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Effects of the BASNEF Model-Based Educational Programs on Blood Sugar Control, (Type 2 Diabetes)

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Abstract

Aims: Complication of diabetes mellitus (DM) is the most important impediment resulted from uncontrolled blood sugar. The patients should be educated on controlling their blood sugar and promoting their preventive behaviors, in order to reduce complications. The aim of the present study is to determine the effects of the BASNEF Model-based educational programs on Blood sugar Control (Diabetes Type 2), in Nader Kazemi Clinic, Shiraz-Iran.

Methods and Materials: This is a perspective and quasi-experimental intervention study, the research population is type 2 diabetics of 40-65 years diagnosed over 5 years. 100 patients fulfilling the inclusion criteria participated in the study. They were randomly divided into experimental and control groups. The instruments for data collection were: a questionnaire established based on the BASNEF Model (Belief, Attitude, Subjective Norm and Enabling Factors), a self reporting checklist related to the patient practice and a checklist for recording the patients' HbA1c and Fasting Blood Sugar (FBS) levels. Content validity method was used to evaluate the questionnaire's scientific validity. The questionnaires were completed by 20 type 2 diabetics to measure reliability (other than those who participated in the study). The faulty ones were removed and the results checked with %95 reliability (Cronbach's ά Coefficient was 84%).

Both groups completed the questionnaires and checklists; the results were documented before and three months after intervention.

The patients of the experimental group participated in 6- session educational classes in the first month of intervention and once more two months after, with 2-session meeting classes as the intervention follow up. Data analysis was conducted using SPSS

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software, chi square-test, T-test for independent samples, matched T-test, and repeated measures ANOVA.

Findings: concerning the mean scores of age, T-test for independent samples showed no significant difference between the experimental group (SD=7.52, Mean=54.40) and control group (SD=6.72, Mean=54.24).
The findings indicated that the mean scores of BASNEF Model variables were significantly increased in the experimental group compared to the control group, after intervention. Also, behavioral control of blood sugar, HbA1c rate (8.65% before intervention and 7.47% after three months) and FBS levels (207.08 before intervention and 124.2 after three months) improved significantly among the experimental group, compared to control group.

Conclusions: Applying the BASNEF Model is very effective in developing an educational program for diabetics, in order to control their blood sugar and enhance behavioral controlling blood sugar. Besides, follow up education on controlling and monitoring is highly recommended.

Key words: Type 2 DM, Fasting Blood Sugar, BASNEF Model

Introduction

Diabetes is the most prevalent disease which results from metabolism disorders and as stated by some scholars it is a disease of endocrines [1]. It is a chronic disease which occurs as the result of disorder in glycoside-carbohydrate metabolism [2]. Disorder in carbohydrates metabolism causes change in all body organs and as a result, it may cause serious or sometimes dangerous complications for the patient. Increase of blood sugar alone does not cause any problem for the patient and it brings its complications little by little without making any sign [3]. Diabetes complications are very different and various. Diabetic patients should control their blood sugar not to be afflicted with complications of diabetes and it calls for the patients' awareness and appropriate self-care operation [4].

A diabetic patient should follow an appropriate and exact food program, have regular physical exercise, take medicine on a regular basis and control his or her blood sugar to prevent diabetic ocular complications [3]. It is a common belief that patients need instruction and assistance for realizing and understanding their health status, making decision for health care and changing health behaviors [4]. Today, the focus of comprehensive health care should be on self-care and education rather than treatment and reliance. Also, effort should be made to increase the individual's capabilities for improvement, independence and non-reliance [4].

Giving health education to people helps them make decisions on their health, get self-confidence and necessary skills to put decisions in to practice [5]. Having knowledge regarding the educational recommendation is not enough and even in spite of good

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knowledge, it is difficult for patients to act according to the knowledge [6].

