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The effect of diabetes training through social networks on metabolic control of individuals with type 2 diabetes; a randomized controlled trial

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Keywords

Diabetes mellitus • Education • Social media • Mobile Health Units

Summary

Background. *Due to spread of smart phones, opportunity to train patients with diabetes and communicate with them using social media is rising. Aim of this study was to evaluate the effect of training through two popular social networks in Iran ("Telegram" and "Soroush") and the metabolic control of people with Type 2 diabetes.*

Methods. *In this randomized controlled trial, we recruited 134 patients with type 2 diabetes, which randomly allocated into two groups: the intervention and the control group on a 1:1 basis. The studied tools included demographic information and awareness of diabetes and international physical activity questionnaires. The intervention comprised a training package that delivered to the intervention group via social media for 45 days. The primary outcome measures included awareness of diabetes management and physical activity level while secondary outcome measures were HbA1c and lipid profile.*

Results. *Social network training led to the increase of the patients' awareness (44.31 ± 2.78 to 46.88 ± 2.25 in intervention group vs 44.14 ± 3.85 to 44.41 ± 3.87 in control group) and physical activities level (23.64 ± 8.46 to 31.68 ± 7.12 in intervention group vs 26.20 ± 9.39 to 30.20 ± 8.11 in control group) (p-value < 0.001). Besides, LDL and HDL levels, and HbA1c (8.19 ± 2.10 to 8.05 ± 1.96 in intervention group vs. 7.53 ± 1.67 to 7.45 ± 1.34 in control group) decreased significantly (p-value < 0.05).*

Conclusions. *Changes in lifestyle and challenges of the patients' attendance in diabetes training sessions, declared that use of social networks can be useful to train diabetes patients remotely, and it is feasible to send training messages to help them improve their diabetes care.*

Background

Diabetes is a non-communicable disease that is known as the epidemic disease of the third millennium [1, 2]. It is estimated that the number of people with diabetes will exceed 642 million in the world in 2040 [3, 4]. In Iran, about 4 million patients had diabetes in 2008, and the experts predict that this number will be tripled in the next 15 years [1, 5]. According to the World Health Organization, training is the basis of treating diabetes [6]. Changes in the lifestyle and awareness of the patients are effective strategies in the prevention of Type 2 diabetes [7]. Therefore, training of people with diabetes indifferent areas such as diet, exercise, physical activity is the basis of treatment, well before the pharmacotherapy. The treatment of diabetes is effective only when the patient knows the nature of his disease well and takes positive steps in treating it [8]. Since training of self-care skills in diabetes is a vital factor in caring for all the patients had diabetes, it seems that the virtual training to provide all the patients with the training services is a need [9].

It is estimated that 1 billion people use cellphones in the world [10]. The results of a survey in 2016 in 31 provinces of Iran, revealed that 53% of the Iranians are users of at least one of the social networks. "Telegram" is considered as the most popular social network among the Iranians and 45% of the Iranian population use this popular social network [11].

Mobile-based social networks have been used for virtual teaching and learning with various success rates. Virtual learning is independent of the time and place, and when the content is presented through text, images, voice, or video, it is more attractive to the audience [12]. Today, because of the industrialization of the cities and the changes of the lifestyle, it is not possible for all of the people to have active participation in the training, therefore, the social networks have been introduced as a very effective and complementary method for the traditional methods of training due to its multimedia capability and remarkable effectiveness [13].

The research studies on the virtual and web-based training show that virtual training can decrease the blood HbA1c level in diabetes patients and bring it to

the normal level [14, 15]. Another study done by Amini et al. indicated that electronic and long-distance training can increase daily physical activity and reduces the body mass index [16, 17]. While most of the studies on virtual training for diabetes have been via web-based solutions, the provision of such training through mobile-based social networks has not been well explored. So, the aim of this study was to investigate the effect of virtual training through two most popular social networks in Iran ("Telegram" and "Soroush") on the metabolic control of people with type 2 diabetes.

