Research Article

Impact of Education via Mobile Phone on Knowledge, Attitude, Practice and HbA1C of Patients with Type 2 Diabetes Mellitus in Karaj-Iran

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Abstract

Introduction: Technological progress and its impact on the social context are so vast that their healthcare field has been affected by these changes. So, research and development in the field of mobile technologies and techniques for data transfer and the adoption and implementation of health education in this way seems indispensable.
Methods: This study was a randomized controlled trial. A total of 81 type II diabetes patients were randomly assigned into two groups: the experimental Group (n= 43) and control group (n= 38). Educational Short Message Service (SMS) was sent to the cellphones of the members of the experimental group. Data were collected through valid questionnaires (α= 0.75), the laboratory sheet reporting the patients' KAP and HbA1C before and after the education via mobile phone and the demographic characteristic list. . Data gathering was run at the baseline of the study and after three months intervention and by SPSS17 and Lisrel software, using chi- square, Factor Analysis and ANCOVA, and the significance level of 0.05.
Results: The results of this study showed that the experimental group compared with the control group improved significantly in knowledge ($p \leq 0.001$), practice ($p \leq 0.001$) and HbA1C ($p \leq 0.001$) Also, the fitness indicators exhibited a proper fit.
Conclusion: The findings of this investigation showed that intervention using SMS via cellphone was effective in the management of type II diabetes mellitus (DM). Mobile health, with high potential in improving health, lifestyle, and perhaps more research in the field of e-Health applications could be taken into consideration as policymakers and health care providers to use electronic management in health system.

Keywords
Diabetes Mellitus Type 2, Knowledge, Attitude, Practice, HbA1C

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Introduction

Health care in the field of public health has, in many countries of the world including Iran, faced many challenges. Among the major problems for this situation are those related to the health education to citizens, in general, and patients with chronic diseases, in particular. There has been an increased demand for the availability of care as well as the ease with which education can be provided. There is also a need to reduce the financial cost of health care and the uneven distribution of health care personnel. Despite many attempts at providing health care services to individuals of society, there are still deficiencies in the quality of services [1]. These strategies should seek to promote the knowledge, attitude, and performance of individuals in order to reduce their reliance over the health systems [2]. In this regard, an essential and determining need is felt for providing health education to individuals and their active participation in health care to prevent and control diseases. The purpose of training programs is to raise awareness, create a positive attitude, and encourage people to function properly with regards to their health. That is to say, the purpose of education is to bring knowledge, attitude, and practice close together as much as possible. And seeing that knowledge and attitude are considered two important factors in the process of education, any positive changes in these two factors can play an important role in achieving the desired goal and good efficiency [3]. The application of educational methods in the field of healthcare and care for patients with diseases difficult to treat like cancer, asthma, diabetes and chronic heart failure has been experienced and its results have been favorable [4]. Of these diseases, diabetes is the third leading cause of death. It is mainly due to the poor control of blood sugar. Research has shown that a good control of blood sugar delays the onset and progression of complications of the disease. In view of that, one of the leading criteria is reducing hemoglobin A1C, which is effective, even by one percent, in reducing the complications [5]. Blood sugar control in these patients is done mainly through a careful diet, medication, and physical activities. Therefore, for a better control of diabetes, it is important to increase patients' knowledge, attitude, performance in relation to the nature and importance of diabetes and its effects, control and treatment [6]. Research shows that the degree of knowledge, attitude, and practice is different in diabetic patients [7]. Another study shows that educational programs are important in raising patients' awareness and improving their attitudes and performance [8]. Research findings indicate that with the use of Hygienic Information and Communication Technology (HICT), it is easy to provide people with information in a simple and understandable way. Electronic health is one of the main areas where HICT is used. Electronic Health (E-health) is introduced mainly to function as a link between the clients and server, providing the necessary health and supportive services when they are away from each other [9]. Mobile technology is the most prominent manifestation of ICT which, like other communication technologies, has found its way into the field of education and health care, contributing to mobile phone-based education. This means of communication has changed the traditional way of training and education, and has given a new definition to the education. Also, in terms of time and place, it has made it possible for learners to learn ubiquitously at home, at work, and on journey, helping to remove many limitations, flaws, and shortcomings. The use of mobile phones has been remarkably increased in daily life and nowadays in the field of health care [4]. In Iran, numerous studies have been conducted on the effect of mobile-mediated education on awareness of diabetic patients. However, no study, to the best of our knowledge, has been conducted to investigate the effect of education

