The effect of education based on health belief model on reduction of HbA1c level in diabetes type 2

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Abstract

Diabetes, as the most common disease caused by metabolic disorders, is an important global challenge. This disease needs a lifelong self-care throughout one's life, so this study aimed to determine the effect of health belief model based on educational program on reduction of HbA1c levels in type 2 diabetic females. This study is a quasi-experimental. The samples were 138 diabetic female into two case (n=69) and control groups (n=69). Data was collected via a questionnaire whose validity and reliability had been confirmed. The checklist was according to their reports and tests (HbA1c). Before the educational intervention, the checklist was completed by the two case and control groups. Then, the case samples received required educations in 5 sessions for one month. The educational program consisted of lecture, question and answer, group discussion and film screening. After 3 months, both groups completed the questionnaire and the checklist. The collected data was analyzed by SPSS software and appropriate tests. This study results showed that the mean scores of HBM structures in groups, before and after the educational intervention, have a statistically significant difference. Reduction of HbA1c levels in two studied groups was significant (from 9.63 mg/l before the intervention to 8.30 mg/l at 3 months after training). Health belief model based on educational program reduces the HbA1c in diabetic patients. Therefore, training in the framework of this model should be further considered by nurses and health care centers.

Keywords: Diabetes type 2, HbA1c, Health Education, Self-care

Introduction

Pandemic of diabetes is associated with rapid cultural changes, aging population, and increased urbanization, changes in dietary habits, decreased physical activity, and improper lifestyle and behavior patterns [1]. The World Health Organization argues that there is a current of clear epidemic of diabetes that is strongly associated with lifestyle and economic status changes [2]. According to the statistics, there are more than 285 million diabetics worldwide [3], (of these, 90% have type II diabetes), and this number will rise to 439 million by 2030 [4]. Most of this increase that is related to population growth, aging, unhealthy dietary patterns, obesity, sedentary lifestyles, will occur in developing countries [5]. A national study, investigating non-communicable disease risk factors, estimated

the prevalence of diabetes in Iran in 2008 at 7.7% (with 95% confidence interval: 7.5-7.9) [6]. The World Health Organization has estimated that the number of diabetic patients in Iran will rise to 6 million by 2030 [6]. Complications of diabetes are much more prevalent and impose heavy expenses on the person and on the society. The onset of complications, especially when combined with large and small vascular diseases leads to reduced quality of life [6]. Morbidity and mortality associated with these complications are considered the world's principle healthcare problems [6]. Hence, today, investment on control of diabetes has attracted considerable attention [7]. Maintaining optimal blood glucose level is the essential in diabetes control, which reduces incidence of diabetes complications [8]. The International Federation of Diabetes recommends that patients utilize self-care strategies for optimal blood glucose control. These strategies include: 1) adherence to a healthy diet, 2) regular intake of medicines, 3) regular exercise, and 4) blood glucose monitoring. Self-care enhances quality of life and reduces expenses, especially the rate of hospitalizations. With constant adherence to self-care, acute and chronic complications of the disease can be prevented or delayed [9].

This study is based on a pattern and a much more effective and useful model than traditional assessments. There are numerous theories in health education, each having applications in a particular society. One of the models used in diabetic patients' self-care is Health Belief Model, which was initially introduced by a group of psychologists in the 1950s to investigate why some people did not use prevention services like radiography for T.B, or vaccination against influenza. These researchers hypothesized that people are scared of the disease, and their health activities are actuated according to the degree of fear (perceived threat), and expectation of reduction in fear as a result of operation, provided that the likely reduction is more important than practical and mental barriers in performing the operation (perceived/pure benefits). This model is still the most widely recognized model in health behavior applications [10], and can be summarized in four constructs that indicate perceived threat and pure benefits:

1) Perceived susceptibility; the person's belief about potential condition or a disease,

2) Perceived severity; the person's belief about severity of the condition or the disease,

3) Perceived benefit; the person's belief about efficacy of some suggested behaviors to reduce the risk or intensity of the disease or the problem, 4) perceived barriers; the person's belief about the costs of suggested visual and mental behaviors. Another concept is the guidance for operation. These events are internal or external that can prepare the person for the operation. Another construct that drew attention in 1988, for better handling of challenges in changing unhealthy habits in the health belief model was self-efficacy, presented by Albert Bendora in sociology theory. It is simply, the person's confidence in his own ability to successfully perform an action [10].

