The effect of education on knowledge, self management behaviours and self efficacy of patients with type 2 diabetes

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KEY WORDS

patient education, knowledge, self-management behaviours, self-efficacy, type 2 diabetes

ABSTRACT

Objective
The study was conducted to evaluate the effect of patient education on knowledge, self management behaviours and self efficacy in patients with type 2 diabetes.

Design
A randomised single blind controlled study was designed to assess the effect of education using a pre and post test design.

Setting
The study was conducted in an outpatient clinic in the Department of Endocrinology and Metabolism, School of Medicine, Ankara University, Turkey.

Subjects
The study population consisted of eighty patients with type 2 diabetes who were randomly assigned to the intervention or control group by recruitment number.

Intervention
An education program was developed and delivered to the intervention group. Knowledge and self reported self management behaviours were tested before and after the education program. For the evaluation of self efficacy of patients with type 2 diabetes, mean scores of diabetes self efficacy scale were analysed. The control group received routine treatment.

Main outcome measures
The improvements in knowledge and in self reported self management behaviours were measured by knowledge test; self efficacy of patients was measured by mean scores of diabetes self efficacy scale.

Results
There were significant differences between the intervention and control groups. Improvements were observed in taking regular walks (p=0.043), recognising nutrients with high caloric content (p=0.037), recommended daily fat distribution (p=0.024), regulating blood glucose levels to avoid complications (*p*=0.002), and in diabetes self efficacy mean scores (p=0.006).

Conclusion
Patient education had a limited effect on knowledge and self reported self management behaviours but a significant effect on self efficacy in patients with type 2 diabetes.

INTRODUCTION

Diabetes mellitus is a chronic disease that constitutes a major public health problem. It affects between two to five per cent of the adult population in industrialised countries (Arend et al 2000). The prevalence of type 2 diabetes is predicted to rise over the next decade (Cooper et al 2003) and according to global estimates from the World Health Organization, the total number of people with diabetes will rise from 171 million in 2000 to 366 million in 2030 (Wild et al 2004). The overall crude prevalence of diabetes in Turkey was 7.2 % between September 1997 and March 1998 (Satman et al 2002). (Wild et al 2004). The overall crude prevalence of diabetes in Turkey was 7.2 % between September 1997 and March 1998 (Satman et al 2002).

Diabetes education has been an essential component of diabetes management since the 1930s and is increasingly recognised as an integral part of chronic disease management. The objectives of educating people with type 2 diabetes are to optimise metabolic control; prevent acute and chronic complications; improve quality of life by influencing patient behaviour and produce changes in knowledge, attitude and behaviour necessary to maintain or improve health (Falvo 2004; Snoek and Visser 2003). Research suggests patients who are informed about their illness and its treatment, are more likely to succeed in managing their illness (Ellis et al 2004). For example, hypoglycaemia is one of the most common problems people with diabetes have to cope with; the management of which differs according to treatment and medications. Self monitoring blood glucose can be used to prevent hypoglycaemic or hyperglycaemic episodes and to identify the impact of lifestyle and medication changes on glucose levels (Banerj 2007). On the other hand, many people with type 2 diabetes need to lose weight. So diet needs to be individualised.

Self management for people with chronic health problems is widely recognised as a necessary part of treatment. The patient is responsible for the day-to-day management of their illness (Lorig and Holman 2000). In order to effectively self manage their disease, people must acquire the necessary knowledge, skill, and confidence and engage in particular behaviours such as testing blood glucose and emotional management (Adams et al 2004). Confidence or self efficacy refers to the individual's belief in his or her capacity to perform the behaviour (Janz et al 2002; Bandura, 1977).

The complex nature of diabetes self management makes it difficult to manage well. Recent large well controlled studies demonstrated that moderate intensity exercise and diet can prevent or delay the onset of type 2 diabetes (DESG 2002g). People with diabetes report that diet and exercise are the most difficult aspects to manage (DESG 2002 a and e). Significant management issues in type 2 diabetes are weight management, the use of self monitoring blood glucose and reducing lipids. Approximately 75% of diabetic patients report deviating significantly from recommended dietary guidelines at least weekly (Goodall and Halford 1991). Additionally, between 40% and 80% of patients under report at least half their blood glucose levels and half the population with diabetes does not follow foot-care recommendations (DESG 2002d).

