes	0.924	5.051[a]	2.000	123.000	0.008*
Income	0.996	0.216[a]	2.000	123.000	0.806
Preventing normal daily behaviours	0.889	7.659[a]	2.000	123.000	0.001*
Diabetes education	0.979	1.315[a]	2.000	123.000	0.272
Understand diabetes and treatment	0.986	0.856[a]	2.000	123.000	0.427
Education	0.960	2.547[a]	2.000	123.000	0.050*
Medication	0.965	2.259[a]	2.000	123.000	0.560
Body mass index	0.984	1.007[a]	2.000	123.000	0.368
Fitting diabetes into life in positive manner	0.977	1.430[a]	2.000	123.000	0.243
Patient-physician communication	0.968	2.038[a]	2.000	123.000	0.135
Blood pressure	0.989	0.695[a]	2.000	123.000	0.501
Fasting blood glucose	0.984	0.972[a]	2.000	123.000	0.381
HbA1c	0.917	5.596[a]	2.000	123.000	0.005*
Gender	0.994	0.371[a]	2.000	123.000	0.691

[a] Design: intercept + age + duration + income + prevention of activities of daily living + diabetes education + understanding diabetes and treatment + education + medication + body mass index + ability to fit diabetes positively in life + patient-physician communication + blood pressure + fasting blood glucose + Hb1Ac + gender.

* $p < 0.05$.

5. Conclusions

Assessment will be useful to determine goals and strategies to include all areas in the individual's life to achieve desirable behavioural changes and integrated into problem solving. Dietary adjustment, effect of food on blood glucose levels, healthy plate and healthy food choices may be affected by cultural and socio-economic factors and acquire. Adults with T2DM may be taught to apply knowledge and behavioural skills to set goals and make informed decisions regarding SCB based on self-efficacy theory. Special care should be provided to adults with younger age groups, low education, low income, who showed low self-efficacy and low self-care behaviours. Improving self-management behaviours of individuals with long-term conditions is essential for building coping skills and for delaying disease progression. Self-efficacy and self-care behaviours are an integral part of the social-cognitive theory and is confirmed with associations with glycemic control. There is a need to improve glycemic control by increasing self-efficacy to manage healthy diet, being aware of importance of medication, and supervised monitoring and progress of illness. This is the first study in the Sultanate of Oman to examine the effect of like glycemic control on the SCB and SE among adults with T2DM.

Table 5
General Linear Model-tests of between-subjects effects.

Source	Total scores	Type III sum of squares	df	Mean square	F	Significance
Corrected model	Self-care behaviour	816.625[a]	15	54.442	3.402	0.000
	Self-efficacy	3865.889[b]	15	257.726	5.213	0.000
Intercept	Self-care behaviour	49.619	1	49.619	3.101	0.081
	Self-efficacy	64.320	1	64.320	1.301	0.256
Age	Self-care behaviour	115.955	1	115.955	7.246	0.008*
	Self-efficacy	275.839	1	275.839	5.579	0.02*
Duration	Self-care behaviour	124.033	1	124.033	7.750	0.006*
	Self-efficacy	406.632	1	406.632	8.225	0.005*
Income	Self-care behaviour	6.184	1	6.184	0.386	0.535
	Self-efficacy	1.438	1	1.438	0.029	0.865
Prevent normal daily behaviours	Self-care behaviour	8.581	1	8.581	0.536	0.046*
	Self-efficacy	637.433	1	637.433	12.893	0.000*
Diabetes education	Self-care behaviour	5.445	1	5.445	0.340	0.561
	Self-efficacy	123.673	1	123.673	2.502	0.116
Understanding diabetes and treatment	Self-care behaviour	0.027	1	0.027	0.002	0.967
	Self-efficacy	55.113	1	55.113	1.115	0.293
Education	Self-care behaviour	25.632	1	25.632	1.602	0.208
	Self-efficacy	33.611	1	33.611	0.680	0.411
Medication	Self-care behaviour	60.537	1	60.537	3.783	0.050*
	Self-efficacy	165.503	1	165.503	3.348	0.050*
Body mass index	Self-care behaviour	0.541	1	0.541	0.034	0.854
	Self-efficacy	55.196	1	55.196	1.116	0.293
Fit diabetes into life in a positive manner	Self-care behaviour	14.812	1	14.812	0.926	0.033*
	Self-efficacy	142.537	1	142.537	2.883	0.050
Patient physician communication	Self-care behaviour	42.164	1	42.164	2.635	0.045*
	Self-efficacy	182.716	1	182.716	3.696	0.050*
Blood pressure	Self-care behaviour	16.451	1	16.451	1.028	0.313
	Self-efficacy	0.278	1	0.278	0.006	0.940
Fasting blood glucose	Self-care behaviour	14.306	1	14.306	0.894	0.346
	Self-efficacy	95.104	1	95.104	1.924	0.168
Hb1Ac	Self-care behaviour	138.615	1	138.615	8.662	0.004*
	Self-efficacy	447.057	1	447.057	9.043	0.003*
Gender	Self-care behaviour	10.726	1	10.726	0.670	0.415
	Self-efficacy	2.774	1	2.774	0.056	0.813
Corrected total	Self-care behaviour	2801.059	139			
	Self-efficacy	9996.363	139			

[a] R squared = 0.292 (adjusted R squared = 0.206) self-care behaviours.
[b] R squared = 0.387 (adjusted R squared = 0.313) self-efficacy.
* $p < 0.05$.

The findings of this study are helpful for nurses to understand the extent to which glycemic control affect perceptions of SE and SCB. Nurse educators have a role to educate adults with T2DM about adjustment of blood glucose levels based on insulin, diet, physical activity, adherence to medication, foot care and blood glucose monitoring. The study recommends a self-efficacy and self-care behaviour program for specific needs of managing diet, exercise, medication and monitoring. Nurse educators can support these adults with T2DM and can introduce the component of self-efficacy model which may motivate individuals while describing food influences glucose concentrations and glycemic control, setting goals for exercise and activity (walking, aerobic exercise) and lifestyle (e.g. meditation, music, art). The role of the diabetes care team is to provide education, counseling and support to the adults who are more likely to be adherent if behaviour changes are personally meaningful and freely chosen to maintain glycemic control.

Conflict of interest statement

There is no financial, personal or other conflicts of interest has been declared by the authors. ICMJE form for disclosure of potential conflicts of interest will be submitted by the authors.

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