Aghamolaei et al. and Farsi et al. investigated application of health belief model in changing diabetic patients' behaviors, and showed that after educational intervention, a significant change in behavior of the intervention group patients was achieved [11,12]. Rubbin et al. conducted a study on 213 diabetic patients of both types with the aim to assess the effect of educational intervention on self-care behavior and metabolic control of patients. After an educational program in relation to self-care (exercise, diet, blood glucose monitoring, and regulating insulin) and metabolic control using HbA1c measurement were investigated. The results revealed that there was a significant difference in self-care behaviors before and 6 months after educational intervention. The same applied to the level of HbA1c before and 6 months after education [13]. Heisler et al. reviewed medical records

of 1032 diabetic patients and concluded that mean HbA1c changed from 8.3% to 7.3%. They also found that 5 self-care behaviors (medication intake, blood glucose monitoring, and diet, exercise, and foot care) were correlated with the lower HbA1c level. The results of this study also showed an increase in HbA1c test by 15%, in eye (vision) test by 16%, and in nephropathy screening test by 13% compared to the previous year. These results reveal the importance of self-care in diabetic patients' blood glucose control [14]. In a study by Sharoon et al., investigating self-management in Mexican diabetic patients resident in the United States, they concluded that only 56% of patients had sufficient knowledge of hypoglycemia, which had been acquired unofficially through experience, 15% knew about chronic complications, 76% knew about self-injection of insulin, 10% about blood glucose testing using a glucometer, and 6% knew about urine glucose testing [15].

Diabetes is a disease in which a major part of treatment is performed by the patient, and it is practically impossible for the patient to be under supervision of doctors and health centers. Thus, providing education on self-care to reduce complications of the disease seems necessary. Therefore, this study was conducted to prove the importance of self-care and its effect on control of diabetes, and the results obtained could be used in educational interventions in other diabetes centers in order to favorably control blood glucose levels. Since diabetic patients' self-care is an extremely important issue in control of the disease, and especially in incidence of complications, and many barriers and problems exist for its implementation in this society, and considering peculiarity of cultural characteristics in Sistan-Bluchestan province and in Zahedan, it seems necessary to investigate this issue in diabetic patients.

Method

In this quasi-experimental study, the statistical population consisted of type II diabetic women attending the diabetes clinic at Ali-Asghar Hospital. The sample size was determined 100 by using sample size formula for comparing mean in two groups (confidence level of 95% and test power of 80%). Taking into account possible exclusions, we selected 138 patients using convenience sampling, and randomly divided them (every other one) into two groups of control and intervention. In order to investigate effect of educational intervention on female patients with type II diabetes aged 30 to 60 years, this study was conducted in 2011 with constructs of health belief model (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and self-efficacy) as independent variables, and self-care behaviors, self-care and HbA1c as dependent variables. The study inclusion criteria were being type II diabetic and female aged 30-60 years with minimum of one year since diagnosis of diabetes, and minimum of one HbA1c test more than or equal to 7% in the past three months for hypoglycemia, with medical records at Zahedan clinic, and consent to participate in the study. Patients with intention to become pregnant, patients with type I diabetes, pregnant diabetics, severe visual impairment or talking disability (for answering the questions) were excluded from the study.

The data collection tool was a multi-section questionnaire with demographic details (8 items) and awareness (26 items), a total of 36 items related to health belief model constructs including; perceived susceptibility (6 items), perceived severity (5 items), perceived benefits (6 items), perceived barriers (5 items), instructions (4 items), self-efficacy (10 items), self-care behaviors (10 items), and a checklist related to HbA1c and blood glucose levels prepared for this study and completed

through an interview with patients. For assessment of awareness, 3-point items (yes, no, do not know), and to assess constructs of the model, 5-point Likert style were used. The constructs of perceived susceptibility, perceived severity, perceived benefits, and self-efficacy were marked conventionally with 1 for the worst and 5 for the best. The construct of perceived barriers was marked conversely (never 5 marks, and very often 1 mark). For the construct of behavior, behavior rate (0 to 7 times) during the past week was questioned. For construct of the instruction, 1 mark was considered for each question.

