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Impact of Educational Intervention Based on Interactive Approaches on Beliefs, Behavior, Hemoglobin A1c, and Quality of Life in Diabetic Women

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ABSTRACT

Background: Diabetes mellitus (DM) is a public health challenge worldwide and to manage it the patient is required to make some fundamental changes in behavior. Patients should be involved in care program to improve their diabetes condition and quality of life (QOL). This study aimed to examine the effect of educational program on beliefs, behavior, glycemic control indicator, and QOL among diabetic women.

Methods: In this interventional study, 90 female outpatients with type 2 diabetes were randomly selected from those referred to diabetes clinic in Khoy, Iran, during 2011. They were divided into two groups, 45 participants as the intervention group and 45 subjects as the comparison group. Knowledge, beliefs, and behavior by valid and reliable questionnaires, and health-related QOL (HRQOL) by means of WHOQOL-BREF questionnaire were assessed. Hemoglobin A1c level (HbA1c) was measured by the colorimetric method, educational program was conducted on the intervention group for 4 weeks, and changes were compared in two groups after a 3-month follow-up.

Results: After intervention, there was a significant difference between two groups in terms of the mean scores of knowledge ($P < 0.001$), attitude ($P < 0.01$), self-efficacy ($P < 0.001$), and behavior ($P < 0.001$). The findings also indicated that there were significant differences between the groups in mean scores of physical, psychological, and social domains of QOL after intervention ($P < 0.001$). In addition, there was a statistically significant difference between two groups in the mean value of HbA1c after educational intervention ($P < 0.01$).

Conclusions: Instructional interventions based on interactive approaches can be useful, and applicable for behavior modification and improvement of HbA1c level and HRQOL in people with DM.

Keywords: Diabetes mellitus, group-based education, women

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INTRODUCTION

A large number of people coming from various ethnic groups and all levels of social and economic status are affected by diabetes mellitus (DM) worldwide.[1] Current projections of the number of people suffering from diabetes indicate that 285 million people are inflicted by diabetes throughout the world and that by the year 2025, this number will reach 324 million.[2]

In Iran, type 2 diabetes afflicts approximately 7.3% over 30-year-old population.[3] Diabetes is a progressive disease with long- and short-term complications that include cardiovascular, renal, ophthalmologic, peripheral vascular, and neurological effects. These severe consequences may have a very detrimental impact on the quality of life (QOL) of people with DM. However, these untoward complications may be delayed or even prevented by effective treatment and education.[4] The cost of these complications exceeds $132 billion annually; in addition, quality and length of life are reduced.[5] Management of diabetes requires specific lifestyle changes including diet, exercise, self-monitoring, frequent visits to health care providers, and often multiple medications. Further, these changes must be sustained for the remainder of the person's life.[5]

To control their disease, people with DM have to understand the importance of their medication and diet and be aware of the way to modify them in accordance with their exercise routine.[6] Hence, diabetes self-management education (DSME) is an essential element of diabetes care.[7] What DSME intends to achieve is to assist patients in gaining knowledge, obtaining information, acquiring coping and self-care skills, and shaping attitudes necessary for effective self-management of their diabetes.[8] The results of several reviews and meta-analyses are indicative of the positive effect of DSME interventions on health and psychological outcomes. An increase in diabetes-related knowledge, improvement of blood glucose monitoring, foot care, medication taking, coping skills, glycemic control, and formation of healthy dietary and exercise habits are some specifics outcomes of these interventions.[8] Unfortunately, more than 50% of diabetic individuals do not have a sufficient amount of knowledge and lack necessary skills. Furthermore, in people with type 1 and people with type 2 diabetes, the mean hemoglobin A1c (HbA1c) levels are higher than the acceptable level. Moreover, an ideal glycemic control (HbA1c <7.0%) is only achieved by less than half of people with type 2 diabetes.[9] Reasons of these failures should seek in educational approaches were implemented in instructional sessions to people with DM.