via mobile on knowledge, attitude, performance of the diabetic patients and their high blood sugar control. So the main concern of this study is to understand how health care systems and E-Health can expand with the use mobile and also to see the effect of education via mobile phones on knowledge, attitude, and performance type II diabetic patients. Furthermore, hemoglobin A1C in the type II diabetic patients has been studied by the use of a quasi-experimental method. The patients are divided into two experimental and control groups. Also, based on the theoretical framework of other studies conducted so far, the conceptual model of mobile-learning (m-learning) in patients with type II diabetes, regarding the main objective of this study, the Persian translation of the following figure has been used.

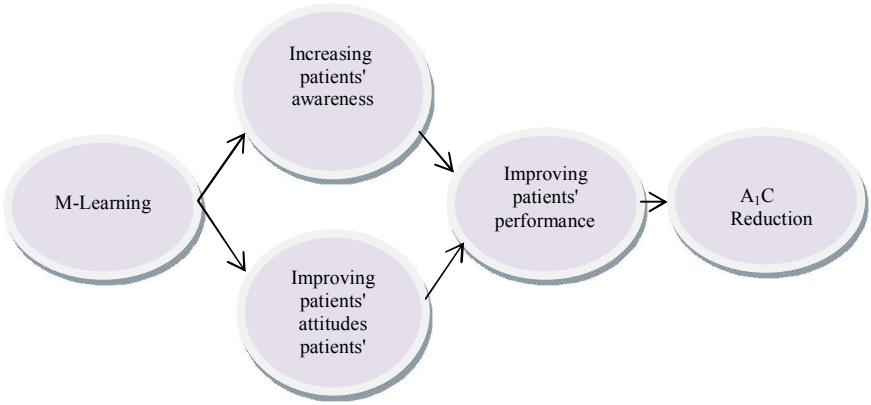

Figure 1: Conceptual model of education through mobile phones impact on hemoglobin A_1C

Regarding the main purpose of research, the theoretical foundations and studies conducted so far, the research questions are as follows:

1. Does education by mobile phone influence the knowledge of type II diabetic patients?
2. Does education by mobile phone influence the attitudes of type II diabetic patients?
3. Does education by mobile phone influence the performance degree of type II diabetic patients?
4. Does education by mobile phone influence the hemoglobin A1C of type II diabetic patients?
5. How do fitness indices in the experimental model of mobile phone-based education influence the amount of hemoglobin in type II diabetic patients?

Methods

This study was a quasi-experimental and a randomized clinical trial study. The participants of the study were type II diabetic patients. The diagnosis of diabetes in the participants was confirmed by an expert, affiliated with the American Diabetes Association, who came to the Diabetes Association of Karaj for a period of three months. The sample size, using the data from Zolfaghari, Mousavi, and Pedram's study [10], had the mean ± (SD) HbA_1C difference is as follows:

- SMS Group: -1.01 ± 0.01
- Telephone Group: -0.93 ± 0.13

And by taking into account the confidence coefficient of 95% and test power of 90% and also by determining the sample size based on the comparison of the mean of the two groups, the researchers assigned the patients into the control group (n=28) and the experimental group (n=28). But due to the risk of sample loss and also in order to increase the accuracy of the study, a total of 100 patients (50 in the experimental group and 50 in the control group) were considered for the sample size.

Samples of the study were selected randomly. That is to say, for three months, all the patients with type II diabetes who went to the Diabetes Association of Karaj were examined and the reference numbers with which the patients entered the center were considered as their numbers in the study. Then, using "MS Excel" software, random numbers were given. And those volunteer patients who were qualified for the study and whose entry numbers were consistent with random numbers were chosen for this study. Later, "Ross" software was used for dividing the samples into control and experimental groups. And using randomized blocks, four patients were selected in each block. And the patients were randomly assigned to the two control and experimental groups, each with 50 patients. The data collection for parts of the questionnaire in this study was done through the self-report and interview technique. To determine the amount of glycosylated hemoglobin, we had their blood samples tested in the same laboratory.