To assess validity, the questionnaire was issued to 15 diabetic patients (outside the study), and based on their opinions, the questionnaire was altered. To determine content validity and content validity index, a panel of experts was used, and items that scored the required marks were selected. To determine reliability, the questionnaire was issued to 30 matched people, and mean Cronbach's alpha based on total sample size was found 76%. Before educational intervention in both control and intervention groups, the questionnaire and the checklist were completed, and patients were referred to the hospital laboratory for HbA1c test. Then, educational intervention was carried out for the intervention group for a period of one month, over 5 educational sessions in the form of lectures, films, questions and answers, and group discussion by the team of educators (researcher, specialist, nursing expert, and interested patients), held at the clinic's training room. In these sessions, necessary trainings were given in relation to diabetes and its complications including proper diet, walking exercise 3 times per week 30 minutes each, regular intake of medication according to doctor's prescription, blood glucose self-monitoring, care for the diabetic foot, and no smoking. Also, a training video CD and a pamphlet were issued to participating patients for use at home. In the process of education, interested and successful patients were used in performing the training in relation to self-care behaviors (cooking method, exercise, and secrets of success in managing diabetes). Three months after intervention, data were again collected through the questionnaire for both groups, and HbA1c test was taken again. However, during this time, patients could contact the researcher on the phone to discuss their questions. To comply with codes of ethics, after final assessment, educational training was also given to the control group and the film and pamphlet were issued to them, as well. The collected data were analyzed by SPSS-15 software using inferential and chi-square tests, and for each group, paired t-test, and for comparison between groups, independent t-test.

Results

During the 3-month follow-up, 4 patients from the intervention group and 2 from the control group were excluded from the study for reasons of moving houses, traveling, change of phone number, death (due to accident). Eventually, the intervention group had 65 patients and the control 67. So, 132 female patients attending diabetes clinic at Aliasgher Hospital in Zahedan were studied. In this study, the two intervention and control groups, in terms of personal characteristics and demographic parameters (age, education, marital status, occupation, type of treatment, smoking, and source of information) were similar and statistically had no significant difference ($P>0.5$). Thus, given the P-values from independent t-test, chi-square, and Fisher's exact test, in personal and basic characteristics, there was no significant difference between the intervention and the control groups (Table 1).

Table 1 *Personal and basic information in the intervention and the control groups*

Study group / Variable		Intervention		Control		Test type and result
		Frequency	%	Frequency	%	
Marital status	Married	59	85.5	58	84.1	Fisher Exact Test
	Single	10	14.5	11	15.9	P=0.224
Education level	Illiterate	45	65.2	46	66.7	Fisher Exact Test
	Literate	24	34.8	23	33.3	P=0.641
Employment status	Housewife	65	94.2	64	92.7	Fisher Exact Test
	Employed	4	5.8	5	7.3	P=0.641
Type of treatment	Diet	5	7.2	6	8.6	Pearson Test
	Physical activity	4	5.8	3	4.3	P=0.224
	Insulin	55	79.7	56	81.1	
	Oral medication	5	7.2	4	5.8	
Smoking	Smoker	11	15.9	13	18.8	Fisher Exact Test
	Non-smoker	58	84.1	56	81.2	P=0.823
Information sources	Health workers	61	88.4	60	87	Fisher Exact Test
	Other	8	11.6	9	13	P=0/224

The paired t-test showed a significant difference in intervention group's mean score of awareness and attitude before and after intervention (3 months after), and independent t-test also showed a significant difference between the two groups' mean awareness scores before intervention (P=0.02). The paired t-test showed a significant difference in the intervention group, before and after intervention, between mean attitude score and health belief model constructs (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, self-efficacy and self-care behaviors) (P<0.0001). Meanwhile, the independent t-test did not show this difference between the intervention and the control groups before intervention (P>0.05). The results also revealed that in the intervention group, level of HbA1c reduced from 9.7% to 8.3%, three months after educational intervention, and paired t-test with 95% confidence showed a significant difference between them (P<0.0001) (Table 2).