AIM

The aim of the study was to evaluate the effect of patient education on knowledge, self management behaviour and self efficacy in patients with type 2 diabetes.

METHOD

A randomised controlled trial was undertaken at the Diabetes Centre (an outpatient clinic), Department of Endocrinology and Metabolism, Ankara University, Turkey. Patients were eligible to participate if they had a diagnosis of type 2 diabetes, had attended at least one follow-up visit and were able to give informed consent. The average age of the patients was over forty years and all except one patient was literate.

Patients with type 2 diabetes, who regularly attended to the centre for treatment and follow up were offered enrolment in the study. Eighty patients agreed to participate and were randomly assigned

to either the intervention or control group according to their assigned number. The patients who agreed to participate were given recruitment numbers. To determine the intervention and control groups, the words 'intervention' and 'control' were written on a separate piece of paper and with 'intervention' being drawn as the first randomisation. To assign the patients into the intervention and the control group, the numbers '1' and '2' were written on a separate piece of paper and number '1' was drawn first, so patients with odd recruitment numbers were assigned to the intervention group. They were forty patients in each group.

In order to plan the education program, a knowledge test was developed and administered to the intervention and control group as a pre test. Based on the results of the pre test, the education program was developed and delivered to the intervention group by the researcher. Two weeks after the education, the knowledge test was re-administered to both groups as post test. As the education was not delivered to the control group, the correct answers were explained to each patient following the post test. The knowledge test consisted of a written questionnaire and was designed to measure knowledge, self reported self management behaviours, and diabetes self efficacy.

The content of the test was as follows:

1. Patient characteristics such as gender, age, educational level, body mass index, duration of diabetes and type of treatment.
2. Twelve questions about knowledge on type 2 diabetes. The questions were based on the recommendations of two physicians from the Department of Endocrinology and Metabolism, and the Teaching Letters (2, 3, 4, 6, 10, 16, 27), which are prepared by Diabetes Education Study Group (DESG) of the European Association for the Study of Diabetes (EASD).
3. Fourteen questions about self reported self management behaviours related to exercise, preventing hypoglycaemia, blood glucose self monitoring, weight control, diabetic retinopathy, foot-care and measuring blood pressure (Teaching Letters 2, 3, 4, 6, 10, 16, 27).

   In terms of exercise, patients were asked questions about stretching, walking regularly, swimming, and cycling. It terms of preventing hypoglycaemia, the patients were asked whether they carried sugar cubes as a precaution to manage sudden falls in blood glucose and whether they monitored their blood glucose levels before exercising and bedtime. Blood glucose self monitoring questions addressed fasting and post prandial blood glucose; weight control questions asked whether patients weighed themselves and how often this was done; diabetic retinopathy questions asked whether the patient had their eyes checked by an ophthalmologist at least every six months and whether they tried to regulate their blood glucose to prevent the development of retinopathy; foot care questions asked whether the patient inspected their feet daily; and blood pressure monitoring questions asked whether blood pressure was measured and the frequency.
4. Diabetes Self efficacy Scale (Stanford Patient Education Research Centre 2004). The scale consists of eight items about confidence to perform diabetes self management behaviours given below:
   - How confident do you feel that you can eat your meals every 4 to 5 hours every day, including breakfast every day?
   - How confident do you feel that you can follow your diet when you have to prepare or share food with other people who do not have diabetes?
   - How confident do you feel that you can choose the appropriate foods to eat when you are hungry (for example, snacks)?
   - How confident do you feel that you can exercise 15 to 30 minutes, 4 to 5 times a week?
   - How confident do you feel that you can

do something to prevent your blood sugar level from dropping when you exercise?

- How confident do you feel that you know what to do when your blood sugar level goes higher or lower than it should be?
- How confident do you feel that you can judge when the changes in your illness mean you should visit the doctor?
- How confident do you feel that you can control your diabetes so that it does not interfere with the things you want to do?

The scale was translated into Turkish. In order to validate the scale in Turkish, the recommendations of a professional English teacher from the University of Ankara were taken into consideration. As the meanings of the original items '1' and '6' lost their real meanings after translation, they were deleted from the scale.

Responses were rated on a scale of one to five where 1 corresponded to 'never'; 2 to 'low'; 3 to 'moderate', 4 to 'good'; and 5 to 'very good'. The reliability of the original scale is 0.85. The Cronbach's alpha of the revised scale was 0.74.