This is more important in patients with type 2 diabetes due to lower knowledge of control of disease [7]. Previous studies pointed out the important role of education in controlling glucose in diabetic patients [8] and mentioned the key role of education for changing habits [9]. The effectiveness of educational programs also is important.

The value of health education programs depends on their effectiveness, and such effectiveness is dependent to a large extent on the correct application of theories and models of the health education [10].

Educational interventions regarding diabetes are aiming at introducing prophylactic methods, treatment and control of disease to patients; so that they will not be affected by chronic complications of diabetes such as ocular and renal complications, amputation, etc [11]. In conducting health education interventions, using behavioral theories and behavioral sciences such as health belief, BASNEF model, rational act theory, social support, and innovation publicity theory could bring new potentials for diabetic patients to become more familiarized with their disease and prevent its complications [11].

A change of behavior model that is suitable for nutritional educational programs is Hubly's change of behavior model. This model includes beliefs, attitudes, subjective norms and enabling factors (BASNEF Model) [12].

Behavioral attitude is a product of one's belief; in fact, it is the positive or negative evaluation of behavior. Subjective norms are one's belief towards the influential persons which depends on the social pressures and reflections. Enabling factors are skills and sources that allow person's aim or intention to change the behavior [13].

In this study, using educational intervention based on BASNEF model, it has been tried to increase diabetic patients' knowledge and improve their insight into the control blood sugar and its prophylactic activities. Also presenting enabling factors such as sufficient information, instruction regarding the controlling blood sugar, and its cooperation and getting the patient's family involved in the process and intervention in their subjective norms, we have helped diabetic patients apply prophylactic methods for their blood sugar and disease control not to be afflicted with complications.

Methods & Materials

This is a perspective and quasi-experimental intervention study. The research population consists of those referred to Nader Kazemi Clinic- Shiraz (2010) with type 2 diabetes, age of 40- 60, diagnosed over 5 years and exposed to danger of complications. Unwilling patients and those who could not participate in

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meetings were removed from the study. In this study, we firstly contacted based on study criterion with 250 type 2 diabetics who had file in Diabetes Center and asked them to participate in the study program. Some of them announced their declination to participate in the program and finally 100 patients were selected as sample population randomly and divided alternatively into experimental group (n= 50) and control group (n= 50); in a way that the first participant was placed in experimental group and the second in control group, since the aim of this study was to compare the mean blood sugar among the two groups. The sample size was calculated using the following formula; the result was 99, however we assumed it 100 subjects.

$$n = \frac{2\delta^2(Z_1 - \frac{\alpha}{2} + Z_1 - \beta)^2}{d^2}$$

The instruments for data collection were a questionnaire established based on the BASNEF model which contained demographic specifications (6 items), knowledge (11 items), beliefs in two parts of attitude toward behavior results (7 items) and attitude toward act (5 items), enabling factors (6 items), behavior intention (5 items), norm beliefs (6 items), subjective norms (5 items); and two checklists. The first checklist (with 6 items) was about patients' prophylactic behaviors concerning blood sugar control (jogging at least 3 times a week and each time 20 minutes, regular medicine consumption based on prescription, having an appropriate prescribed food program, going to clinic for measuring blood sugar and consulting and participating in educational classes) completed on the basis of self-reporting.

The second checklist was applied to record the patients' HbA1C and FBS levels. The scoring method of the questionnaire was designed on 5-point Likert scales.

The validity of the questionnaire was measured using content validity and face validity methods.

Five experts' opinions were considered for assessing content validity. The questionnaires were completed by 20 type 2 diabetics (other than those who participated in the study). The faulty ones were removed. They were checked with %95 reliability (Cronbach's ά Coefficient was 84%).

Reliability of the questionnaire was measured by means of reinvestigating; it was acceptable (84%).

