Effect of Virtual Nutrition Training Based on the Health Belief Model on the Awareness of Patients with Type II Diabetes

Mostafa Jafari [1], Hossein Ashtarian [1, *] and Parvin Nokhasi [1]

[1]Health Education and Promotion Department, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran

Corresponding author: Health Education and Promotion Department, School of Public Health, Kermanshah University of Medical Sciences, Kermanshah, Iran. Email: hossien_ashtarian@yahoo.com

Abstract

Background: Various teaching methods could be used to reduce complications in diabetic patients.

Objectives: The present study aimed to assess the effect of nutrition training based on the health belief model (HBM) and electronic methods on the awareness of patients with type II diabetes in Kermanshah, Iran in 2012.

Methods: This quasi-experimental study was conducted at a diabetes clinic in Kermanshah City. In total, 60 patients were selected via convenience sampling and divided into three groups of 20, including SMS, blog, and collaborative blog. Data were collected before, immediately after, and three months after the educational intervention using a standard questionnaire. Data analysis was performed in SPSS version 16 using the Kruskal-Wallis test, Friedman's test, and analysis of variance (ANOVA) at the significance level of 0.05.

Results: The mean score of awareness was considered significant (P < 0.01). In addition, significant differences were observed in the perceived sensitivity and barriers, cue to action, and self-efficacy in the blog group (P < 0.05) before and three months after the intervention. In the collaborative blog group, a significant difference was denoted in the perceived severity and cue to action before and three months after the intervention (P < 0.05). Cue to action also differed significantly in the SMS group, and the self-efficacy score significantly changed only in the blog group after the intervention (P = 0.006).

Conclusions: According to the results, using blogs, group/collaborative blogs, and SMS could effectively increase the awareness of the diabetic patients. Therefore, virtual training could enhance the structures of the HBM, with the exception of the perceived sensitivity domain.

Keywords: Nutrition, Education, E-Learning, HBM, Type II Diabetes

1. Background

Diabetes is considered to be the most prevalent chronic disease across the world, and the increasing prevalence of the disease is a major health concern. The global prevalence of diabetes in 2011 was estimated to be 366 and 552 million, which is expected to further increase by 2030 (1, 2). In terms of the diabetic patients living across the world by the year 2030, the share of developing countries would be 77.6% (3). In addition, a national study examining the risk factors for non-communicable diseases indicated the prevalence of diabetes to be 7.7% within the age range of 25 - 64 years (4). The World Health Organization (WHO) has estimated that there will be more than six million diabetic patients in Iran by 2030 (5).

Diabetes control reduces the associated mortality and prevents the long-term complications of the disease (2). Nutrition plays a pivotal role in disease control and is an inherent element of the nutritional treatment of diabetes for reducing the associated mortality, morbidity, and disease complications. Receiving updated nutritional information, especially through virtual education, is essential for diabetic patients (6). Educational interventions via phone, SMS, and the internet are the new approaches to raising the awareness of diabetic patients in this regard (7, 8).

The internet is a worldwide communication system through which people communicate and exchange information anytime and anywhere (9, 10). Given the wide availability of mobile phones and their widespread use, these devices have proven efficient in health education as well (11, 12). In a study in this regard, Wangberg et al. (13) reported that SMS-based educational interventions are effective in increasing the knowledge and awareness of diabetic patients. SMS seems to be an effective tool in raising the awareness of diabetic patients (14).

The health belief model (HBM) provides an appropriate framework for educational interventions in different fields, including diabetes control. To date, this model has been used as a framework for designing and implementing educational interventions in various areas of health care (15, 16). However, few studies have investigated the effects of using virtual education on diabetic patients in Iran, and it remains unclear which e-learning method is more effective in the training of diabetic patients.

2. Objectives

The present study aimed to evaluate the effect of nutrition education on the awareness of patients with type II diabetes using three electronic teaching methods based on the HBM.

