Original Article

Impact of an education program on patient anxiety, depression, glycemic control, and adherence to self-care and medication in Type 2 diabetes

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ABSTRACT

Background: Diabetes mellitus (DM) requires continuous medical care, patients' self-management, education, and adherence to prescribed medication to reduce the risk of long-term complications. The aim of this study was to assess the benefits of an education program on diabetes, patient self-management, adherence to medication, anxiety, depression and glycemic control in type 2 diabetics in Saudi Arabia. **Materials and Methods:** This was a prospective study, conducted among 104 diabetic patients at a major tertiary hospital in Riyadh, Saudi Arabia, between May 2011 and October 2012. Education materials given to diabetic patients included pamphlets/handouts written in Arabic, the national language. Special videotapes about DM were made and distributed to all participants. In addition, specific educational programs through the diabetes educators and one-on-one counseling sessions with the doctor were also arranged. Patients were interviewed using a structured interview schedule both during the baseline, and after 6 months of the program. The interview schedule included, socio-demographics, clinical characteristics, diabetes self-management, adherence to medication, anxiety, and depression. Glycemic control was considered poor, if hemoglobin A1c (HbA1c) was $\geq 7\%$. **Results:** The mean age of the study population was 57.3 ± 14.4 years. Seventy one were males (68.3%) and 33 (31.7%) were females. After six months of the diabetes education program, there were significant improvements in patients' dietary plan ($P = 0.0001$), physical exercise ($P = 0.0001$), self-monitoring of blood glucose (SMBG) ($P = 0.0001$), HbA1c ($P = 0.04$), adherence to medication ($P = 0.007$), and depression ($P = 0.03$). **Conclusions:** Implementation of education programs on diabetes among type 2 diabetic patients is associated with better outcomes such as their dietary plan, physical exercise, SMBG, adherence to medication, HbA1c and depression.

Key words: Anxiety, depression, diabetes education, diabetes self-management, Saudi Arabia

INTRODUCTION

The world-wide burden of diabetes is projected to be 5.4% of the adult population by the year 2025. The disease is associated with multiple medical complications that decrease health-related quality of life and contribute to earlier mortality.[1] According to a recent publication of the International Diabetes Federation, 5 of the top 10 countries with the highest prevalence rates of diabetes in the world are located in the Gulf Region.[2] The Kingdom of Saudi Arabia has one of the highest rates of diabetes in the world, with a prevalence reported at 23.7%.[3] More alarming perhaps, is the rising trend of diabetes observed in Saudi Arabia in recent years. There has been approximately a ten-fold increase in the past three decades in Saudi Arabia. If this trend continues, one cannot help but predict future diabetes rates in the country as no different from those seen in such ethnic populations as the Pima Indians of whom nearly 50% of their adult population is diabetic.[4]

Good metabolic control is essential for maintaining and preventing such long-term complications as retinopathy, nephropathy, neuropathy, and cardiovascular diseases.[5]

Glycosylated hemoglobin A1c (HbA1c) is the primary target of glycemic control. The American Diabetes Association recommends that the HbA1c should be below 7.0%.[6]

It is well-established that diabetes mellitus (DM) requires continuous medical care, self-management by patients, education, and adherence to prescribed medication to reduce the risk of long-term complications.[7] DM is also associated with an increased risk of certain psychiatric disorders, particularly depression, and anxiety disorders.[8] Patients who have diabetes and a comorbid psychiatric disorder are more at risk of poor treatment outcomes than those without a psychiatric disorder.[9]

Education programs on diabetes are essential components of overall management of diabetes. Numerous studies have shown the benefits of diabetes education on overall improvement in the care of diabetic patients including a reduction in hospitalizations.[10,11] Diabetes control and complications trial research group found a significant correlation between glycemic control and a reduction in complications of diabetes through intensive education programs.[12]

In Saudi Arabia, diabetes is a common disease, which is closely linked with the local dietary customs and strong social traditions within society, which exacerbate the problems and undermine intervention programs for diabetes.[4] This study, therefore, aimed at understanding the effectiveness of diabetes education programs on metabolic control and psychological well-being of patients with type 2 diabetes in Saudi Arabia.

MATERIALS AND METHODS

This was a prospective study, conducted among 104 diabetic patients at a major tertiary hospital in Riyadh, Saudi Arabia, between May 2011 and October 2012. Patient selection was conducted through convenience sampling, non-probability technique. The patients were recruited from the hospital during their routine visit. Inclusion criteria were: Aged between 18 years and 70 years; diabetes identified as type 2; diabetes diagnosed ≥1 year and being a Saudi national. Exclusion criteria were: History of psychopathology and medically unstable patients, type 1 diabetes, and gestational diabetics. Patients were interviewed using a structured interview schedule designed to elicit information on their self-management, scale of adherence to medication and hospital anxiety and depression scale (HADS). The demographic data such as age, gender, marital status and level of education were collected. Poor glycemic control was defined as (HbA1c ≥7%).