Data collection was done both at the beginning of the study and 12 weeks after the intervention for both the control and experimental groups. Having given their written informed consent, one hundred qualified patients were entered into the study. And the questionnaires were completed by the researcher and a research assistant (nursing students, with the prerequisite knowledge, who had been trained for this purpose). Also, the patients' height and weight were recorded in their medical record. The patients' cellphones were checked and examined by the researcher and the research assistant to make sure that the patients or their companions (who were responsible for giving the patients the text message) could receive the messages; then, they were given the necessary instructions. The patients received short educational text messages through their cell phones for 12 weeks and each week, four times. The content of these messages included diet, following medication orders, exercise recommended by their doctor, their own blood glucose measurement, feet care management, and the tips concerning avoiding whatever that caused complications.

During the intervention, over 48 text messages were sent via the researcher's own cell phone to the experimental group patients. In the meantime, by landline or cell phone, every two weeks, we collected the feedback on messages, recording them in the forms already set. During the intervention, patients in the control group did not receive any education and training from the researcher. At the end of the intervention period, both groups were called and asked the days they were scheduled to see their doctors to meet the researcher and the research assistant as well so that they could complete the same questionnaire and the hemoglobin A_1C amount again. At the end of the 12-week intervention, seven patients in the experimental out of the one hundred patients who participated in the study were crossed out for reasons like family problems (one), lack of willingness to continue to participate in the study (n = 2), lack of a mobile phone equipped with Farsi voicemail (one), leg fractures and hospitalization (one) and the failure to fill out the post-test questionnaire (n = 2). And in the control group, 12 patients were excluded from the study because they were absent for completing the post-test questionnaires. So 81 people, including 43 in the

experimental group and 38 patients in the control group, remained in the study till the end of the research.

The data collection instruments for this study were sheet of medical record and questionnaire. In this study, in order to scrutinize the performance of patients, after implementing the intervention (in addition to the completion of questionnaires and the self-report of behaviors), the laboratory index of hemoglobin A_1C was used. The periodical measurement of this index (usually every three months) evaluates metabolic control and the effectiveness of treatment. The medical recording sheet included the following information:

Family history of diabetes- body mass index (in kg/m) - smoking (the variable smoking in this study means if the person has smoked at least 100 cigars in the course of his life and/ or if (s) he typically smokes), acute diabetes complications and hemoglobin A_1C. In order to measure body mass index, height was measured without shoes and with an accuracy of 5.0 cm, and weight was measured with minimal clothing and no shoes and with an accuracy of 500 grams (with the same scale and centimeters) was used. The questionnaire consisted of two parts. The first part included six questions about demographic characteristics like gender, marital status, age, education and job. The second part consisted of a questionnaire of knowledge, attitude and practice, known as «KAP», which composed of 25 items. Items 1 to 14 assessed the individual's degree of knowledge about the nature of their illness, symptoms of diabetes type 2, causes of complications and the importance of controlling blood glucose within the normal range. Answers were corrected as follows: each correct answer by one point and each wrong answer by zero point. The maximum score of knowledge was 14 while the minimum score was zero. Questions 15 to 19 assessed a person's attitude in relation to the type of reaction they had in the face of issues and situations-related to diabetes. Questions had five items in a Likert scale of four degrees, from strongly agree (4) to strongly disagree (1) points. And respondents were asked to show the degree of their agreement by selecting one of the four options (from strongly agree (4) to strongly disagree (1) points in the areas of the need for regular exercise, the planned proper diet, regular use of medications, importance of maintaining blood sugar within the normal range and a regular visit to the doctor. Each correct answer had four points. The maximum score for attitude was 20 and the minimum score was 5.Questions 20 to 25 assessed the person's performance in relation to the practical considerations about the necessary care for type II diabetes and consisted of five three-items choices in the areas of time of the last measurement of blood pressure and blood lipids, time of the last visit to the doctor and ophthalmologist, and time of the last urine test and leg examination. To each correct answer, the score 1 and to each wrong answer zero were assigned. The maximum score for performance was 6 and the minimum score was zero. The total score of the questionnaire was 45.