3. Methods

This quasi-experimental study was conducted on the patients with type II diabetes referring to a diabetes clinic in Kermanshah, Iran. The inclusion criteria were computer literacy, internet and SMS access, and computer skills. In total, 60 patients were selected via convenience sampling and randomly divided into three groups of 20, including blog, collaborative blog, and SMS. Sample size was determined at 95% confidence level and $\beta = 0.80$ based on previous studies, and 20 patients were assigned to each group. Educational needs assessment was performed at the diabetes clinic of Taleghani Medical Center via interviews with the staff and some of the patients.

Data were collected using a questionnaire that was validated by a panel of experts, including 12 faculty members of health education, nutrition, and educational psychology. In addition, the reliability of the questionnaire was measured in 21 patients as a pretest-posttest at a two-week interval, and reliability was confirmed at the Cronbach's alpha coefficient of 0.80. The questionnaire consisted of three main sections, including demographic characteristics (15 items), nutrition knowledge (18 items; total score: 0 - 18), and items designed based on the HBM constructs (28 items). The items in the questionnaire were scored based on a Likert scale (strongly agree-strongly disagree).

The HBM has various domains, including perceived susceptibility (five items), perceived severity (five items), perceived barriers (six items), perceived benefits (six items), self-efficacy (six items), and cue to action (13 items). Notably, the weight and height of the patients were measured, and body mass index (BMI) was also measured after completing the questionnaires. For the intervention, all the patients individually used the Persian version of the national program of diabetes prevention program

(17) and the Iranian regime dietetic association handbook for three months (18); these are the main references employed for educating diabetic patients. The contents of the books were used by three education methods in the present study, including blog, collaborative blog, and SMS. Immediately after the three-month intervention, the patients completed the questionnaire, and BMI was measured again. Three months after the intervention (six months after baseline), data collection was repeated without training (Figure 1), and the participants were asked to complete this stage via phone.

3.1. Statistical Analysis

Data were collected before the intervention, immediately after the intervention, and three months later. Data analysis was performed in SPSS version 22 using the Kolmogorov-Smirnov test, analysis of variance (ANOVA), Tukey's post-hoc test, and the Kruskal-Wallis tests to compare the variables between the three study groups.

4. Results

In total, 60 diabetic patients were assessed in three groups of blog, collaborative blog, and SMS. No significant differences were observed between the groups in terms of age and a history of diabetes (Table 1).

At baseline, no significant differences were denoted between the study groups in terms of gender, marital status, and education level (Table 2).

At baseline, awareness and BMI had no significant differences between the study groups. The obtained results also indicated that the mean score of awareness significantly decreased before, immediately after, and three months after the intervention in the blog group (P = 0.002) and collaborative blog group (P = 0.001), while no significant change was denoted in the SMS group in this regard (P = 0.308). Furthermore, no significant difference was observed in the effect of the educational intervention on awareness before, immediately after, and three months after the intervention in the blog group (P = 0.85), collaborative blog group (P = 0.670), and SMS group (P = 0.909), thereby indicating no significant change in this regard. No significant differences were denoted in the BMI and effectiveness of the intervention before, immediately after, and three months after the intervention (Table 3).

In the present study, no significant differences were observed in the HBM domains between the groups at baseline. However, significant differences were denoted in the tests before, immediately after, and three months after the educational intervention in the blog group in the domains of perceived susceptibility (P = 0.03), perceived barriers (P = 0.03), cue to action (P = 0.01), and self-efficacy (P ≤ 0.01).