All patients who were willing to participate in this research were asked to sign an informed consent agreement to participate in this study. The study was approved by the Research and Ethics Committee of a tertiary hospital, Riyadh, Saudi Arabia.

The educational program comprised 5 units in 12 sessions covering all the major aspects of DM. Two nurses were trained as diabetes health educators. All the information used in the education, including pamphlets/handouts in the national language (Arabic) was given to all patients. Special audio/videotapes (about etiology of diabetes, its complications, use of medication, anxiety or depression associated with diabetes) were made and distributed to all participants. In addition, specific educational programs through the diabetes educators and in one-on-one counseling sessions with the doctor were arranged.

Diabetes self-management

Diabetes self-management behaviors were collected to assess the adherence to diabetes regimens including, diet, physical exercise, and blood glucose testing. Patients were advised to adhere to the diet if the dietary plan had been adhered to for 3 or more days in the preceding week. Patients were considered as engaging in physical activity, if they performed at least 30 min of physical exercise or had walked for 3 or more days in the previous 7 days. Self-monitoring blood glucose was defined as patients having home monitored glucose for five or more days in the previous 7 days.[13]

Medication adherence measure

The self-reported measure of adherence to medication was assessed using a previously validated 8-item scale and supplemented with additional items that addressed the circumstances surrounding adherence behavior.[14] Failure to adhere to a medication regimen could occur as a result of several factors such as, problems of remembering to take medication, and high complexity of the medical regimen etc. The questions were phrased to avoid the "yes-" bias by reversing the wording of the questions on the failure of patients to follow their medication regimen, as the tendency for patients to give positive answers is high. Each item measured a specific medication-taking behavior and was not a determinant of adherence behavior. Response categories were yes/no for each item with a dichotomous response and a 5-point Likert response for the last item.[14]

HADS

The anxiety and depression symptoms were assessed using the Arabic version of HADS. This scale was validated in an Arab population, which could discriminate patients from controls at a sensitivity of 79%, and a specificity of 87%. It is very simple and easy to use by most people, without any language barriers, and has no culturally or psychologically sensitive questions.[15,16]

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 to 21. The HAD scale defines the score of <7 as a non-case (absence anxiety or depression), 8-10 as borderline (anxiety or depression symptoms), and ≥11 as definite (anxiety or depressive symptoms).[15]

Statistical analysis

Data analyses were carried out using Microsoft Excel 2002 (Microsoft Corporation, Seattle, WA) and Graph Pad InStat Version 3 (Graph Pad Software, Sand Diego, USA). In addition to the descriptive analysis, Student's *t*-test was carried out to make comparisons between the baseline and the 6-month value, and Fisher's exact test was used compare the self-management of DM. $P < 0.05$ was considered statistically significant.

RESULTS

This prospective study was conducted among 113 diabetic patients at a major tertiary hospital in Riyadh, Saudi Arabia. Nine patients (9/113, 8%) withdrew in the course of the 6 months of the study. A total of 104 patients continued until the end.

The demographic data (marital status, level of education, income, employment) are shown in Table 1. The mean age of the study participants was 57.3 ± 14.4 (mean ± SD) years. Seventy one were males (68.3%) and 33 (31.7%) were females. The mean duration of diagnosis of DM was 12.7 ± 7.3 (mean ± SD) years, and the mean body mass index was 31.063 ± 4.4 (kg/m²). Gender and educational status (graduates vs. undergraduates) did not have any significant effect on the study variables ($P > 0.05$). Table 2 indicates the self-management behaviors of the study population. As a result of the education program, the proportion of patients who followed a dietary plan as recommended by the dietitian increased from 12.5% to 39.4% ($P = 0.0001$); patients who performed adequate physical exercise (at least 30 min) increased from 11.5% to 41.3% ($P = 0.0001$) and patients who monitored their blood glucose increased from 21.1% to 44.2% ($P = 0.0001$). Figure 1 demonstrates the relationship between diabetes education and glycemic control. Compared to the baseline, a significant difference was found after the education program on patients' glycemic control ($P = 0.04$). Figure 2 illustrates the relationship between diabetes education and adherence to medication. After the diabetes education session, there was a significant improvement in patients' adherence to medication regimen ($P = 0.007$). Figure 3 illustrates the

relationship between diabetes education program and anxiety, depression and HADS. Compared to the baseline, there was a significant improvement in the depression level ($P = 0.03$) of patients at 6 months. The study also found lower anxiety and HADS level after the six months of the education program; however, these differences were not statistically significant ($P > 0.05$).