The questionnaire and the first checklist were completed before educational intervention by the experimental and control groups, and the patients were introduced to the same laboratory for HbA1c and FBS tests. Then, the educational intervention was put in operation for the experimental group within six 55-60

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minute sessions during one month in the form of lecture, question and answer, group discussion and practical presentation. Patients were provided with necessary information and instructions about diabetes, appropriate diet and regular medicine taking, the importance of participating in educational classes as well as exercise in controlling the blood sugar.

The patients' families also participated in one educational session. Another session was devoted to explaining the subjective norms through inviting the diabetes specialists, nutrition experts etc (educational package).

Immediately after the educational intervention, the first checklist and the questionnaire were completed by the two groups' members. Two follow-up sessions were held in the next two months regarding patients' activities. Three months after the intervention, the questionnaire and the first checklist were completed by the two groups' members and they were sent for HbA1c and FBS examinations; the results were recorded in the second checklist. It worth to mention that their FBS levels were recorded in 4 steps (before intervention, one month after intervention, two months after intervention, and three months after intervention), in order to follow up their control process and self-care. Data analysis was conducted using SPSS software, Chi square-test, T test for independent samples, matched T-test, and repeated measures ANOVA.

Table 1: Relative frequency distribution of the studied participants based on gender, occupation and education

Demographic Specifications	Experimental Group Members (Percentage)	Control Group Membes (Percentage)
Gender		
Female	39(78)	37(74)
Male	11(22)	13(26)
Occupation		
Employee	6(12)	9(18)
Self-employed	2(4)	3(6)
Farmer	1(2)	2(4)
Housekeeper	33(66)	29(58)
Other	8(16)	7(14)
Education		
Illiterate	14(28)	15(30)
Primary School	19(38)	18(36)
Secondary School	6(12)	6(12)
High School Diploma	4(8)	5(10)
Associate Degree or Higher	7(14)	6(12)

Results

T test for independent samples showed no significant difference between the mean scores of age in the experimental group (SD=7.52, Mean=54.40) and control group (SD=6.72, Mean=54.24), as well as mean scores of

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afflicted patients of the experimental group (SD= 4.37, Mean=9.76) and control group (SD=3.95, Mean=9.84). Chi-square test showed no significant difference between the experimental and control groups regarding the gender, occupation and education (Table 1).

Table 2 Comparison of the mean scores of patients' knowledge and attitude with the results of behavior, attitude toward practice, enabling factors, subjective norms, norm beliefs, and the patients' practice intention based on self-reporting

Variables &Groups	Pre- Test M (SD)	Post- Test M (SD)	3 Months Follow-up test M (SD)	RMA Tests Result
Knowledge				
Experimental	17.27(11.93)¤*	73.45(17.79)¤***	84.90(12.12)¤***	P<0.001
Control	24.90(13.72)	25.33(12.04)	25.95(12.69)	P= 0.50
Patients attitude towards results				
Experimental	27.35(8.58)¤	77.42(10.56)¤***	86.71(7.28)¤***	P<0.001
Control	28.07(9.35)	29.85(8.85)	38.14(10.76)	P <0. 05
Attitudes Towards the practice				
Experimental	34.60(14.10)¤	82.0(8.32)¤***	82.80(11.30)¤**	P<0.001
Control	38.80(12.76)	39.70(12.71)	51.20(10.07)	P>0.05
Enabling Factors				
Experimental	22.66(18.38)¤	77.66(12.19)¤***	88.16(6.96)¤***	P<0.001
Control	27.0(13.73)	28.66(11.43)	34.66(13.18)	P<0.05
Normative Beliefs				
Experimental	45.66(12.54)¤	72.08(11.7)¤***	79.16(9.59)¤***	P<0.001
Control	47.83(12.03)	25.33(12.04)	25.95(12.69)	P= 0.50
Subjective Norms				
Experimental	36.30(15.21)¤	60.90(18.8)¤***	70.50(15.65)¤***	P<0.001
Control	40.0(13.13)	47.08(11.04)	47.76(11.47)	P= 0.95
Intention Towards the behavior				
Experimental	31.60(14.01)¤*	85.40(9.02)¤*	88.60(7.82) ¤**	P<0.001
Control	37.90(11.47)	42.0(13.36)	39.40(10.95)	P>0.05
Patients' operation- based self reporting				
Experimental	33.0(21.42)¤	78.0(17.31)¤*	88.0(10.66) ¤**	P<0.001
Control	38.33(17.57)	38.66(13.23)	39.66(12.54)	P>0.05