To validate the knowledge test, it was administered to ten patients and according to the results no changes were made except place of living of the patients was omitted. Pilot study participants were excluded from the main study.

The test, including all four sections given above, was given to all patients before education as a pre test. The educational intervention was designed to coincide with scheduled medical visits. Subjects participated in the education program three months after the initial assessments were completed. The results of routine laboratory assessments were recorded for all participants. Two weeks after the initial education program, the test was re-administered to the intervention and control groups.

The correct answers were explained the intervention group during education and to each patient in the control group following post test. To prevent contamination of the intervention, education was delivered to five groups of patients in the intervention group in different weeks.

The education program included diabetes specific information and information about self management behaviour including blood glucose self monitoring, hypo and hyperglycaemia, exercise, diet, weight control complications, foot care and the importance of medical care. The education was delivered by the researcher using a question based patient centred approach which consisted of answering participant's questions about diabetes and its care.

The program lasted for 90 minutes and was delivered in groups of 7-12 patients in two sessions of 45 minutes one week apart. The program was repeated for each of the five cohorts of subjects in the intervention group and evaluated by post test.

Data analysis processes

Data were processed using the Statistical Package for the Social Sciences (SPSS) for Windows version 10.0. In order to compare the intervention with the control group, chi-square and Fisher's exact test were undertaken for dichotomous variables. Unpaired Student's t-test was used to analyse the mean pre and post education program self efficacy test scores of the intervention and the control groups. The differences were considered to be statistically significant at $p<0.05$.

RESULTS

Patient Characteristics

There were no significant differences in gender, age, education level, body mass index, diabetes duration, or type of treatment between patients in the intervention and the control groups (table 1).

Knowledge

Hypoglycaemia

Patients were asked about the causes of hypoglycaemia and they indicated 'forgetting snacks' as the cause of hypoglycaemia. The results are shown in table 2.

Table 1: Patient characteristics in the intervention and control group

Characteristics	Intervention group (n=40)	Control group (n=40)	p-value
Gender			
Female	20	21	1
Male	20	19	0.833
Age (years)			
≤ 39	2	1	0.833
40-44	3	1	
45-49	5	7	
50-54	9	11	
55-59	11	9	
≥ 60	10	11	
Level of education			
< High school	14	16	0.084
High school	0	5	
> High school	26	19	
BMI (kg/m2)			
< 29	9	9	0.965
29-31	20	21	
≥ 32	11	10	
Duration of diabetes (years)			
0-4	9	14	0.447
5-9	8	9	
10-14	12	11	
≥ 15	11	6	
Type of treatment			
Tablets	36	36	1
Insulin	16	15	1
Tablets and insulin	13	12	1

Patients were asked to state the benefits of blood glucose self monitoring levels at bedtime. Before education, two patients in the intervention and none in the control group reported the necessity of blood glucose self monitoring (p=0.247). After education, four patients in the intervention and one in the control group reported the necessity of blood glucose self monitoring at bedtime (p=0.179).

Diet

Patients were asked which nutrient increased blood glucose level. Before education, 28 patients in the intervention and 31 in the control group responded correctly (p=0.612).

Table 2: Number of patients in the intervention and the control group responding correctly to questions about diet, nutrient with high caloric content, daily fat distribution and causes of hypoglycaemia

Characteristics	Intervention group (n=40)	Control group (n=40)	p-value
Forgetting snacks			
Before the education	26	22	0.494
After the education	34	31	0.568
Nutrient with high caloric content			
Before the education			
Correct	10	13	0.622
Incorrect	30	27	
After the education			
Correct	20	10	0.037
Incorrect	20	30	
Daily fat distribution			
Before the education			
Correct	18	11	0.162
Incorrect	29	22	
After the education			
Correct	23	12	0.024
Incorrect	17	28	

Following education, 32 patients in the intervention and 30 in the control group gave the correct answer, but the change was not statistically significant when compared to the control group (p=0.790).

The responses regarding nutrient with high caloric content and recommended daily fat distribution are shown in table 2.

Ten patients in the intervention and thirteen patients in the control group could name nutrients with high caloric content before the program, which rose to 20 in the intervention and ten in the control group after the education program and the difference was significant (p=0.037).