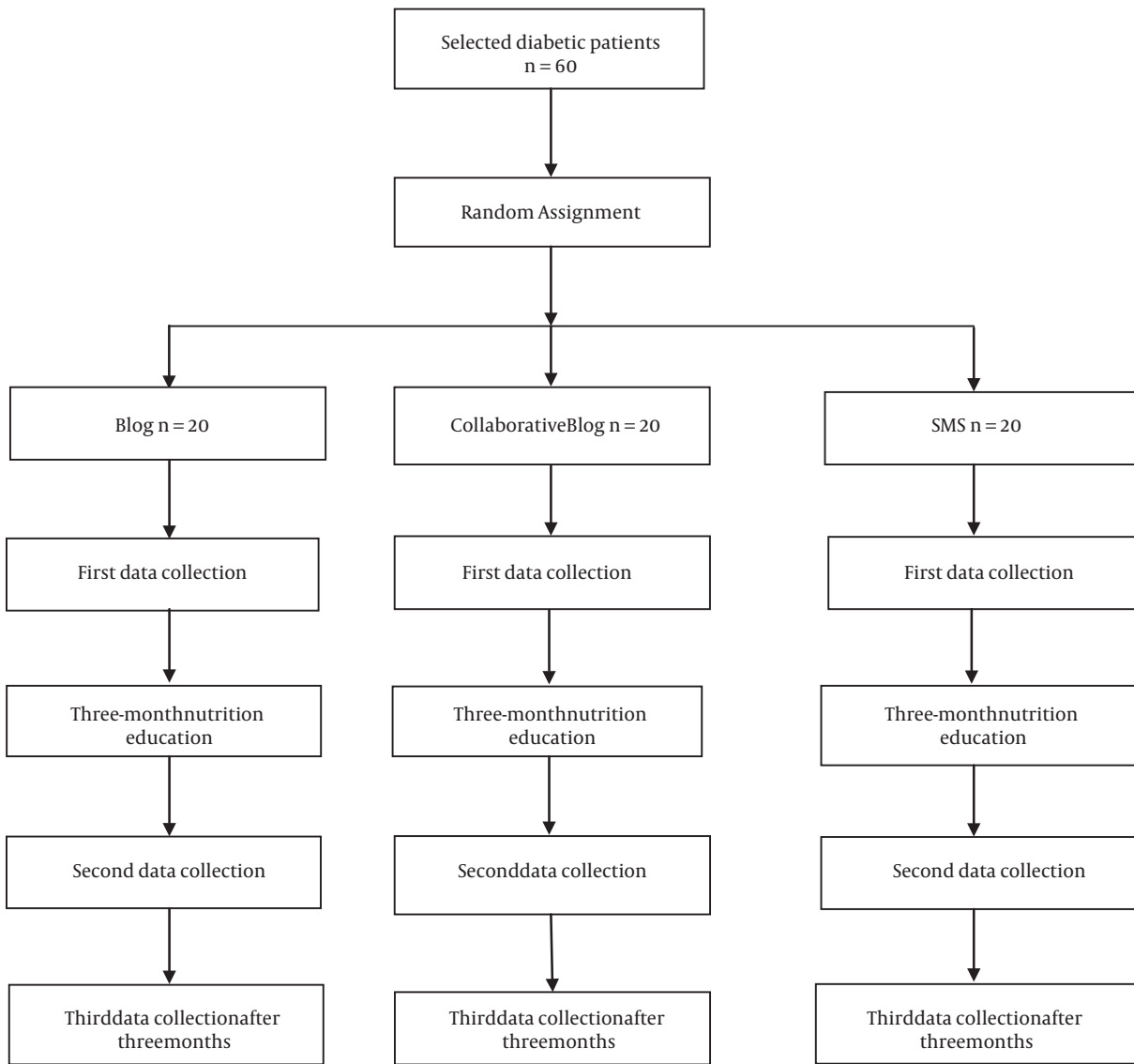**Figure 1.** Flowchart of study design and methodology

Table 1. Comparison of Mean Age and History of Diabetes in Study Groups

Demographic Characteristics	Blog	Group/collaborative Blog	SMS	Total	P-Value
Age, y	50.9 ± 8.2	52.6 ± 8.9	51.0 ± 9.0	51.3 ± 8.5	0.89
History of Diabetes, mo	82.0 ± 57.9	102.4 ± 62.3	87.4 ± 61.4	90.6 ± 60.1	0.55

Table 2. Comparison of Frequency of Gender, Marital Status, and Education Levels Between Study Groups[a]

Demographic Characteristics	Blog	Group/Collaborative Blog	SMS	Total	P-Value
Gender					41%
Male	60 (12)	65 (13)	45 (9)	56.7 (34)	
Female	40 (8)	35 (7)	55 (11)	43.3 (26)	
Marital status					
Single	10 (2)	-	-	3.3 (2)	-
Married	90 (18)	100 (20)	100 (20)	96.7 (58)	
Education level					1.00
Diploma (or below)	55 (11)	40 (8)	55 (11)	50 (30)	
Academic	45 (9)	60 (12)	45 (9)	50 (30)	

[a] Values are expressed as No. (%).