Independent T-test Results between the two groups; *P>0.05; **P<0.01; ***P<0.001

Patients lacked the required information before intervention. There was a significance difference between the mean scores of knowledge of the two groups, i.e. the mean score of the experimental group was higher than that of the control group (P<0.001).

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Matched t-test of experimental group showed that the mean scores of knowledge significantly increased immediately and 3 months after the intervention (P<0.001). Repeated Measures ANOVA (RMA) also confirmed the above relationship (P<0.001). There is not any significant difference in control group concerning the mean scores of knowledge before educational intervention, immediately after intervention, and three months after intervention. RMA test also showed the same results in control group (P=0/05) (Table 2).

Independent T-test indicated that there was no significant difference between the attitude mean scores regarding the results of the two experimental and control group's behavior before the educational intervention (P= 0/692), while the difference was significant immediately after the intervention (P<0.001), and 3 months after the educational intervention (P<0.001). Matched T-test in experimental and control groups indicated a significant difference in the attitude mean scores regarding the patients' behavior before, immediately after and 3 months after the intervention (P<0.001) (Table 2).

Before the educational intervention, there was no significant difference between the mean scores of attitude toward practice of the two groups; while the difference became significant immediately after (P<0.001) and three months after the educational intervention (P<0.001). RMA test indicated the significance of difference between the mean scores of attitude before, and immediately after the intervention (P<0.001). Matched T-test in experimental group indicated no significant difference in three months after the educational intervention, as well as between the mean scores of attitude toward practice in the control group before and immediately after the intervention; while the difference became significant three months after the educational intervention (P<0.001) (Table 2).

T-test for independent samples indicated no significant difference between the mean scores of enabling factors among the two groups before the educational intervention, but the difference was significant immediately after (P<0.001) and three months after the intervention (P<0.001).

RMA test indicated the significance of difference between the mean scores of enabling factors in experimental group before, immediately after, and three months after the educational intervention (P<0.001). There was no significant difference between the mean scores of enabling factors in control group before and immediately after the educational intervention, while the difference became significant three months after the intervention

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(P<0.001) (Table 2).

The mean scores of the subjective norms did not differ significantly in the two groups before the intervention, but this difference became significant immediately after and three months after the intervention (P<0.001). RMA test indicated significant difference in the mean scores of the subjective norms among the experimental group, before, immediately after, and three months after the intervention (P<0.001). It showed no significant difference among the control group (Table 2).

T-test for independent samples indicated that there was no significant difference between the mean scores of the norm beliefs among the two groups before the educational intervention; while, this difference was significant immediately after and three months after the intervention (P<0.001). RMA test indicated a significant difference between the mean scores of the norm beliefs in the experimental group before, immediately after, and three months after the educational intervention (P<0.001), but no significant relation in the control group (Table 2).

The mean score of the behavior intention for the patients in control group was higher than that of experimental group before the educational intervention; but, immediately after and three months after the intervention the mean score of behavior intention and its changes was higher in experimental group compared to the control group (P<0.001). The result of matched T-test in control group indicated a significant difference between the mean scores of the behavior intention before and immediately after the intervention (P<0.001); but, no significant difference three months after the intervention (Table 2).

Independent T-test showed no significant difference in the mean scores of the patients' practice among the two groups before the educational intervention, while the difference became significant three months after the intervention (P<0.001). RMA test indicated significance of the difference between the mean scores of the practice in the experimental group before, immediately after, and three months after the educational intervention (P<0.001), but no significant difference among the control group (Table 2).