Despite the existence of ample evidence supporting the effectiveness of DSME interventions in the improvement of diabetes-related health outcomes, not many studies so far have examined the effect of delivery format of DSME on diabetes health-related outcomes. According to Mensing and Norris, compared to individual-based approaches, group-based approaches usually urge a higher level of interaction and interpersonal dynamics.[10] In addition, certain educational activities, such as social modeling or problem-based learning, are better fostered by group settings than by individual settings.[10]

To some researchers, in comparison to individual-based DSME, group-based DSME improves diabetes-related health outcomes to a greater extent. Moreover, it is believed that compared to individual education, group education costs less.[11] Norris *et al.* (2001) conducted a study with the aim of examining group versus individual approaches to DSME. The results of their study showed that patients in both settings achieved the same level of success in applying self-care practices. Nutritional management and physical activity were the only two self-management practices in which group-based learning resulted in marginally better self-care outcomes than individual-based learning. The researchers concluded that each one of the intervention approaches enjoyed a unique set of features and advantages.[12]

The study conducted by Deakin *et al.* revealed that group-based education was effective in improving fasting blood glucose levels, HbA1c, systolic blood pressure, body weight, need for medication, and diabetes knowledge among individuals suffering from type 2 diabetes.[13] With regard to positive advantages of group-based approaches (interactive approaches), it seems that those will be more helpful and effective than other approaches in educating people with diabetes. Therefore, the aim of the present research was to examine the impact of interactive approaches-based educational intervention program on beliefs, behavior, HbA1c, and QOL in diabetics.

METHODS

Study design and participants

This experimental study was conducted during the year 2011 in Khoy, Islamic Republic of Iran. We assessed people with DM, who were admitted in Diabetic Clinic of Khoy for eligibility, within 3 months. A total of 352 patients were screened. Women were considered eligible for the study if they had type 2 DM had not attended in a formal diabetes education program and participated voluntarily in the study. From the screened patients, 240 subjects had the study criteria and agreed to participate in the study. Finally, ninety subjects were estimated, as total sample size, considering the previous study results[6] and they were randomly selected from 240 patients, and the rest were excluded from the study.

We randomly allocated and matched the two groups according to demographics and the study main variables [Table 1]. We repeated random allocation several times and selected the most homogeneous groups. Figure 1 shows the flowchart for enrollment of the participants in the study. For better usage of interactive educational techniques in education sessions, intervention

Table 1: Distribution of study variables in two groups

Variables	Intervention group (*n*=45)	Comparison group (*n*=45)
Age group (years) (*n*, %)		
18-30	0 (0)	1 (2.2)
31-43	10 (22.2)	11 (24.4)
44-56	21 (46.7)	20 (44.4)
>56	14 (31.1)	13 (28.9)
Education (*n*, %)		
Illiterate	21 (46.7)	23 (51.1)
Primary	11 (24.4)	10 (22.2)
Secondary	6 (13.3)	6 (13.3)
Tertiary	5 (11.1)	4 (8.9)
University	2 (4.4)	2 (4.4)
Monthly income (*n*, %)		
Weak	22 (48.9)	23 (51.1)
Fairly moderate	13 (28.9)	12 (26.7)
Moderate	5 (11.1)	6 (13.3)
Good	5 (11.1)	4 (8.9)
Information source (*n*, %)		
Health personnel	34 (75.5)	32 (71.1)
Others	11 (24.4)	13 (28.9)
Visit interval by physician (*n*, %)		
≤2 months	26 (57.8)	24 (53.3)
>2 months	19 (42.2)	21 (46.7)
Treatment routes (*n*, %)		
Insulin	8 (17.8)	9 (20)
Oral drugs	30 (66.7)	31 (68.9)
Both insulin and oral drugs	5 (11.1)	4 (8.9)
None	2 (4.4)	1 (2.2)
Health beliefs (mean±SD)		
Attitude	64.5±15.3	65±15.7
Self-efficacy	40.4±5	42.5±4.6
Self-care behavior	2.4±5	2.5±0.91
HbA1c (mean±SD)	9.42±1.91	9.75±1.95
HRQOL (mean±SD)		
Physical health	45.71±15.72	45.55±17.95
Psychological health	49.55±12.1	51.48±13.7
Social health	55.2±17	57.6±18
Environment	54.4±7.03	56.6±6.33
Overall HRQOL	50.7±18.4	52.8±18.3
Duration of diabetes (years)	8.12±6.21	7.98±5.56
Body mass index	28.7±4.5	29.01±4.7
Knowledge	7.28±3.45	7.1±2.9