Table 3. Mean Scores of Awareness Before, Immediately After, and Three Months After Educational Intervention in Study Groups[a]

Variable	Before Intervention	Immediately After Intervention	Three Months After Intervention	P-Value*
Awareness				
Blog	12.8 ± 2.2	15.2 ± 1.7	15 ± 1.7	0.002
Collaborative blog	13.2 ± 1.6	14.8 ± 1.5	14.9 ± 1.6	0.001
SMS	14.2 ± 2.0	14.8 ± 2.0	15.1 ± 1.0	0.308
P-value**	0.085	0.670	0.909	
BMI, kg/m²				
Blog	29.4 ± 4.4	29.3 ± 4.6	29.5 ± 4.0	0.103
Collaborative blog	27.1 ± 5.1	26.0 ± 5.1	27.1 ± 5.0	0.307
SMS	28.8 ± 5.2	29.04 ± 6.1	29.3 ± 6.1	0.449
P-value**	0.329	0.328	0.251	-

[a] *, P-value within groups; **, P-value between groups.

In the collaborative blog group, the significance was only highlighted in the domains of perceived severity (P < 0.01) and cue to action (P = 0.01), as well as the domain of cue to action in the SMS group (P ≤ 0.01). The effectiveness of the intervention was not considered significant in the study three groups after the intervention, with the exception of the self-efficacy domain (Table 4).

5. Discussion

The results of the present study indicated that the mean score of awareness significantly increased in the blog and collaborative blog groups before, immediately after, and three months after the educational intervention. This is consistent with the study conducted by Noohi et al. (19). In the current research, no significant change was observed in the awareness score of the patients in the SMS group, which is inconsistent with the results obtained by

Goodarzi et al. (20). In the mentioned study, the awareness of diabetic patients was reported to increase through an educational program based on sending SMS via mobile phones (20, 21).

In the present study, the patients in the blog and collaborative blog groups experienced a more effective intervention compared to those in the SMS group. Furthermore, significant differences were observed within the collaborative blog group in terms of perceived susceptibility, perceived barriers, self-efficacy, and cue to action. In the SMS group, only the domain of cue to action was considered significant. These findings are in line with the previous studies investigating dietary interventions (22).

Our findings demonstrated no significant changes in the study groups regarding various HBM domains, especially the perceived benefits domain. Correspondingly, high mean scores were obtained in the perceived benefits domain by the diabetic patients in the blog, collaborative blog, and SMS groups. In addition, the scores of the pa-

Table 4. Mean and Significance of HBM Domains Within and Between Study Groups[a]

Variable	Before Intervention	Immediately After Intervention	Three Months After Intervention	P-Value*
Perceived susceptibility				
Blog	22.20 ± 2.3	23.6 ± 1.7	22.9 ± 2.6	0.032
Collaborative blog	22.60 ± 2.3	23.5 ± 1.6	23.3 ± 1.6	0.223
SMS	23.6 ± 1.5	24.0 ± 1.6	24.0 ± 1.8	0.316
P-value**	0.112	0.557	0.255	-
Perceived severity				
Blog	23.2 ± 2.4	24.0 ± 1.7	22.7 ± 3.3	0.121
Collaborative blog	24.15 ± 1.1	23.15 ± 3.6	22.3 ± 1.9	0.002
SMS	24.1 ± 2.1	24.0 ± 1.9	24.1 ± 1.8	0.978
P-value**	0.205	0.492	0.144	-
Perceived barriers				
Blog	20.7 ± 5.4	23.6 ± 4.4	20.9 ± 4.9	0.026
Collaborative blog	20.0 ± 4.4	21.7 ± 5.1	20.3 ± 4.7	0.907
SMS	21.2 ± 5.7	23.3 ± 4.1	21.9 ± 5.9	0.363
P-value**	0.955	0.352	0.352	
Perceived benefits				-
Blog	26.0 ± 4.4	28.2 ± 1.9	27.0 ± 2.9	0.255
Collaborative blog	27.2 ± 2.2	27.3 ± 2.4	26.7 ± 2.6	0.873
SMS	21.15 ± 5.7	23.3 ± 4.1	21.9 ± 5.9	0.363
P-value**	0.092	0.070	0.178	-
Cue to action				
Blog	21.10 ± 13.9	27.7 ± 16.1	32.2 ± 16.5	0.011
Collaborative blog	29.30 ± 15.7	34.2 ± 13.4	40.7 ± 20.7	0.029
SMS	28.3 ± 15.2	31.2 ± 14.4	40.0 ± 9.3	0.002
P-value**	0.177	0.388	0.176	-
Self-efficacy				
Blog	24.85 ± 4.2	27.6 ± 2.8	26.0 ± 2.6	0.006
Collaborative blog	26.5 ± 3.1	25.8 ± 2.9	25.1 ± 3.1	0.055
SMS	27.0 ± 2.5	28.1 ± 4.2	27.1 ± 3.30	0.607
P-value**	0.133	0.021	0.121	-