This questionnaire was used in India by Subish Palaian, Denish and Ravi Shankar [11] and its validity was reported 72 percent. It was also used by Saadia, Rushid, Alsheha, Saeed and Rajab Studies in Saudi Arabia [12] and by Malathy, Narmadha , Ramesh , Alvin and Denish in India [13] and all of them declared its reliability and validity as acceptable. Malathy noted in their report that this scale was designed by American multimedia journal for collecting related information. For the translation of the questionnaires, first, an English translator translated the questionnaire into Persian with the guidance of an expert. Then, this Persian version of the questionnaire was translated back into the original language by another translator who was fluent in

English. This translation was the same as the original questionnaire. Then, by doing a pre-test on thirty of the subjects, the questionnaire items were revised. And finally, some of the questions that did not match with the Iranian social and cultural background were modified. In other words, they were 'localized', with the guidance of a specialist. With regard to knowledge, the scores were divided into three groups of weak (0-4), moderate (5-9) and good (10-14). As for attitude, the scores were divided into three groups of weak (5-10), moderate (11-15) and good (16-20). And with regard to performance, the scores were divided into three groups of weak (0-2), moderate (3-4) and good(5-6).Content validity of the research instrument was confirmed from the specialized point of view based on the judgment of a panel of experts (6 patients). The index range of content validity was between (1.00 - 0.78), the result was (CVI>0.75) and content validity ratio was one, and thus (CVR>0.99).

The scientific validity of research instruments was confirmed following a pilot study on 30 samples different from samples of the current research, and using internal consistency (Cronbach's alpha) and test-retest index, (α= 75%). Also, the internal correlation coefficient of knowledge, attitude, and performance were reported to be 0.809, and 0.897, and 0.785, respectively (Table 1).

Table 1: Reliability coefficients of mobile phone-based education scale on hemoglobin A_1C levels in patients with type 2 diabetes

Indices coefficient	knowledge	attitude	performance	Hemoglobin A1C
Cronbach's alpha	0.73	0.76	75	0.78
Number of questions	14	5	6	-

According to Table 1, since the results of the calculations done for estimating the reliability of scales forming preliminary tests indicated that the Cronbach's alpha coefficient was more than 70%, it can be concluded that the scales in this study enjoyed an acceptable degree of reliability.

The research proposal was evaluated by the Regional Ethical Committee in Research in Medical Sciences, Islamic Azad University of Karaj and was given the code of ethics 0025.

Also, this study was given the assigned code (RCT201112158416N1) on the Iranian Registry of Clinical Trial site. The collected data were analyzed using techniques of descriptive statistics (tables and mean) and inferential statistics (Chi-square test, analysis of covariance and factor analysis) by using SPSS version 17 and Lisrel.

Results

In the current study, the mean (SD) age of the experimental and control groups was 50.98 (SD = 10.32) and 56.71 (SD = 9.77) years, respectively and the mean (SD) body mass of the subjects in the experimental group was 28.51 (SD = 3.9) and that of the control group was 27.31 (3.49 = SD).

There was a significance difference for the age variable between the control and experimental groups (P = .012) and the adjustment of this variable was done in the analysis of covariance. However, based on the findings shown in Table 2, it can be said that the experimental group and the control group did not differ from each other in terms of other demographic variables and the collected data were reliable and the lack of difference between them was the result of chance or accident.

Table 2: Results of chi-square test for comparing the ratios of qualitative variables between the two groups

variable	Experimental group	Control group	Chi-square degree	Sig.
gender	34(79.1)=(female) 9(20.9)=(male)	29(76.3)=(female) 9(23.7)=(male)	0.89	0.766
Marital status	2(4.6)=(single) 41(95.3)=(married)	1(2.6)=(single) 37(97.4)=(married)	0.900	0.638
education	13(30.2)=(preliminary/basic) 27(62.8)=(average) 3(7.0)=(high)	22(57.9)=(preliminary/basic) 15(39.5)=(average) 1(2.6)=(high)	9.474	0.55
job	30(69.8)=(house wife) 13(30.2)=(at work)	26(68.4)=(house wife) 12(31.6)=(at work)	2.187	0.701
Family history	31(75.6)=(with) 10(24.4)=(without)	30(78.9)=(has) 8(21.1)=(doesn't have)	0.125	0.724
smoking	30(69.8)=(house wife) 13(30.2)=(at work)	26(68.4)=(house wife) 12(31.6)=(at work)	2.187	0.701

As shown in table 2, the comparison of the variables was not statistically significant ($p>0.05$). The numbers within parentheses show the percent.