Table 2 *The mean and standard deviation of scores of health belief model constructs in the intervention group before and after intervention*

		Before intervention Mean (SD)	After intervention Mean (SD)	P-value
Awareness	Intervention	46.46(±5.66)	51.76(±2.28)	<0.0001
	Control	48.59(±4.41)	48.59(±4.31)	0.183
Attitude	Intervention	8.57(±0.86)	12.98(±1.02)	<0.0001
	Control	9.02(±0.95)	9.11(±0.94)	0.226
Perceived susceptibility	Intervention	16.62(±5.39)	21.16(±3.58)	<0.0001
	Control	17.87(±3.39)	17.86(±6.19)	0.485
Perceived severity	Intervention	16.49(±5.08)	17.87(±3.39)	<0.01
	Control	4.48(±14.83)	14.88(±5.41)	0.426
Perceived benefits	Intervention	28.44(±2.57)	29.64(±0.99)	<0.001
	Control	29.22(±1.71)	29.17(±1.73)	0.263
Perceived barriers	Intervention	13.94(±3.39)	8.96(±2.22)	<0.001
	Control	12.56(±4.41)	12.59(±4.38)	351
Self-efficacy	Intervention	29.33(±5.67)	42.03(±2.42)	<0.001
	Control	30.46(±5.51)	30.5(±5.48)	0.373
Behavior	Intervention	29.36(±9.91)	39.69(±4.74)	<0.0001
	Control	27.59(±8.95)	27.8(±9.09)	0.520
HbA1c	Intervention	9.71(±1.81)	8.3(±1.17)	<0.0001
	Control	9.04(±1.54)	9.06(±1.52)	0.570

Discussion

One of the reasons for failure to achieve the desired treatment outcome in diabetes is lack of patient involvement in treatment. This involvement is an important factor in treatment of patients that require compliance with a lifelong, difficult treatment program [11]. In the current study, education program was performed in accordance with Health Belief Model, which is a psychological model that attempts to explain and predict health behaviors, and focuses on people's attitudes and beliefs [16].

One of the dimensions studied was patients' level of awareness. The knowledge and skills acquired through diabetes educational training appear to be necessary to begin the self-control process [16]. In this study, the intervention group patients' attitudes and awareness significantly improved after intervention. This improvement could be attributed to the shared education and use of educational film, as this was evident from patients' feedbacks in the subsequent sessions. The results obtained with regards to improved attitudes and awareness in diabetic patients, are comparable with those of similar studies [17, 18, 19, 20].

Education is necessary in all diseases. In diabetes, education is the first step in controlling the disease, which could be effective in improving patients' self-care. One of the reasons for patients' failure to control their own disease could be inadequate awareness [21]. Many studies have concluded that lack of awareness about self-care skills, incorrect information, or lack of proper understanding of the treatment program is an important aspect in non-compliance with the recommended treatment program [15,22]. However, awareness must not be over-emphasized since in many cases people do know what they ought to do, yet they do not practice what they know [10, 23].

The paired t-test results showed improvement in mean scores of perceived susceptibility and severity and self-efficacy in the intervention group after education, and these results are in line with those of other studies [11, 12, 24].

The results also showed a significant increase in mean score of perceived benefits, and a significant decrease in perceived barriers, which also concur with the results of similar studies [11. 12, 24]. However, Farsi et al. did not report significant changes in these constructs [11]. In the present study, such behaviors as physical activity, regular and timely intake of medication, self-monitoring of blood glucose, use of proper diet, foot care were considered as performance. Prior to training, no significant difference was observed between the two groups in terms of these performances. In the intervention group, mean performance scores increased significantly 3 months after educational intervention. However, no such increase was observed in the control group. The results obtained for diabetic patients' performance in terms of physical activity, regular intake of medication, and proper diet were in agreement with the results in other studies [11, 12, 24, 25].

