

Association between diabetes self-care, medication adherence, anxiety, depression, and glycemic control in type 2 diabetes

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Currently 285 million people worldwide (6.6% of the total world population) have diabetes. It is projected that by 2030, this number will grow to 438 million or 7.8% of the population.¹ The Kingdom of Saudi Arabia (KSA) is a rapidly developing country with a changing pattern of lifestyle of people towards urbanization and dietary habits. The chronic consumption of high energy, high fat diets, and low levels of physical activity lead to changes in energy balance with conservation of energy stored as fat. Such excess energy intake per se promotes insulin resistance even before significant weight gain occurs. In KSA, the prevalence of diabetes mellitus (DM) is reaching 23.7%.² Glycosylated hemoglobin (HbA1C) is the primary target of glycemic control and the American Diabetes Association (ADA) recommends that the HbA1c should be below 7%.

Diabetes mellitus requires continuous medical care, patients' self-management, education, and adherence to prescribed medication to reduce the risk of long-term complications. The DM is also associated with an increased risk of certain psychiatric disorders, particularly depression and anxiety disorders. Patients who have diabetes and a comorbid psychiatric disorder are at increased risk of poorer management and treatment outcomes than those without a psychiatric disorder.³ The objective of the present study is to find out the association between self-care behavior, medication adherence, anxiety, depression, and glycemic control in type 2 diabetes in Kingdom of Saudi Arabia.

This cross sectional study was conducted among 147 diabetic patients at Sultan Bin Abdulaziz Humanitarian City, Riyadh, KSA between May 2011 to July 2011. Inclusion criteria were: age range should be 18-70 years; diabetes identified as type 2; diabetes diagnosed \geq one year and Saudi national. Exclusion criteria included a history of psychopathology and medically unstable patients, type 1 diabetes, and gestational diabetics. The Research & Ethics Committee of Sultan Bin Abdulaziz Humanitarian City, Riyadh, KSA approved the study.

A questionnaire was used for interviewing the patients regarding their self-care management behavior, medication adherence scale, and hospital anxiety

and depression scale (HADS). Demographic data included: age, gender, marital, and employment status. Participation was voluntary and data were handled confidentially. The body mass index was calculated based on height and weight [BMI=weight (kg)/(height (m)²]. The HbA1c readings were collected from the patients' records (analyzed using the DCA Vantage™ Analyzer, Siemens health care diagnostics, New York, United States). Poor glycemic control was defined as HbA1c \geq 7%. Self-care management behaviors were collected to assess the adherence to diabetes regimens that included diet, physical exercise, and blood glucose testing. Following a dietary plan means that patients were following the eating plan 3 days or more in the previous 7 days as recommended by the dietitian. Patients were considered being engaged for at least 30 minutes in physical exercise if they walked 3 days or more in the previous 7 days. Self-monitoring blood glucose (SMBG) was defined if patients performed home glucose monitoring for 5 days or more in the previous 7 days.⁴ The self-reported measure of medication adherence was developed from a previously validated 8-item scale and supplemented with additional items addressing the circumstances surrounding adherence behavior.⁵ The anxiety and depression symptoms were assessed using the HADS scale.⁶ The HADS consists of 7 items each for anxiety (HADS-A) and depression (HADS-D). The items were scored on a 4-point scale from zero (not present) to 3 (considerable). The item scores were added, giving sub-scale scores on the HADS-anxiety and the HADS-depression from 0-21.⁶

Data analyses were carried out using Graph Pad InStat Version 3 (Graph Pad Software, San Diego (CA), USA). In addition to the descriptive analysis, Student's t-test was used to make comparisons among the different groups. A *p*-value of <0.05 was considered statistically significant.

The mean age of the study group was 57.3 \pm 14.4 (mean \pm SD) years. Ninety-nine patients were male (67.3%) and 48 (32.7%) were female. The mean duration of diagnosis of DM was 12.7 \pm 7.3 years. The study found that 29.3% of the patients had HbA1c level $<7\%$ and 70.7% had a higher HbA1c level $\geq 7\%$ (Table 1). Around 91 (83.4%) of uncontrolled glycemic level (HbA1c $\geq 7\%$) patients did not follow dietary plan as recommended by the dietitians. This finding is in agreement with previous studies, which indicated that self-care management practices were lower in poorly controlled DM patients.⁷ Diet and exercise are especially important for people living with DM, as they are the most practical non-pharmacological means by which

Table 1 - Demographic, self-care and medication adherence of the study population (N=147).