The following table exhibits the answers given to questions one to four of the study as follows:

Table 3: Results of analysis of covariance comparison between experimental and control groups after the intervention and adjusting basic measurements and age

variable	group	mean	SD	F	Sig.
Knowledge-before	experimental control	7.9767 8.0526	2.58649 2.74611		0.886
Knowledge-after	experimental control	10.8372 8.6842	2.15948 1.97423	45.242	0.000*
Attitude-before	experimental control	18.1628 16.7368	1.25224 1.91275		0.520
Attitude-after	experimental control	18.2558 17.1579	4.32651 1.77865	1.590	0.192
Performance-before	experimental control	3.7209 3.8684	1.18172 0.77707		0.515
Performance-after	experimental control	4.9302 4.2632	1.16282 0.92086	23.880	*0.000
Hemoglobin A1C -before	experimental control	7.814 7.832	1.2401 1.1271		0.756
Hemoglobin A1C-after	experimental control	7.023 7.484	1.0263 1.2637	5.291	*0.024

There was a significant difference between the control and experimental groups regarding the variables of knowledge, performance, self-efficacy, and hemoglobin A1C after intervention and adjusting measurements before the intervention and age ($p<0.05$).

Table 4 has summarized the findings related to the fifth research question on the effect of fitness indices in the experimental model of mobile phone-based education on the amount of hemoglobinA1C in type 2 diabetic patients.

Table 4: Fitness indices of structural equation model of mobile phone- based education

Indices	Chi-square value	F	P-Value	RMSEA	GFI
Fitted value	323.70	176	0.0001	0.087	0.97

As table 4 shows, the factor analysis model of the present study has a good fit. In other words, regarding the significance level of $\alpha \leq 0.05$ and the suitability of fitness indices GFI and RMSEA, this model can be used to predict the level of hemoglobin A1C in patients with type II diabetes.

Conclusion

The main aim of the present study was to determine and compare the level of awareness, attitude, performance, and hemoglobin A_1C of patients with type II diabetes in control and experimental groups before and after training. According to the findings shown in table 3 and the results of ANCOVA for comparing the mean of awareness, attitude, performance, and hemoglobin A_1C variables in experimental and control groups after the intervention and adjusting the basic scales and age, we found that there was a significant difference in the experimental group for awareness variable after intervention ($p<0.05$) in such a way that the mean (standard deviation) of patients' awareness increased from 7.79 (SD= 2.58) to 10.83 (SD= 2.15), while the mean (standard deviation) of awareness changed from 8.05 (SD= 2.11) to 8.68 (SD= 1.97) in the control group. The mean of awareness variable in the experimental group was greater than that of the control group. In a study carried out by Rakhshandehroo, Ghaffari, Heidarnia and Rajab, the mean (standard deviation) of awareness in patients with type 2 diabetes increased from 7.5 (SD=3.2) before intervention to 12.9 (SD = 3.9) after intervention [14]. In Shamsi, Sharifi-Rad, Kachoei and Hassan Zadeh's study, the mean (standard deviation) of awareness variable in the control group was reported to rise from 53.1 (SD=21) to 55.9 (SD=18.2) that is not a considerable change ($p<0.001$) [15]. These findings are in line with those of Malathy ($p<0.001$). The mean score (standard deviation) of patients' awareness was 9.8 (SD = 3.68) before the intervention and changed to 12.92 (SD = 3.56) after the intervention [13]. Furthermore, based on the findings in Rezai, Tahbaz, Kimiagar, and Alavi's study, the mean rank (standard deviation) of patients' awareness before and after the intervention increased from 14.2 (SD= 3.88) to 21.9 (SD = 2.64) [16]. In a study by Khamse, Abdi, Malek, Shafie and Khdakarim, it was found that as the patients' awareness of the importance of the diabetes type 2 increased, the control of sugar blood was done with more regularity ($p<0.05$) [17]. In the study by Aghamohammadi investigating the effect of training intervention on required cares for a diabetic leg, 73.33 percent of participants' awareness was average, while after the training, 86.67 percent of the patients gained more knowledge about the disease [18]. The degree of awareness in most patients in Moridi and Esmail Nasab's study was low (less than 3), while it rose to 73.3 percent (7-11) after training [19]. The scores of patients' awareness in Fatehi, Malekzadeh, Akhavimirab, Rashidi and Afkhami-Ardakani ' study, increased from 7.92 to 11.51 after a three-month intervention training course by SMS ($p<0.001$) [20]. The results of Heidari, Moslemi and Montazeri fard's study revealed that the mean score (standard deviation) of patients' awareness was 56.1 (SD= 6.7) before training which increased to 66.1 (SD= 8) ($p<0.001$) after training [21].