After the intervention, HbA1c level in the intervention group showed a significant difference compared to before intervention, while there was no significant difference in HbA1c level in the control group before and after the intervention, which were in line with results of other similar studies [24]. The reduced HbA1c level was mainly due to changes of behavior in the intervention group, and it is a mean value of patients' blood glucose level in the past 6 to 8 weeks. It has been shown that in the long-term, HbA1c close to normal level can reduce the risk of diabetes complications [25]. Exercise has a major role in glucose metabolism, on the other hand, self-monitoring of blood glucose makes it possible for the patient to be aware of his own blood glucose level at all times, and take the necessary measures to reduce or stabilize it (at an acceptable level). Of these measures, one is reduction in daily carbohydrate consumption. Given that exercise has an important role in reducing HbA1c, thus, exercises suitable for age and physical conditions of diabetic patients, and encouraging them to regularly perform these exercises is highly recommended [22, 26].

Although there are doubts regarding correlation between education and metabolic control in diabetic patients, some researchers have reported positive effects of educating patients on reduction of HbA1c. Maintaining HbA1c at a low level prevents diabetes complications. It has been reported that, if HbA1c is maintained on average at 7.2, the result will be reduction of 76% in retinopathy, 60% in neuropathy, 50% in renal disease, and 35% in cardiovascular diseases [27, 28].

Limitations in this study were lack of patient cooperation in timely attendance at classes, and illiteracy of the study subjects that had difficulties in completing the questionnaire (questionnaires were completed by the researcher), also, late attendance for laboratory tests.

Conclusion

Since education is considered the main component in healthcare, it is necessary to pay more attention to training design and planning based on behavior change models and theories for diseases, and different health issues. The results obtained in this study indicated that education based on health belief model that encompasses the learners' beliefs and attitudes could be useful and effective in enhancing diabetic patients' self-care behaviors. Perhaps, it was for this reason that based on needs assessment, the educational content with a sharing method and educational CD were used in the education process. Therefore, it is recommended that training in each center be designed to comply with social and cultural characteristics of that region.

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Contributions

Study design: IZ, SN
Data collection and analysis: NS, IZ
Manuscript preparation: AH, FR, MM

Conflict of interest

"The authors declare that they have no competing interests."