Matched T-test in the experimental group indicated that the mean score of HbA1C has decreased three months after the educational intervention (P<0.001). The same test in control group indicated no significant difference in the mean scores of HbA1C before and three months after the educational intervention (P= 0.08) (Table 3).

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Table 3 Comparison between the mean scores of HbA1C in the patients before and three months after the educational intervention

Variables & Groups	Pre- Test M (SD)	3 Months Follow-up Test M (SD)	Tests Result
HbA1C Level Experimental	8.65(1.74)¤	7.47(1.58)¤***	P<0.001
Control	8.57(1.35)	8.51(1.34)	P= 0.08

Independent T-test Result between the two groups; *P>0.05; **P<0.01; ***P<0.001

Chart 1 shows that FBS levels have been less in the control group in comparison to the experimental group before the educational intervention, but the FBS levels significantly decreased among the experimental group compared to the control group in 1, 2, and 3 months after the educational intervention; so that the curve trend was reversed.

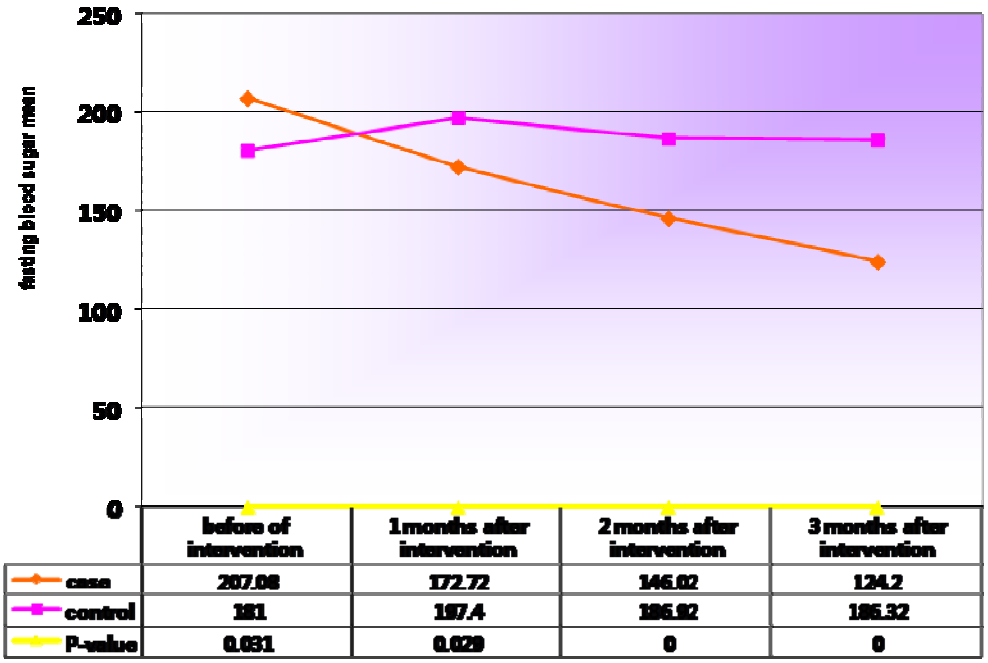


Chart 1 Comparison of the Mean scores of the fasting blood suger among the patients

Discussion

The low awareness of both experimental and control groups before educational intervention reveals the lack of information and the required instructions for blood sugar control in Diabetes Center. The mean score of the experimental group awareness compared to the control group, immediately after educational intervention and three months after remarkable increased; it proves the positive effect of

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educational intervention on patient's awareness and the process continuity. The findings of the present study are in conformity with the quality control study of diabetics, self-care, and the increase of awareness after educational intervention [14]; prevention and control of diabetics [15]; and the study of diabetics' knowledge of self-care [16]. It also conforms to the increase of students' awareness based on the BASNEF model regarding the social skills after educational intervention [17] and the increase of inter-personal skills after educational intervention [18].