Variables	Total number of patients	HbA1c level <7	HbA1c level ≥7
<i>Demographic and socio economic data</i>			
<i>Gender</i>			
Male	99	28 (28.3)	71 (71.7)
Female	48	15 (31.2)	33 (68.7)
<i>Age</i>			
<40	18	5 (27.8)	13 (72.2)
40-49	31	10 (32.2)	21 (67.8)
50-59	19	6 (31.6)	13 (68.4)
>60	79	22 (27.9)	57 (72.1)
<i>Marital status</i>			
Married	126	31 (24.6)	95 (75.4)
Unmarried	21	8 (38.1)	13 (61.9)
<i>Employment status</i>			
Employed	35	12 (34.2)	23 (65.8)
Unemployed	112	31 (27.7)	81 (72.3)
<i>Smoking</i>			
Smoking	42	11 (26.1)	31 (73.9)
Non smoking	105	32 (30.5)	73 (69.5)
<i>Body mass index</i>			
Normal weight (18.50 - 24.99)	39	12 (30.8)	27 (69.2)
Over weight (≥25.00-29.99)	75	21 (28.0)	54 (72.0)
Obesity (≥30)	33	10 (30.3)	23 (69.7)
<i>Self care management n (%)</i>			
<i>Follow eating plan as recommended by dietitian</i>			
Yes	38	25 (65.8)	13 (34.2)
No	109	18 (16.6)	91 (83.4)
<i>Participate in at least 30 minutes of physical exercise</i>			
Yes	41	29 (70.7)	12 (29.3)
No	106	14 (13.2)	92 (86.8)
<i>Self-monitoring blood glucose</i>			
Yes	57	37 (65.0)	20 (35.0)
No	90	9 (10.0)	81 (90.0)
<i>Medication adherence (mean±SEM)</i>			
Medication Adherence		7.4±1.4	5.4±1.2*
<i>Psychological factors (mean±SEM)</i>			
Anxiety		7.9±1.3	10.3±1.7 [‡]
Depression		6.9±0.9	9.8±1.3 [‡]
Total HADS		14.8±1.8	20.1±2.1 [‡]

Groups compared by "t" test * $p=0.0007$, [‡] $p=0.0005$, [†] $p=0.0002$, [‡] $p=0.0001$, SEM - standard error of mean, HADS - anxiety and depression scale

patients may significantly improve their blood glucose levels. Exercise increases insulin sensitivity (both short and long term), lowers blood sugar levels, and reduces body weight.⁸ Blood glucose level can significantly drop during and after physical activities, due to the increased utilization of glucose as a fuel during exercise and the up-regulation of glucose transport into working

muscles.⁸ This study found that 92 (87%) poorly controlled DM patients did not participate in at least 30 minutes physical exercise (Table 1). Self-monitoring of blood glucose represents an important adjunct to A1C because it can distinguish among fasting, preprandial, and postprandial hyperglycemia, assessing glycemic excursions, and documenting hypoglycemic episodes. It has been suggested that SMBG could assist in improving metabolic control and quality of life of type 2 diabetes patients.⁹ In this study, the majority of poorly controlled diabetic patients (90%) did not follow SMBG (Table 1).

Adherence to prescribed anti diabetic medications is crucial to reach metabolic control as non-adherence with blood glucose lowering or lipid lowering drugs is associated with higher HbA1c and cholesterol levels.¹⁰ In this study we found that when compared to well controlled patients (HbA1c <7), a significant difference was found in poorly controlled patients medication adherence ($p=0.0007$) (Table 1).

In people with type 2 diabetes, depressive symptoms markedly impaired the health related quality of life. Anxiety/depression is twice as common among diabetic patients when compared with matched control subjects without diabetes.³ The present study also revealed a higher level of anxiety ($p=0.0005$), depression ($p=0.0002$) and total HADS ($p=0.0001$) among poorly controlled DM patients as compared to well controlled patients. The major limitation of this study was the limited number of patients examined in a single hospital and its cross-sectional nature. Further research is needed to address these limitations.

In conclusion, the results of this study indicate that poor diabetes self-care management behavior, low adherence to medicine, higher level of anxiety, and depression are associated with poor glycemic control. Our findings suggest that more attention must be paid to Saudi diabetes in order to improve glycemic control and to prevent or minimize complications.

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Ethical Consent

All manuscripts reporting the results of experimental investigations involving human subjects should include a statement confirming that informed consent was obtained from each subject or subject's guardian, after receiving approval of the experimental protocol by a local human ethics committee, or institutional review board. When reporting experiments on animals, authors should indicate whether the institutional and national guide for the care and use of laboratory animals was followed.