Table 1: The demographic and socio-economic data of the study population

Variables	Number of patients (%)
Gender	
Male	71 (68.3)
Female	33 (31.7)
Age	
<40	13 (12.5)
40-49	21 (20.2)
50-59	13 (12.5)
>60	57 (54.8)
Marital status	
Married	91 (87.5)
Unmarried	13 (12.5)
Education	
Graduates	17 (16.3)
Undergraduates	87 (83.7)
Employment status	
Employed	23 (22.1)
Unemployed	81 (77.9)
Residence	
Alone	15 (14.4)
With family	89 (85.6)
Monthly income	
SAR<5000	19 (18.3)
SAR 5000-10000	59 (56.7)
SAR>10000	26 (25)
Smoking	
Smoking	31 (29.8)
Non smoking	73 (70.2)

SAR: Saudi Arabian Riyal

Table 2: Glycemic control and diabetes self-care management behavior

Variable	Baseline (%)	6 months (%)
Follow eating plan as recommended by dietitian		
Yes	13 (12.5)	41 (39.4)*
No	91 (87.5)	63 (60.6)
Participate in at least 30 min of physical exercise		
Yes	12 (11.5)	43 (41.3)#
No	92 (88.5)	61 (58.6)
Self-monitoring blood glucose		
Yes	22 (21.1)	46 (44.2)†
No	82 (78.8)	58 (55.8)

Baseline versus 6 months, Compared by Fisher's exact test *P=0.0001, #P=0.0001, †P=0.0001
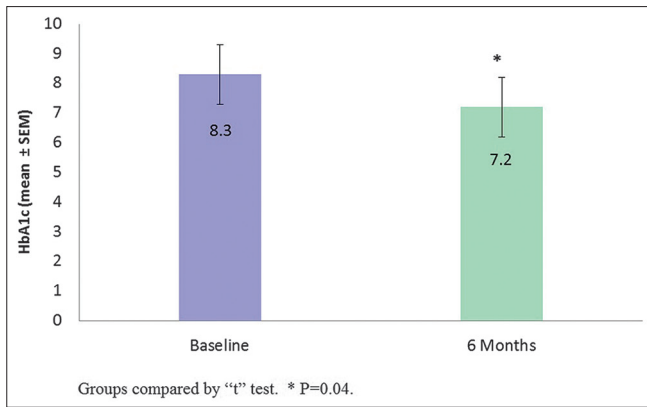
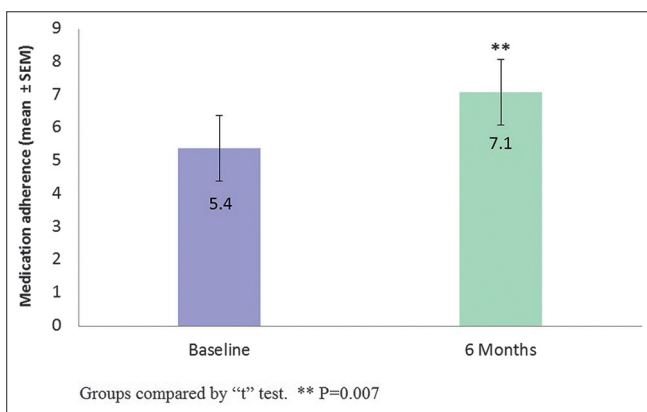**Figure 1:** Relationship between diabetes education and glycemic control

Figure 2: Relationship between diabetes education and medication adherence
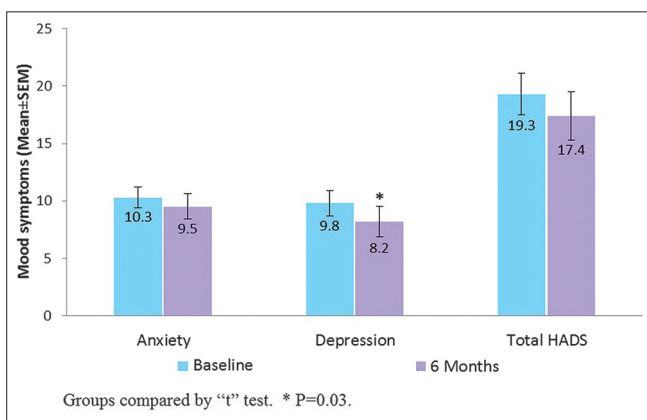

Figure 3: Relationship between diabetes education and anxiety, depression and hospital anxiety and depression scale

DISCUSSION

Diabetic patients develop complications as a result of poor insight of the disease and inadequate glycemic control. Patient education is the most effective way of managing the disease and reducing the complications of diabetes.[17] In contrast, studies have reported

that many non-pharmacologic strategies (patient education, psychological intervention, dietary education, self-monitoring, and telemedicine) have been developed, but their effectiveness is still unclear.[18,19] However, a study reported that each 1% reduction in HbA1c level was associated with a 37% decrease in the risk of micro-vascular complications and a 21% decrease in the risk of diabetes related death, with no evidence of a threshold.[20]