The patients' beliefs concerning the blood sugar control behaviors are studied in two parts:

a) Patients' attitude toward the behavior results

The mean scores of the attitude toward the results of behavior immediately after educational intervention and after three months increased in both experimental and control group. But the mean variations and the increase of the scores has been considerably higher in the experimental group than that of the control group. The above findings reveal the effectiveness of the BASNEF model-based intervention in the area of belief and continuation, amending and promotion of the patient's attitude toward the blood sugar control behaviors. The patients of the experimental and control groups have been selected from the Diabetes Center and there was no restriction in prophylactic instructions access for control group; also the findings showed the promotion of the attitudes and beliefs of patients in control group toward the worthiness of blood sugar control behaviors.

These findings conform to those obtained from case study of Diabetes Center of Sanandaj-Iran [19-20], regarding the diabetics' attitude toward self-care and the promotion in their attitude after education as well as the study on promotion of diabetics' attitude in Abhar-Iran [14] in this regard. Findings of this study also are in conformity with those of Baghiyani Moqaddam's study on the increase of the attitude score regarding the diabetic control behaviors after educational intervention based on BASNEF model [11].

b) Attitude towards Practice

The mean score of the patient's attitude toward practices to control blood sugar immediately after intervention has increased in experimental group, but three months after intervention there has been no significant increase. There has been no increase in the mean score of the patients' attitude toward practice to control blood sugar immediately after intervention in control group; however since the control group three months after educational intervention did not deprived of the clinic facilities, control blood sugar instructions and information, the mean score of their attitude toward practice increased. These

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findings are confirmed with Raman's study on the patients' attitude toward retinopathy status and its increase after education in India [21] and other similar studies [22, 23]. In the study of Rakhshanderou, the use of education theories have been emphasized for changing the attitudes [24] and in other studies, the role of educational methods of discussion and question and answers have been mentioned as an effective method in improving nutritional attitude[17-25].

Immediately after education and three months later, the experimental group obtained significantly higher mean score in enabling factors compared to the control group which indicates the sustainable access to the enabling factors during the study. Also, in the control group three months after educational intervention the mean score of enabling factors increased. It worth to note that enabling factors include access to the required information and instructions concerning the blood sugar control; holding educational classes; and family cooperation in employing the blood sugar control methods.

Whereas, there was ethically no restriction for control group to refer to the Clinic and they accessed the information, the score of enabling factors in this group increased three months after intervention. Based on the "PRECEDE" model, this factor may also affect the awareness, attitude and behavior of the individuals [26] and this finding conforms to other studies [22, 23]. There was no significant difference between the mean score of the subjective norms in both control and experimental groups before educational intervention; however, the mean scores of the subjective norms in the experimental group increased immediately and three months after educational intervention which indicates more family care and more attention of diabetes specialists and other practitioners, along with the effects of education on those who engage in such patients.

There was no increase in the mean scores of the subjective norms in the control group immediately and three months after educational intervention. Norm beliefs indicate that the "in-charge persons " view is of great importance for the patient with regard to the blood sugar control methods. The mean score of the norm beliefs significantly increased immediately and three months after the intervention in the experimental group, but no significant increase in the control group. This significance reveals the effects of educational intervention, family involvement and the in-charge physician on the educational program. In order to increase the scores of the norm beliefs we should spend our time in educating the individuals and explaining them the facts. Studies suggest that teaching effective subjective norms including family, friends,

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people of the same age, school in-charges [16], teachers and family children [18] results in increase of participation in the process of behavioral changes based on the BASNEF model. But, Baghiani Moqaddam's Study indicated that the diabetics use physicians and health care personnel to control and treat their diseases; they are less influenced by family and those who have no specialty in this field [11]. Some studies also pointed out the importance of staff's' role in curing diabetic patients [27].