Methods and Materials

Study design

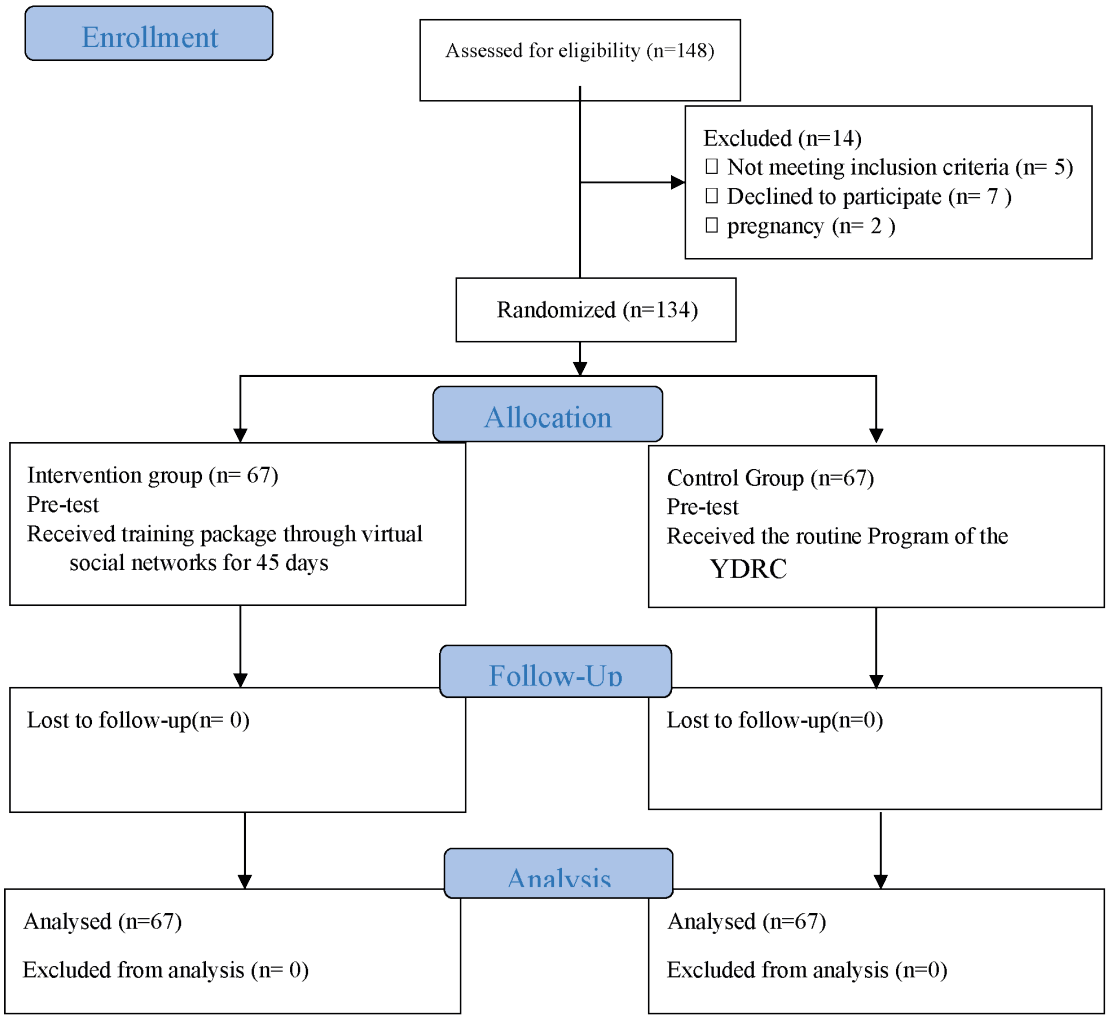
This was a randomized controlled trial with two groups (intervention and control) conducted in Yazd Diabetes Research Center (YDRS), in which the educational program through virtual networks was the intervention and the primary outcome measures included awareness of diabetes management and physical activity level while secondary outcome measure included HbA1c and lipid profile. Yazd Diabetes Research Center (YDRS) is one of the largest centers located in the central of Iran and services patients with diabetes from the southern region of the country [18-20]. The flowchart of the study is briefly shown in Figure 1.

Participants

The study population was patients with type 2 diabetes, who referred to the YDRC. The inclusion criteria included: patients with Type 2 diabetes, of ages above 18, having reading and writing abilities, attending in the training-briefing classes before entering the study, having a smartphone, and being able to use the social networks such as "Telegram" or "Soroush" applications. The patients who did not intend to cooperate, those with incurable disease, and pregnant women were not entered the study.

Considering the confidence level of 0.95 and the mean of HbA1c in the patients with diabetes of referring to YDRC (report extracted from the center system) and predicting a 10% decrease in its amount, the required

Fig. 1. Consort Flowchart of the study.



sample size was estimated to be 60 people in each group. Due to the possibility of attrition in the participants, 67 people in each group were included in the study.
Totally 148 people were assessed for egilibity, based on the information recorded in the patients' files at the YDRC and a short phone call with them. From them, 134 people meet the inclusion criteria and were selected as study participants and were randomly allocated into two groups of intervention and control (67 each group). To prevent exchange of information between groups, the intervention started after complete measurements of the control group.