Although the patients' awareness of various hygienic issues is important and valuable and the patients' awareness of the disease and its controlling process is of high significance, the awareness will not lead the patients to taking hygienic behaviors

as long as the patients do not have faith in their knowledge. Accordingly, another main variable of this study was patients' attitude. The mean score (standard deviation) of samples' attitude was 18.16 (SD= 1.25) in the experimental group which increased to 18.25 (SD= 4.32). The score for control group was 16.73 (SD= 1.91) which increased to 17.15 (SD= 1.77). The findings in table 3 as well as the analysis of the attitude scores of the experimental group after training intervention presented no significant difference ($p<0.05$). One point worth mentioning is that the maximum score for attitude was determined to be 25 (low = 5-10, average = 11-15, relatively high=16-20), and that before the training intervention both groups had a relatively high score. In the Rakhshanderoo et al.'s study, the mean (standard deviation) of the patients' attitude was 9.8 (SD= 2.32) before the training intervention which increased to 11.4 (SD= 0.95) after the intervention [14]. In Moridi et al.'s study, 51.7 percent of the patients had a positive attitude before the intervention and the figure increased to 96.7 percent after the intervention [19]. In Cuspidi, Sampieri, Macca, Fusi, Salerno and Lonati's study, the long-term effect of the systematic training course in a group structure brought about an improvement in patients' attitude towards their disease care [21]. The mean score (standard deviation) of patients' attitude increased from 1.84 (SD= 0.88) before training to 2.76 (SD= 0.86) after training in Malati et al.'s study [13]. Similarly, in Heidari et al.'s study, the mean point (standard deviation) of patients' attitude grew from 26 (SD= 4.2) before training intervention to 32.3 (SD= 3.7) after training intervention [21]. Rezai et al. reported the rise in the mean score of patients' attitude [16]; however, the results of the study by Buckley, Tiny, McKinley, Gallagher and Dracup showed that nursing training did not have an impact on patients with heart disease attitude. The researchers concluded that the possible reason for the result could be running the short-term training intervention (30 minutes) [23]. In a similar study, Tullmann, Haugh, Dracup and Bourguignon found that nursing training has caused an increase in the knowledge of patients with Coronary syndrome in their reaction to Infarction symptoms. However, their study revealed that the training brought no change in the patients' attitude [24]. The researchers declared that the possible reason for the results might be the participant's high age (over 65) (similar to the present study). Nevertheless, it should be stated that the change in attitude is one of the most difficult steps in training intervention and not all studies, which were able to achieve significant difference, were necessarily successful in changing the attitude. For instance, in the study done by Shabbidar and Fathi, entitled "The effect of nutrition training on the awareness, attitude, and performance of patients with diabetes type 2", the comparison between individuals' attitude towards diet and health showed that there was no distinctive variation between experimental and control groups after a three-month training intervention [25].

A group of researchers believes that the effect of training increases when it assumes a practical aspect and consequently the individuals' performance scores will increase significantly [15]. Based on the findings exhibited in table 3, after the training intervention, the mean score (standard deviation) of the samples' performance in the experimental group increased from 3.72 (SD= 1.18) to 4.93 (SD= 1.16), while the increase in the control group was from 3.86 (SD= 0.777) to 4.26 (SD= 0.920). The mean of this variable in the experimental group was greater than that of control group, so there was a significant difference between the two groups ($p<0.05$).