The mean score of the behavior intention among the control group patients was more than that of the experimental group, before the educational intervention; although the mean score of the behavior intention was very low in the both groups before the intervention. The interesting point is that the mean scores of the behavior intention increased in the control group and decreased in the experimental group, three months after the educational intervention. However, the mean changes and its increment in the experimental group were higher in comparison to the control group which shows the effect of education on the patients' intention.

The score increase of attitude concerning the results of blood sugar control behaviors, and the increase of the patients' willingness to perform those behaviors happened to a large extent in the experimental group, and to a small extent in the control group. The score increases of the norm belief and subjective norms were mostly observed in the experimental group, but at all in the control group. Based on the BASNEF model such changes affects the patient's intention to perform the required behaviors including medicine taking according to prescription, observing an appropriate diet and physical exercises.

These findings conform to the studies performed on the diabetics' intention to brush their teeth and reporting it regularly [28]; nutrition education of the diabetics [29]; retinopathy screening and improvement of self-management behavior intentions [30]. The patients' function has been studied in two sections:

a) The patients' role in self-reporting and care receiving;

In this research, behaviors like jogging; having physical exercises; taking medicine regularly; measuring blood sugar monthly; following an appropriate diet and participating in educational classes were considered as operation. Before educational intervention, no significant difference was observed between the control and experimental groups concerning the mean scores of the blood sugar control operation. The mean score of the operation in experimental group increased immediately and three months after educational intervention, but no increase

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observed in the control group. Due to the high mean scores of the knowledge, attitude, enabling factors, subjective norms, and patients' intention in the experimental group, the operation also increases.

The findings conform to the operation of diabetic patients in the literature, regarding the proper physical exercises, increase of operation after the intervention [31], regular medicine consumption [32], referring to clinics for controlling the disease [33], effect of physical exercise on retinopathy, increase of patients' operation in retinopathy [34], effect of diet education on the operations of type 2 diabetics and increase of the correct operation of individuals in applying food stuff [29, 35, 36].

b) The role of the patients' function in blood sugar control;

The findings of this study indicated that the mean HbA1C increased from 8.65 before the intervention to 7.47 three months after the educational intervention, and the patients achieved desirable treatment objectives; but, there was no significant difference between the mean HbA1C before and three months after the intervention in the control group. Through proper control of blood sugar, many dangerous diabetic complications could be prevented e.g. 1% decrease in HbA1C leads to 27% decrease of micro-vascular disorders and 21% decrease of macro-vascular diabetic complications [37].

Using the BASNEF model in Diabetes Center-Yazd BaghianiMoqadam concluded that the mean HbA1C was 9.84 before the intervention, but it decreased to 7.28 after the educational intervention [11]. This significant decrease in the study indicates the long duration of intervention (5 months). If the present study was performed in longer periods than three months (since several treatment methods were studied at the same time) the results would be probably the same as the above mentioned study.

Among the most effective factors on decrease of HbA1C rate the BASNEF model-based education [28], proper physical exercises [31], taking medicine to control blood sugar, observing a proper diet [32], physical exercise and diet-based treatments [38] have been reported which conform to the findings of our research.

During the present research, FBS levels of the patients were recorded in order to examine the patients' self-care and applying the instructions more carefully. Before the educational intervention, the mean score of FBS level was higher among the experimental group compared to the control group. But 1, 2, and 3 months after the intervention, the mean score of FBS level was very lower in the experimental group compared to the control group.

The FBS level and its relation to the HbA1C also showed a rational trend in controlling

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blood sugar which accordingly decreased in the experimental group, but remained unchanged or increased in the control group.

The results of this research conform to other researches performed on the effects of diet on blood sugar [33, 39], and effect of the diet education on FBS [40].

The results of this study reveal that using the BASNEF model is effective on blood sugar control among the diabetic patients and it is highly recommended to apply the model in educating the diabetic patients for blood sugar control.

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