SD=Standard deviation, HRQOL=Health-related quality of life, HbA1c=Hemoglobin A1c level

group were divided into three subgroups (each subgroup included 15 patients). A female nurse was trained by the researcher about implementing educational program and educating diabetic patients using interactive approaches in two 2-h sessions. Then, the trained nurse (educator) instructed each subgroup for 60 min/week (intervention group) by involving patients in educational sessions. However, no educational intervention conducted on comparison group exception the routine treatment. Educational sessions were held for 4 weeks, and participants were followed after 3 months.

The education program was according to the protocol of Iranian Diabetes Association. In instructional sessions, collaborative and interactive teaching methods (group discussion, brainstorming, and question and response techniques) were used. Especially, for promoting self-efficacy of diabetics, the educator utilized specific training approaches such as verbal persuasion, modeling, and performance accomplishments. According to interactive approaches, there is a discussion during the educational sessions with the active participation of the patients and that all the information is derived and analyzed on the basis of patients' knowledge and experience.[6] Before education, data relating to study demographic and main variables were collected, but 3 months after health education program, only main variables were evaluated and compared.

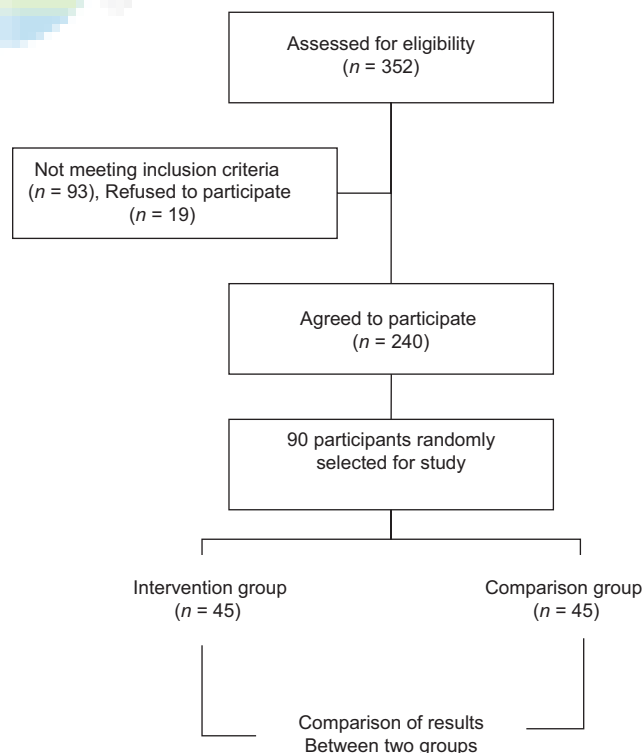The study protocol was approved by the Ethics Committee of Tehran University of Medical Sciences. All

Figure 1: Flowchart of participants' selection for study

ethical issues such as obtaining informed (oral) consent and presenting the study objectives for subjects were followed. The questionnaires were anonymous, and all the information was kept confidential in this study.

Procedures and variables assessment

To collect the study data, we developed a self-reported questionnaire using similar instruments applied in other studies. This measurement instrument included six subscales: Characteristics (8 items); diabetes knowledge (11 items); attitude toward behavior (12 items); self-efficacy (15 items); behavioral performance (12 items); and health-related QOL (HRQOL) (26 items). Response categories for each item relating to self-efficacy, attitude, and QOL include a 5-point Likert scale ranging from 1 to 5. In addition to questionnaire, blood sample was also taken.