Eighteen patients in the intervention and eleven in the control group described recommended daily fat distribution correctly. After education, 23 in the intervention group and 12 in the control group knew the recommended daily fat allowance was <30% of the total caloric intake. The difference was significant (p=0.010).

Patients were asked whether nutrient intake needed to be reduced in order to lose weight. Prior to the education program, 29 in the intervention group and 15 in the control group stated that fat was the nutrient to be reduced. After education, 26 in the intervention and 18 in the control group responded correctly, but the difference was not significant (p=0.892).

Diabetic Retinopathy

As diabetic retinopathy is a complication that leads to blindness, patients were asked whether they knew the damaging effects of retinopathy. Before and after the education program 39 patients in the intervention and all in the control group knew diabetes could damage the eyes (p=1.000). Patients were not asked about other complications such as cardiovascular and renal disease, because it was difficult for patients to evaluate.

Self reported self management behaviours

Exercise

Patients were asked their exercise practices, specifically they were asked whether or not they did stretching, walked regularly, swam, or cycled. All subjects in both groups replied that they understood exercise to be 'walking' (see table 3).

Table 3: Comparison of self reported self management behaviours exercise and diabetic retinopathy in the intervention and the control groups

Self management	Intervention group (n=40)	Control group (n=40)	p-value
Walked regularly			
Before the education			
None	13	12	0.888
≤ 30 minutes	5	4	
31-60 minutes	22	24	
After the education			
None	6	16	0.043
≤ 30 minutes	7	5	
31-60 minutes	27	19	
Regulated blood glucose to prevent diabetic retinopathy			
Before the education			
Yes	11	6	0.274
No	29	34	
After the education			
Yes	21	7	0.002
No	19	33	

Preventing hypoglycaemia

Carrying sugar cubes

Carrying sugar cubes is a standard recommendation for patients to manage hypoglycaemia in the Diabetes Centre, Department of Endocrinology and Metabolism, Ankara University, Turkey. Twenty-seven patients in the intervention and 26 in the control group reported carrying sugar cubes before the education program (p=0.494), which rose to 35 in the intervention group after the education, but the difference was not statistically significant between the two groups (p=0.568).

Blood glucose self monitoring

Six patients in each group reported they monitored their blood glucose levels before exercising (p=1.000). After the education program, seven patients in the intervention and one in the control group reported monitoring their blood glucose before exercising, which indicates education did not affect the likelihood of testing blood glucose before exercising (p=0.057). Likewise, the education program did not significantly affect the likelihood to test bed time blood glucose in the intervention group and there was no statistically significant difference between the intervention and the control groups (p=0.179).

In addition, participants were asked about fasting blood glucose self monitoring and testing post prandial blood glucose. Fifteen patients in the intervention and 17 in the control group reported testing fasting blood glucose before education (p=0.818), which increased in the intervention group after the program but the difference was not statistically significant (p=0.502). There were no statistically significant differences between the intervention and the control group at either time point for post prandial blood glucose testing before (p=1.000) or after (p=0.378) the education program.

Weight control

Weight control is important to managing type 2 diabetes and is causally linked to obesity. Patients were asked whether they weighed themselves or not and the frequency of weighing. Before the

education, 23 patients in the intervention and 27 in the control group reported that they weighed themselves (p=0.032). After the education, 27 in the intervention and 29 in the control group reported weighing themselves, however the difference was not statistically significant (p=0.537).

Diabetic retinopathy

The relationship between high blood glucose levels and retinopathy and the importance of regular eye checks at least every six months even if no signs of retinopathy are detected were emphasised in the education program. The number of patients who reported they met this recommendation was similar in the intervention and control group (p=0.453) and did not change after the education (p=1.000).

The comparison of patients who reported trying to regulate their blood glucose according to the values of blood glucose self monitoring to prevent diabetic retinopathy in both groups, is shown in table 3.

Foot care

The importance of inspecting feet every day was highlighted in the education program. Before the education program, thirty-two patients in the intervention and 31 in the control group reported they inspected their feet every day (p=1.000). After the education, 37 in the intervention and 35 in the control group reported inspecting their feet every day (p=0.712).

Measuring blood pressure

Before education, nine patients in the intervention and eleven patients in the control group reported they measured their blood pressure daily (p=0.797) and these numbers did not change after the education (p=0.790).