Reference

1. Wild S, Roglic G, Green a, Sicree R, King H. Global prevalence of diabetes. Estimates for the year 2000 and projections for 2030. *Diabetes Care*. 27(5):1047-53.
2. Abolhasani F , Mohajeri Tehrani MR, Tabatabaei O. Burden of diabetes and its complications in Iran in year 2000.*Iranian Journal of Diabetes and Lipid Disorders* 2005; 5:35-48.
3. Shaw JE, Sicree RA, Zimmet PZ. Global estimates of the prevalence of diabetes for 2010 and 2030. *Diabetes Res Clin Pract* 2010; 87(1):4-14.
4. World Health Organization. Diabetes program. WHO Estern Mediterranean Region: the prevalence of diabetes in the WHO Eastern Mediterranean Region. Available from: htth//*www.who.int/entity/diabetes/actionnow/en/consultation*; [Last Accessed:on 2012 may 2].
5. Marshal SM, Flyvbjerg A. Prevention and early detection of vascular complications of diabetes. *BMJ*; 2006; 333(7566):475-80.
6. World Health organization and international Diabetes Federation. Diabetes Action Now: an initiative of world Health organization international Diabetes Federation. Available From: htth//*www.who.int/entity/diabetes/actionnow/en/consultation*.[Last Accessed on: 2010 May
7. Funnell MM, Brown TL, Childs BP, Haas LB, Hosey GM, Jensen B,et al National standards for diabetes self-care management education. Diabetes Care 2008; 13(Supp11): 97-104.
8. JAY S SKYLER.Diabetes Control and Complications Trial – a glycaemic control study in type 1 diabetes.*New Engl J Med* 1993;329:977-86.
9. Gagliardino JJ.A model education program for people with type 2 diabetes. Diabetes Care 2001; 24: 1001-7.
10.Norris Sl, Lau J, Smith SJ, Schmid CH, Engelgau MM. Self-management for adults whit type2 diabetes: a meta-analysis of the effect on glycemic.control. Diabetes Care 2002; 25: 1159-71.
11. Aghamollaei T, Eftekhar H, Shojaeizadeh D, Mohammad K, Nakhjavani M, Ghofrani Pour F: Behavior, Metabolic Control and Health-related Quality of Life in Diabetic Patients at Bandar Abbas Diabetic Clinic. *Iranian J publ Health* 2003, 32(3):54-59
12. Farsi Z, Jabari-Moroui M, Ebadi A. Application of Health Belief Model in change of self-care behaviors of diabetic patients. *Iranian Journal of Nursing* 2009; 22(61):61-71. [Persian]
13. Rubbin R. Differential effect of diabetes education on self-regulation and life stage behaviors .Diabetes Care 1998; 14(4):335-338.
14. Heisler M, Smith DM, Hayward RA, Krein SL, Kerr EA. How well do patients assessments of their diabetes self-management correlate with actual glycemic control and receipt of recommended diabetes services? Diabetes Care 2003; 26: 738-43.
15. Khan LA, Khan SA. Level of knowledge and self-care in diabetics in a community hospital in Najran. Ann Saudi Med 2000; 20(3-4):300-301.
16. Khabazian M, Yadolahi A, Abdolhasani. Rate Knowledge about diabetes in habitant Yazd City. *Scientific Journal of Yazd University of Medical sciences* 2001; 8:11-14. [Persian]
17. Mardani M, Shahraki Vahed A, Piri AR. Effects of Education Based on Health Belief Model on Dietary Adherence in Diabetic Patients. *Iranian Journal of Diabetes and Lipid Disorders* 2010; (9):1-6.

18. Elizabeth Russell-Minda, Jeffrey Jutai, C.Psych.,2 Mark Speechley, Kaitlin Bradley, Anna Chudyk, Robert Petrella. Health Technologies for Monitoring and Managing Diabetes: A Systematic Review. *J Diabetes Sci Technol 2009;3(6):1460-1471.*

19. Hee-Sung K. Impact of Web –based nurse's education on glycosylated hemoglobin in type Diabetes Prevention program research group. Within –trial cost- effectiveness of life style intervention for the primary prevention of type 2 diabetes .Diabetes Care 2003; 203: 2618-23.

20. UKPDS Group,(1998).Effect of intensive blood-glucose control with metformin on complications in overweight patients with type 2 diabetes (UKPDS 34). *Lancet*; 352:854–65

21. Gucciardi E, Demelo M, Lee RN, Grace SL. Assessment of two culturally competent diabetes education methods: individual versus individual plus group education in Canadian Portuguese adults with type 2 diabetes. *Ethn Health* 2007; 12(2):163-87.

22. Sharifirad Gh, Hazavehi MM, Baghianimoghadam MH, Mohebi S. The Effect of a Health Belief Model Based Education Program for Foot Care in Diabetic Patients Type II in Kermanshah, Iran (2005). *Int J Endocrinol Metab* 2007; 2:82-90

23. Tankova T, Dakovska G, Koev D. Education of diabetic patients--a one year experience. *Patient Educ Couns* 2001; 43(2):139-45.

24. Goldstein DE, Little RR, Lorenz RA, et al. Tests of glycemia in diabetes. *Diabetes care* 2004; 27(7):1761-1773.

25. Rosemary P. Basa, Evaluation of a diabetes specialty center: structure, process and outcome, patient Education and counseling (1995);25(1): 23 – 29.

26.Anna S, Urban R, (2001) .Field test of a group education program for type 2 diabetes, *Patient Education and Counselin*g, 44, 129-39.

27. Kochhar A, Nagi M, (2005). Effect of supplementation of traditional medicinal plants on blood glucose in noninsulin-dependent diabetics: a pilot study. *J Med Food*. 8:545–9.