Data relating to study variables were collected the following formats:

1. Diabetes knowledge: Knowledge was assessed using a series of validated tests.[3] The range of scores was from 0 to 22
2. Self-efficacy toward self-care behavior: Self-efficacy was assessed using statements such as: "I am able to do self-care activities every day," and "I think I'm able to take extra self-care activities when the doctor advises me to do so," the range of scores was from 15 to 75
3. Attitude toward self-care behavior: Attitude was assessed by a set of valid indirect tests[3] (12 items: 6 items for behavioral beliefs and 6 items for outcome evaluation). The total score of attitude was the sum of a multiple of scores for the two sections. The range of scores was from 6 to 150
4. Self-care behavior: To assess levels of diabetes self-care behavior, we used the summary of diabetes self-care activities measure.[14] Range of frequency for self-care behavior was 0 to 7 days/week
5. HRQOL: Was assessed by means of WHOQOL-BREF questionnaire that was previously validated by Nejat in Iran.[15] The scored ranged from one to five encompassing four domains: Physical health, psychological health, social relationships, and environment. Raw scores were converted to transformed scores in each domain. The transformed scores ranged from 0 to 100.[15]
6. HbA1c: Glycosylated hemoglobin (HbA1c) was measured by colorimetric method using hemolysate (BioSystems, Barcelona, Spain). HbA1c was tested in twice: Before educational intervention and 3 months after intervention.

To test content validity, except QOL instrument, all questionnaires were examined by an expert panel. The experts evaluated each item in terms of distinctiveness, understandability, and appropriateness for the study purpose. Next, based on the comments of the panel, some final revisions were undertaken.

To evaluate the reliability of the instrument, ninety diabetic patients were asked to complete the questionnaires. Furthermore, for each questionnaire, Cronbach's alpha was calculated. The reliability of study surveys using internal consistency was studied and Cronbach's alpha values for knowledge, attitude, self-efficacy, self-care behavior, and HRQOL were computed and confirmed (0.76, 0.81, 0.78, 0.86, and 0.92, respectively).

Statistical analysis

To analyze the data, we applied descriptive statistics such as frequencies, percentages, and Chi-square test for qualitative variables. The Kolmogorov–Smirnov test was used to determine the normality of the study quantitative variables. With regard to the normal distribution of data, the independent *t*-test and dependent *t*-test were utilized to compare the means of two independent groups and two related groups. SPSS software version 16.0 (SPSS Inc., Chicago, IL, USA) was utilized for data analysis. $P < 0.05$ was considered as significant in all tests.

RESULTS

Table 1 shows the frequency of characteristics and mean ± standard deviation of study main variables in two groups before education. There is no significant difference between the two groups in all of the variables.

Table 2 indicates the status of the mean scores of the studied psychosocial variables in the two groups before and 3 months after education. After education, the intervention group had statistically significant increase in the mean score of knowledge ($P < 0.001$), attitude ($P < 0.001$), self-efficacy ($P < 0.001$), and behavior ($P < 0.001$).

Table 3 shows effects of educational intervention on the other study variables in the two groups before and 3 months after education. After educational program, the intervention group had statistically significant increase in the mean score of physical health ($P < 0.001$), psychological health ($P < 0.001$), social health ($P < 0.001$), and total HRQOL ($P < 0.001$). Although mean of environment score improved from 54.4 to 56.8, the paired *t*-test was not statistically significant. Furthermore, intervention group had statistically significant reduction in the mean of HbA1c from 9.42 to 7.81 ($P < 0.001$). Patients in the control group showed no significant changes in the outcomes measured ($P > 0.05$).

DISCUSSION

The results of this study revealed that educational intervention based on interactive educational approaches

Table 2: Comparison of the mean±standard deviation scores of variable of knowledge, beliefs, and behavior in participants before and after education in two study groups

Variable	Intervention group (n=45)			Comparison group (n=45)			P value of between groups[b]
	Before education	3 months after education	P[a]	Before education	3 months after education	P[a]	
Knowledge	7.28±3.45	11.24±2.18	<0.001*	7.1±2.9	6.9±2.8	0.76	<0.001*
Beliefs							
Attitude	64.5±15.3	120.5±14.1	<0.001*	65±15.7	66±16.3	0.185	<0.001*
Self-efficacy	40.4±5	68.6±3.4	<0.001*	42.5±4.6	43. ±5.7	0.115	<0.001*
Behavior	2.4±0.63	4.3±0.56	<0.001*	2.5±0.91	2.4±0.9	0.531	<0.001*