Self efficacy

Table 4 shows the mean diabetes self efficacy scale scores. The results indicate that education improved self efficacy in the intervention group compared to the control group.

The difference between the mean scores of self efficacy before and after education in the intervention group was compared to the difference found in the control group and the difference was statistically significant (p=0.006).

Table 4: Diabetes self efficacy scale mean scores of the intervention and the control groups

	Intervention group (n=40)	Control group (n=40)	p-value
Before the education	[a]20.0 ± 4.0	19.4 ± 4.3	0.538
After the education	21.9 ± 3.2	19.4 ± 4.4	0.006

[a] Data are mean ± SD

DISCUSSION

The purpose of this study was to evaluate the effect of patient education on knowledge, self management behaviours and self efficacy in patients with type 2 diabetes. The intervention specifically developed for this study was short-term and did not include long-term follow-up.

The evidence from other randomised controlled trials suggests that self management approaches effectively increase participants' knowledge, symptom self management, other self management behaviour such testing blood glucose, weight control, self efficacy, and aspects of health status (Barlow et al 2002). However in this study, knowledge improved to a limited extent and as self reported self management behaviour, only walking regularly and trying to regulate blood glucose levels to prevent diabetic retinopathy, improved significantly. Recent meta-analyses have reported that in the absence of follow-up intervention, health-related improvements gained from self management programs do not persist over the long-term (Tang et al 2005) and it is not easy to distinguish between the specific benefit of such interventions and the non specific effects of study participation, which include increased patient attention and motivation (Devries et al 2003).

Self efficacy of patients however gained significantly. The increase in self efficacy as a result of this short-term intervention was considered to be due to patients thinking they could easily perform activities which were expected of them because of knowledge gained about managing their illness by changing self management behaviour. Even so, self efficacy needs be evaluated with long-term interventions to measure the real effect of education.

During the education program, questions related to self management behaviours such as blood glucose self monitoring and exercising were asked so patients could learn from each others experiences and patients' questions were responded to. Anderson-Loftin and Moneyham (2000) also reported that experiential learning was more meaningful and culturally relevant than traditional lecture-based teaching.

Diet was discussed in detail because it constitutes one of the cornerstones of preventing obesity and regulating blood glucose. Norris et al (2001) found collaborative interventions that focused on increasing knowledge demonstrated positive effects on glycaemic control in the short term. The results of this study indicate that dietary factors were not well known by patients, so regulation of blood glucose levels and obesity caused problems that patients had to cope with.

The damaging effects of hyperglycaemia on the eyes were already well known by patients in both the intervention and control groups before the education.

The improvement in the self management behaviour of exercising was notable. There was a significant improvement in walking regularly for 30 minutes or more, which was similar to other studies (Steed 2005; von Goeler et al 2003; Norris 2001; Hendricks 2000).

Blood glucose self monitoring before exercise and testing fasting blood glucose showed only a little progress. Norris et al (2001), Parchman et al (2003) and Steed et al (2005) also found that diabetes education increased the frequency of blood glucose self monitoring and can significantly delay the progression of or reduce the risk of long-term complications associated with type 2 diabetes (Tang et al 2005).

Although not significant, the frequency of inspecting the feet daily increased in the intervention group. This improvement showed that simple and easily practiced behaviours can be performed more frequently than other self management behaviours. Hendricks et al (2000) and Steed et al (2005) also reported that diabetes self management education improved daily foot care regimens. Also a positive change was observed in weight control in that the number of patients reported to weigh themselves increased.

Norris et al (2002) reported that long-term interventions to ensure long-term maintenance of initial behaviour change are needed.

CONCLUSIONS

Although follow-up occurred only two weeks after the education program, there were some improvements in knowledge, self reported self management behaviour and a significant difference in diabetes self efficacy between the intervention and control groups. This short-term intervention showed that the education program which was developed according to patient's needs could improve patient's management of their illness. However patients should be supported to maintain the self management behaviours long-term. It is recommended that long-term studies are designed to ensure long-term maintenance of self management behaviours and to improve self efficacy.

Limitations of study

This study includes many limitations such as short-term follow-up and lack of maintenance to acquire long-term behavioural change but it encourages education and self efficacy.

RECOMMENDATIONS

Long term patient education programs should be developed on the basis of patients' needs and concerns for long-term follow-up and maintenance.

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