Owing to its nature, diabetes is not always easy to treat. Part of the difficulty lies in the fact that the treatment of diabetes depends entirely on the part played by patients themselves.[4] Studies have reported that to have better results in the management of diabetics, diabetes self-management education (DSME) is important.[10,21-23] An effective DSME is key to improving the self-management capabilities of diabetics,[24] which the present study has confirmed. Regulation of dietary patterns[25] remains the cornerstone to the management of all forms of DM, and nutrition education is essential in a comprehensive program of diabetes education.[26] In the present study, we observed a significant improvement in the dietary plan of the patients after the six months of the education program. This is in agreement with a previous study, which indicated that after the education program, compliance to a healthy diet significantly increased, adherence to a dietary plan, avoidance of foods high in fat and spacing of carbohydrates were much improved.[27]

A number of studies have shown that self-monitoring of blood glucose (SMBG) represents an important adjunct to HbA1c, because it makes distinctions among fasting, pre-prandial, and postprandial hyperglycemia, assessing glycemic excursions, and documenting hypoglycemic episodes.[27,28] Studies have also shown a high correlation of HbA1c and mean glucose as measured by SMBG, and that diabetes education increased the SMBG activities of DM patients.[29] However, a recent study reported that regular use of SMBG was not superior to irregular/never use of SMBG on glycemic control, though it seemed to be a good intervention for the prevention of diabetic nephropathy. SMBG should be recommended for patients whose level of education is high to meet its goal of use. It should also be incorporated into self-management with effective educational intervention.[28] This present study, found significant improvements in the patients' practice of self-monitoring blood glucose after the 6 months of education ($P = 0.0001$).

It is well-established that exercise is the most practical non-pharmacological means by which patients may significantly improve glycemic control.[30,31] Exercise increases insulin sensitivity (both short and long term), lowers blood sugar levels and reduces body weight.[25]

Blood glucose levels can significantly drop during and after physical activities because of the increased utilization of glucose as a fuel during exercise and the up-regulation of glucose transport into the working muscles.[25] Despite these benefits, literature states that many patients with diabetes have stopped exercise programs.[30] However, in the present study, we found an increase in the proportion of patients who began to take adequate physical exercise (at least 30 min) after the education program.

Many studies have indicated that education programs for patients with DM have produced significant benefits in glycemic control.[10,11,32] The evidence suggests that participation in a multi-factorial health education program on diabetes significantly improved glycemic and lipid levels in the short-term, particularly among participants with extremely adverse HbA1c or low-density lipoprotein levels prior to participation.[33] In this study, we found that six months of an educational program for DM patients helped the patients to gain better glycemic control.

The challenge of poor adherence to medication has been debated for at least three decades. This problem has been generally ignored or not perceived as a serious public health issue. There has therefore, been little direct systematic or sustained intervention in this area. Adherence to prescribed anti-diabetic medications is crucial to reaching metabolic control, for non-adherence to taking blood glucose lowering or lipid lowering drugs is associated with higher HbA1c and cholesterol levels.[34] Patients' lack of adherence to their medication regimen probably rests on the fact that they perceive their role in their care as largely passive. This has been a long-standing problem for both patients and health-care providers.[35] Of the different strategies for diabetes control, the improvement of adherence is key to optimizing metabolic control.[36,37] After the 6 months of the education program, we also found a significant improvement in the level of adherence to medication in the study population.

Previous literature reported an association of anxiety/depression and hyperglycemia.[9] When these conditions co-exist, the risk of developing co-morbidities, and complications increase, resulting in greater patient suffering, and escalating cost. Besides, depressive symptoms markedly impair the quality of life of people, especially, those with type 2 diabetes.[38] Anxiety/depression is twice as common among diabetic patients compared with matched control subjects without diabetes.[39,40] This study, revealed a significant improvement of depression ($P = 0.03$) and a trend towards improvement in the indices of anxiety.

The major limitations of the study were the absence of a control group, which limits the internal validity of the study outcome, as well as the small sample size from a single hospital. Further research is needed to address these limitations. Despite these limitations, our study has provided valuable information on the role of education on various aspects of the management and care of diabetes especially in a place where the local culture may not always be responsive to the intervention of diabetes education.

In conclusion, the results of this study indicate that diabetes education is positively associated with improvement in patient dietary plan, physical exercise, SMBG, adherence to medication, HbA1c, and depression. Our findings confirm the value of diabetes education in Saudi Arabia and warrants more attention in this area.

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