Independent *t*- and paired *t*-tests were used for comparing means, *P<0.01 is significant (two-tailed). [a]P value of within groups, [b]P value of between groups

Table 3: Comparison of the mean±standard deviation scores of variable of hemoglobin A1c level and quality of life in participants before and after education in two study groups

Variable	Intervention group (n=45)			Comparison group (n=45)			P value of between groups[b]
	Before education	3 months after education	P[a]	Before education	3 months after education	P[a]	
HbA1c	9.42±1.91	7.81±1.26	<0.001*	9.75±1.95	10.26±1.73	0.42	<0.001*
HRQOL							
Physical health	45.71±15.72	66.58±6.51	<0.001*	45.55±17.95	44.92±17.43	0.95	<0.001*
Psychological	49.55±12.1	68.87±6.2	<0.001*	51.48±13.7	50.37±12.8	0.16	<0.001*
Social	55.2±17	70.5±7.6	<0.001*	57.6±18	56.3±16.7	0.52	<0.001*
Environment	54.4±7.03	56.8±7.3	0.123	56.6±6.33	54.1±5.9	0.12	0.123
Total HRQOL	50.7±18.4	64.1±11.1	<0.001*	52.8±18.3	51.1±16	0.32	<0.001*

Independent *t*- and paired *t*-tests were used for comparing means, *P<0.01 is significant (two-tailed). [a]P value of within groups, [b]P value of between groups. HRQOL=Health-related quality of life, HbA1c=Hemoglobin A1c level

increases knowledge, health beliefs, behavior, and improves HbA1c and HRQOL. It seems that improvement in HbA1c and HRQOL of diabetics is dependent on behavior change and also behavior modification might be related to the change that educational intervention made in participants' knowledge, attitudes, and self-efficacy. Lack of awareness has been identified as one of the reasons why patients do not control their disease.[16]

The type of education that can improve patient's self-care is known to be the first step in controlling diabetes. As in the current study, mean score of knowledge level in women with DM increased in intervention group after education and paired *t*-test confirmed the significant difference. In contrast, this variable was not changed in the comparison group at the end of the study. This finding was supported by other studies results. For instance, results of study of Hartayu *et al*. showed that group-based interactive approach increased knowledge level of diabetic patients in intervention group after education. They concluded interactive strategy is effective to improve diabetic patients' knowledge.[17] Furthermore, other studies have confirmed that this instructional approach (interactive approach) is effective in improving knowledge of participants and these studies supposed increased of patients' knowledge will be more, if they involve in educational process.[8]

Although knowledge level of diabetics plays the important role in managing and controlling their condition, but it is not sufficient.[18] To better manage and control diabetes, other effective factors such as attitude and self-efficacy of diabetic patients should also be considered. Attitudes and self-efficacies of diabetics are more effective than knowledge in improving metabolic control.[19]

The results showed statistically significant differences in attitude mean score of the intervention group after the educational intervention, which is consistent with previous studies.[8] It seems that attitude also is influential on self-care activities and glycemic control. To raise intention to engage in self-care of diabetics, it is necessary that patients gain a positive attitude toward self-care behaviors. One study[20] also proved that a relationship existed between diabetes-specific health beliefs and following a diabetes regimen and controlling glucose among older people with noninsulin-dependent DM. Self-efficacy, as another psychosocial factor, can play the main role in changing behavior, and then diabetes educators, practitioners, and consultants should consider to this subject. This study finding indicated the mean score of self-efficacy increased after education and paired *t*-test confirmed it. Results of previous studies are consistent with our finding.