Intervention

The educational program started after the intervention group selection and the first training-briefing session. Participants over 45 days and via Telegram or Soroush social networks. Furthermore, to increase participants' motivation, a number of inspirational messages were sent to them on Fridays and other national holidays. Moreover, participants were invited to attend the YDRC biweekly and met one of the research team carrying out process evaluation. There was also an opportunity for them to ask their questions about content of the training package.
The pre-test was administered after participants joined the relevant group Telegram or Soroush groups. The post-test was administered Six weeks after the end of the training period and posting the last message to the channel. Concerning the control group, all the relevant variables were assessed both before the study began and three months after it. The training content included texts, pictures, charts, and clips produced based on the standard curriculum of the International Diabetes Federation. In addition, some arrangements were made with YDRC specialists in endocrinology, nutrition, Iranian traditional medicine, and health education for the time and order of posting the relevant messages to increase their effectiveness.
The use of short texts, pictures, and clips which were optimized for internet use and which described diabetes and provided information about how to control the disease and avoid its harmful effect and also consideration of a fixed time for posting the relevant messages, *i.e.* 8:00 a.m. every day, led to patients' satisfaction and made them interested. Overall, 80 messages were sent over a period of 45 days, *i.e.* two messages per day, except for holidays.

Data collection instruments

In this study, before (baseline) and after the intervention, the participants completed demographic information, awareness of diabetes and international physical activity questionnaires. In addition, lipid profile and HbA1c were also measured.
International Physical Activity Questionnaire (IPAQ) - short form, was used to measure physical activity level [21, 22]. This questionnaire consists of seven questions in four parts of intense, moderate, walking and sitting activities, which includes sports activities, work environment activities and resting activities. This questionnaire finally accounts the amount of energy used during activities based on activity intensity and metabolic equivalent coefficient. The validity and reliability of the Persian version of this questionnaire has been confirmed [23]. Diabetes awareness questionnaire whose validity and reliability was approved in the study by Niroomand et al. was used for measuring the participants knowledge level regarding diabetes [24].
This study followed all the ethical considerations and approved by ethical committee (IR.SSU.SPH.REC.1396.61) in Shahid Sadoughi University of medical Sciences in Yazd, IRAN.

Data analysis

Descriptive statistics (mean ± standard deviation), the frequency (percentage) of quantitative and qualitative variables were calculated respectively. After checking the normality of the variables using Kolmogorov–Smirnov test, paired sample and independent T-test were used, for comparing the mean and the differences of the variables before (baseline) and after the intervention respectively when the data were normally distributed. Equivalent non-parametric tests were used when the data were not normally distributed. All analyzes were done in spss software version 21.

Results

Most of the participants were between 50 to 70 years old, female, with elementary education level, married, and housewife as shown in Table I.
Since the samples were chosen randomly, the two groups were compared based on gender, marital status, education, and occupation and there was no significant difference between the two groups which shows the homogeneity of the groups.
The comparison of the average awareness score of the study participants in the two groups before and after the intervention showed that there was no significant difference between the two groups before the intervention, while after the intervention there was a significant difference between the two groups (Fig. 2). In addition, the comparison of the before and after the intervention difference in the two groups, also showed a statistically significant difference, which means that the educational intervention has a significant effect on the level of awareness of the participants in the intervention group (Tab. II).
Table III shows that the amount of HDL was more in the intervention group compared to the control groups after the intervention. The comparison of the difference in the averages shows that the increase was more in the control group (Fig. 2).
The comparison of the HbA1c means of the study participants in the two groups before and after the intervention showed that there was a significant difference between the two groups before the intervention and after the intervention. But the comparison of the before and after the intervention difference in the two groups, showed a statistically significant difference, which means that the educational intervention has a significant

Tab. I. The frequency and the characteristics of the patients in intervention and control groups.

Variables		Intervention group N (%)	Control group N (%)	p-value
Age	18 to 50	16 (23)	18 (27)	0.61
	50 to 70	39 (58)	41 (61)	
	Above 70	12 (18)	8 (12)	
Gender	Male	27 (40)	38 (57)	0.08
	Female	40 (60)	29 (43)	
Education	Illiterate[a]	9 (13)	15 (22)	0.25
	Elementary	40 (60)	34 (51)	
	Diploma or Associate's degree	14 (21)	17 (25)	
	Bachelor's degree or more	4 (5.5)	1 (1.5)	
Occupation	Clerk	16 (23.9)	13 (19.4)	0.07
	Housewife	38 (56.7)	29(43.3)	
	Freelancer	13 (19.4)	25 (37.3)	

[a] They were able to read and write.

Tab. II. The comparison of awareness of diabetes management means before (baseline) and after the intervention program in the intervention and control groups.