[a] *, P-value within groups; **, P-value between groups.

tients in the perceived severity domain were considered significant in the collaborative blog group, which could be attributed to the prolonged disease history of these patients.

The present study indicated that all the HBM domains (perceived susceptibility, perceived severity, perceived barriers, perceived benefits, and cue to action) improved in the patients with type II diabetes, with the exception of the self-efficacy domain; this is inconsistent with the results obtained by Papzan et al. (23).

5.1. Conclusions

According to the results, using blogs, group/collaborative blogs, and SMS could effectively enhance the awareness of diabetic patients regarding their disease. Moreover, virtual education proved effective in improving various structures of the HMB, except perceived sensitivity. Therefore, it is recommended that a framework be designed and implemented based on the structures of the HBM for educating diabetic patients properly.

Acknowledgments

Footnotes

References

1. Whiting DR, Guariguata L, Weil C, Shaw J. IDF diabetes atlas: global estimates of the prevalence of diabetes for 2011 and 2030. *Diabetes Res Clin Pract*. 2011;**94**(3):311–21. doi: 10.1016/j.diabres.2011.10.029. [PubMed: 22079683].

2. Azar M, Gabbay R. Web-based management of diabetes through glucose uploads: has the time come for telemedicine? *Diabetes Res Clin Pract*. 2009;**83**(1):9–17. doi: 10.1016/j.diabres.2008.09.055. [PubMed: 19056140].

3. Azizi F, Guoya MM, Vazirian P, Dolatshati P, Habbibian S. [Screening for type 2 diabetes in the Iranian national programme: a preliminary report]. *East Mediterr Health*. 2003;**9**(5-6):1122–7. Persian.

4. Esteghamati A, Gouya MM, Abbasi M, Delavari A, Alikhani S, Alaedini F, et al. Prevalence of diabetes and impaired fasting glucose in the adult population of Iran: National Survey of Risk Factors for Non-Communicable Diseases of Iran. *Diabetes Care*. 2008;**31**(1):96–8. doi: 10.2337/dc07-0959. [PubMed: 17921357].

5. World Health Organization. *Prevalence of diabetes in the who Eastern Mediterranean region. Diabetes Programme*. Geneva: The Institute; 2010.

6. Franz MJ, Bantle JP, Beebe CA, Brunzell JD, Chiasson JL, Garg A, et al. Evidence-based nutrition principles and recommendations for the treatment and prevention of diabetes and related complications. *Diabetes Care*. 2002;**25**(1):148–98. doi: 10.2337/diacare.25.1.148. [PubMed: 11772915].

7. Goz F, Karaoz S, Goz M, Ekiz S, Cetin I. Effects of the diabetic patients' perceived social support on their quality-of-life. *J Clin Nurs*. 2007;**16**(7):1353–60. doi: 10.1111/j.1365-2702.2007.01472.x. [PubMed: 17584354].

8. Kerr EA, Gerzoff RB, Krein SL, Selby JV, Piette JD, Curb JD, et al. Diabetes care quality in the Veterans Affairs Health Care System and commercial managed care: the TRIAD study. *Ann Intern Med*. 2004;**141**(4):272–81. doi: 10.7326/0003-4819-141-4-200408170-00007. [PubMed: 15313743].