In an experimental study and in accordance with self-efficacy theory in physical activity improvement, Allen examined the effect of education among the patients with type 2 diabetes. It was found that a significant difference existed between self-efficacy averages of the experimental and control groups before and after the intervention (8 weeks later).[21] The findings of our study were consistent with those of Henrietta's. In Henrietta's study, it was found that there was a positive correlation between self-efficacy and diabetes activities. This indicated that individuals with higher self-efficacy performed more diabetes self-care activities.[22]

The study conducted by Whittemore *et al.* confirmed that in women with type 2 diabetes, positive health outcomes may be led by their perceived self-confidence and support.[23] Findings of Gumbs's study also showed that those women receiving DSME were significantly more likely to check their own blood sugar and feet on a regular basis, to perform moderate physical activities, and to have received foot examination, glycosylated hemoglobin measurements, and dilated eye examinations by healthcare providers over the past year.[24] The impact of education on self-care behavior, as a final short-term objective, was also assessed in this interventional study.

The results showed that the patients' mean of performance in intervention group has improved after the intervention. Paired *t*-test showed that the mean of self-care behavior scores in intervention group is different, but not in the control group. It means that education using interactive training methods is effective on behavior of diabetic patients. Results of Kroese's *et al.* study were consistent with our findings. As he and his colleagues found that educational had a positive effect on the improvement of cognitive skills, self-care activities, and also dietary and exercise behaviors.[25] Others have also resulted in significant improvements in diabetes outcomes.[26] For instance, Deakin *et al.* concluded that in patients with type 2 DM, group-based education in self-management strategies improves clinical and lifestyle outcomes.[13] The results indicated that a significant difference existed between HbA1c levels before and after the intervention in the experimental group and not in the control group. These findings of the study are consistent with those of other studies.[4,27] Reduction of HbA1c is mainly a consequence of changes in the behavior of the intervention group members. During the 6–8 weeks of education period, the average of patients' blood glucose levels was closer to normal. In addition, the long-term risk of complications was reduced.[28] Maintenance of HbA1c low levels will prevent complications associated with diabetes. A 1% decrease in HbA1c causes a 21% reduction in mortality associated with diabetes, a 14% decrease in myocardial infarction, and a 37% decrease in microvascular complications are demonstrated by research studies.[29]

Improving the QOL for patients with diabetes in a way that they can lead as normal a life as possible is one of the main objectives of diabetes management. It is an important measure of outcome that should be examined on a routine basis in clinical trials which are concerned with evaluating patients' education.[4] This study showed that before diabetes education, patients with diabetes had a lower overall HRQOL in all aspects. Health education led to higher scores in all dimensions except for the environment in intervention group. In case, these changes were not observed in the control group. The results of this study are consistent with those observations made by other studies which have found that diabetes education contributes to an increase in the HRQOL score.[30] Furthermore, there is ample evidence from different interventional studies for the positive impact of educational programs on various aspects of QOL and overall well-being.[4,31] The study has several strengths. First, the educational intervention was pragmatically designed for implementation in a primary care setting for patients. Second, Basic principles relating to interactive educational techniques fully considered in educational meetings. Finally, we measured long-term outcomes of education in addition to its short-term outcomes. Shortage of follow-up period y, small sample size, and losing samples within the study process were the study limitations. Therefore, increased educational follow-up periods, and using big sample size were recommended for researchers who will conduct educational studies.

CONCLUSIONS

Results highlighted that applying interactive and collaborative educational approaches in educating women with diabetes 2 were important, helpful, and valuable. After education, ample changes have been seen in areas of patients' health beliefs, behavior, glycemic control index, and QOL. The study suggests that practitioners, nurses, and other health care providers should consider interactive education as a core element in delivering health care to diabetic patients.

Hence, educational interventions should be designed in a way that they put the focus on individual needs of each patient, that is, a patient-centered approach is needed. In designing an educational program, factors such as the patient's priorities, feelings, expectations, and lifestyle changes following the disease should also be taken into account. In addition, patients with type 2 diabetes should receive ongoing education. The reason behind this is that over time knowledge tends to be lost and as a consequence maintaining the beneficial effects of the intervention will become more difficult.

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Conflicts of interest

There are no conflicts of interest.

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