In the study conducted by Shamsi et al., the mean score (standard deviation) of the patients' performance in the experimental group was 37.31 (SD= 30.73) before training which increased to 75.94 (SD= 200.74) ($p<0.001$), whereas the change in the

control group was from 36.17 (SD= 29.1) to 39.72 (SD= 32) which was not a significant difference [15]. Similar results were obtained from Moridi and Esmailnasab's study in which the performance score of 61.7 percent of the patients for diabetes before the training was average, but it increased to relatively high in 83.3 percent of the patients after the training [19]. A significant difference was seen in Rakhshanderoo et al.'s study after analyzing the differences in performance scores of the participants before and after running the training intervention. The mean score (standard deviation) of individuals 'performance increased from 2.9 (SD= 1.25) before the training to 4.3 (SD= 0.88) after the training [14]. Heidari et al.'s study showed an increase of 15.5 (SD= 2.9) to 19.7 (SD= 2.3) in mean score of the patients' performance [21]. The results in Rezai et al.'s study also showed a rise of 60 percent after training in the performance of those who had a relatively good performance, and the percent of those who had a low performance dropped to 0 percent [16]. The performance of the patients with diabetes increased after training in Moini and Matalebi's study [26, 27]. The short-term training intervention in the University of Pretoria (2002) enhanced the awareness, attitude, and clinical care of the patients. In Mallaty et al.'s study, however, the mean score (standard deviation) of the performance of the patients presented no significant difference before and after training and the score only changed from 2.80 (SD= 0.40) to 2.88 (SD= 0.32) (p<0.001) [13]. This issue confirms the fact that the reason for behavioral and performance change is not the lack of facilities such as expense, time, etc., but the problem sometimes lies in the perception of the patients with diabetes of their disease and its seriousness. Both proposed concepts are among the important principles in theories and patterns of behavioral changes in intervention in hygiene training and health development. Based on the findings in table 3, there was a significant difference in the experimental group for the hemoglobin variable before and after the intervention (p<0.05) in a way that the mean of this change decreased, while the decrease in the hemoglobin before and after the intervention in the control group was not significant (p<0.05). The same results were found in Kim and Yoon's study after monitoring the patients by telephone for 12 weeks [28]. According to the study conducted by Rezai et al., the HbA1C of the patients increased after three months of training intervention [16]. The mean (standard deviation) of HbA1C of the patients in the experimental group through telephone decreased after three months of monitoring and training intervention in Nesari, Zakeri Moghaddam, Rajab and Bassam's study, whereas the decrease was not significant in the control group [29]. The degree of HbA1C of the patients under study in Zolfaghari's study also declined after three months of intervention by SMS. The decrease was 1.01 percent, while the HbA1C in the group under training by telephone decreased about 0.93 percent [10]. In the Rakhshanderoo et al.'s study, the HbA1C of the patients decreased after three months of direct and indirect training through face to face interaction, giving speech, group discussion, training clip, and educational pamphlets [14]. The laboratorial results of the present study about decreasing the HbA1C by training intervention was consistent with the findings obtained from Iranian and international studies, supporting the effectiveness of the training intervention. However, the distance education by cell phone distinguishes the current study from other studies which usually have used direct and indirect training approaches. The monitoring by telephone has been recognized as a cost effective program in various countries where the approach has been able to reduce the level of sugar blood in a long-term period and has been able to decrease the side effects of diabetes [30]. Today, as the majority of our citizens has

access to cell phone and, contrary to the computer and internet , the application of cell phone demands no special skill on the part of its users, while it is simple and free of technophobia; and as the role of education and that of observing a correct diet are important and as the correct change in the life style of the patients with diabetes can either highly help reduce the side effects of the disease or it can positively affect the economical assets and human force, it is necessary to use technologies which have been tested in other countries. In addition,, improvement in the disease prevention culture and events can preserve people's health and can lead to a healthy and jovial society, reducing other expenses.

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