9. Kim HS, Yoo YS, Shim HS. Effects of an Internet-based intervention on plasma glucose levels in patients with type 2 diabetes. *J Nurs Care Qual*. 2005;**20**(4):335–40. doi: 10.1097/00001786-200510000-00009. [PubMed: 16177585].

10. Glasgow RE, Kurz D, King D, Dickman JM, Faber AJ, Halterman E, et al. Twelve-month outcomes of an Internet-based diabetes self-management support program. *Patient Educ Couns*. 2012;**87**(1):81–92. doi: 10.1016/j.pec.2011.07.024. [PubMed: 21924576]. [PubMed Central: PMC3253192].

11. Klasnja P, Pratt W. Healthcare in the pocket: mapping the space of mobile-phone health interventions. *J Biomed Inform*. 2012;**45**(1):184–98. doi: 10.1016/j.jbi.2011.08.017. [PubMed: 21925288]. [PubMed Central: PMC3272165].

12. Patrick K, Griswold WG, Raab F, Intille SS. Health and the mobile phone. *Am J Prev Med*. 2008;**35**(2):177–81. doi: 10.1016/j.amepre.2008.05.001. [PubMed: 18550322]. [PubMed Central: PMC2527290].

13. Wangberg SC, Arsand E, Andersson N. Diabetes education via mobile text messaging. *J Telemed Telecare*. 2006;**12 Suppl 1**:55–6. doi: 10.1258/135763306777978515. [PubMed: 16884582].

14. Fatehi F, Malekzadeh G, Akhavimirab A, Rashidi M, Afkhami-Ardekani M. [The Effect of Short Message Service on Knowledge of Patients with Diabtes in Yazd, Iran]. *Iran J Diabtes Obes*. 2010;**2**(1):27–31. Persian.

15. Borhani F, Abas-zadeh A, Taebi M, Kohan S. [Effective communication and personal health beliefs in patients with type 2 diabetes]. *Iran J Payesh*. 2010;**9**(4):371–83. Persian.

16. Kim HS, Kim NC, Ahn SH. Impact of a nurse short message service intervention for patients with diabetes. *J Nurs Care Qual*. 2006;**21**(3):266–71. doi: 10.1097/00001786-200607000-00012. [PubMed: 16816608].

17. Delavarie A, Mhdavi hzaveh A, Navroozinejad A, Yarahmadi S. *[National Diabetes Prevention and Control Program]*. Tehran: Sada Publication; 2004. p. 24–63. Persian.

18. Sheykh F. *[Manual of Diet Therapy: Iranian nutrition Society]*. 2nd ed. Tehran: Salemi Publicationi; 2003. p. 206–10. Persian.

19. Noohi E, Khandan M, Mirzazadeh A. [Effective of electronic education on knowledge attitude and self-care in patient's diabetic type 2 refer to diabetic center of Kerman University of medical science]. *Nurs Res*. 2011;**22**(6):74–9. Persian.

20. Goodarzi M, Ebrahimzadeh I, Rabi A, Saedipoor B, Jafarabadi MA. Impact of distance education via mobile phone text messaging on knowledge, attitude, practice and self efficacy of patients with type 2 diabetes mellitus in Iran. *J Diabetes Metab Disord*. 2012;**11**(1):10. doi: 10.1186/2251-6581-11-10. [PubMed: 23497632]. [PubMed Central: PMC3598175].

21. Zandi A. Application of health belief model in change of self care behaviors of diabetic patients. *Iran J Nurs*. 2009;**22**(61):61–72.

22. Sharifirad G, Najimi A, Hassanzadeh A, Azadbakht L. Application of BASNEF educational model for nutritional education among elderly patients with type 2 diabetes: improving the glycemic control. *J Res Med Sci*. 2011;**16**(9):1149–58. [PubMed: 22973383]. [PubMed Central: PMC3430039].

23. Papzan A, Soleimani A, Papzan M. [The Comparative Study of Using Mobile Phone Vs. Lecture Method in Teaching. Case: Agricultural Students of Ravansar Township in Kermanshah, Iran]. *J Educ ICT in Educ*. 2009;**1**(12):55–60. Persian.