Awareness of diabetes management	Before (baseline)		After		Difference		p-value
	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	
Intervention group	46 (11)	45.31 ± 2.78	48(3)	46.88 ± 2.25	-2 (2)	-1.56 ± 1.32	0.000[a]
Control group	45 (7)	44.12 ± 3.85	45(6)	44.41 ± 3.87	0 (1)	-0.26 ± 0.44	0.000
P-value	0.11[b]		0.000[b]		0.000[b]		

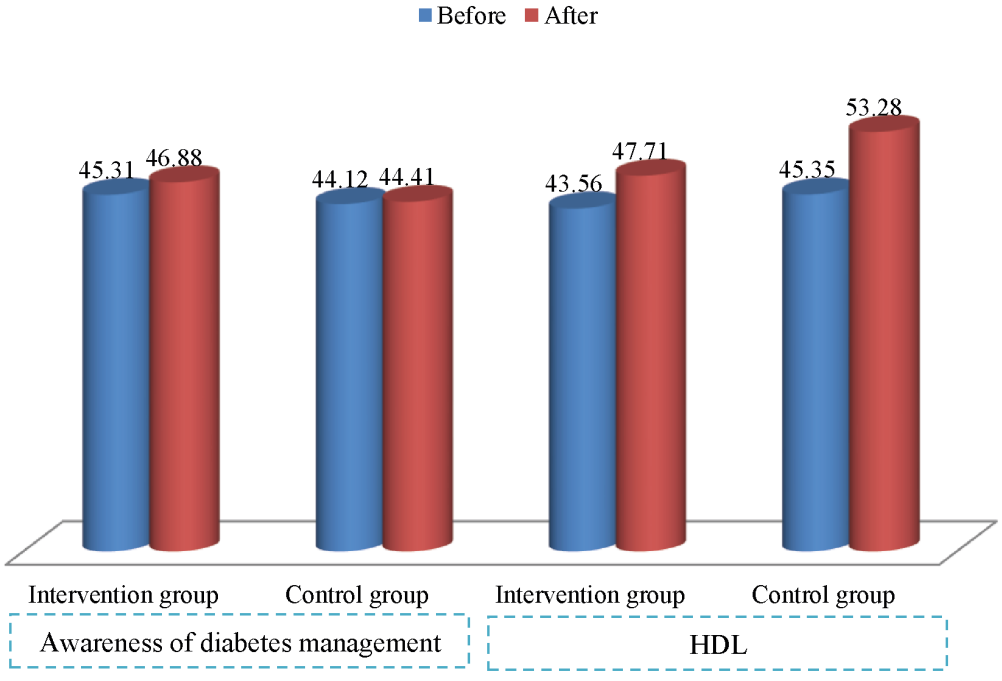
[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test

Tab. III. The comparison of the HDL average before(baseline) and after the training intervention between the two groups.

HDL	Before (baseline)		After		Difference		p-value
	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	
Intervention group	43 (12)	43.56 ± 10.36	47 (12)	47.71 ± 9.48	-4 (2)	-4.14 ± 1.92	0.001[a]
Control group	42 (14)	45.35 ± 17.33	50 (14)	53.28 ± 17.11	-8 (5)	-7.92 ± 6.31	0.001[a]
P-value	0.82[b]		0.04[b]		0.001[b]		

[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test.

Fig. 2. The comparison of mean for awareness of diabetes management and HDL before (baseline) and after the intervention program in two groups.



Tab. IV. The comparison of the HbA1c means before (baseline) and after the training treatment in the intervention and control groups.

HbA_{1c}	Before (baseline)		After		Difference		p-value
	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	
Intervention group	7.70 (2.60)	8.19 ± 2.10	7.50 (2.10)	8.05 ± 1.96	0.20 (0.20)	0.14 ± 0.21	0.001[a]
Control group	7 (1.70)	7.53 ± 1.67	7 (1.40)	7.45 ± 1.34	0.0 (0.60)	0.08 ± 0.48	0.410[a]
P- value	0.03[b]		0.06[b]		0.04[b]		

[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test.

Tab. V. The comparison of the score of the physical activity before (baseline) and after the intervention in the two groups.

IPAQ	Before (baseline)		After		Difference		p-value
	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	
Intervention group	24 (10)	23.64 ± 8.46	32 (8)	31.68 ± 7.12	8 (7)	8.04 ± 6.33	0.000[a]
Control group	24 (15)	26.20 ± 9.39	28 (12)	30.20 ± 8.11	4 (4)	4 ± 3.59	0.000[a]
P-value	0.08[b]		0.20[b]		0.000[b]		

[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test

Tab. VI. The comparison of the LDL average before (baseline) and after the training between intervention and control groups.

LDL	Before (baseline)		After		Difference		p-value
	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	Median (IQR)	Mean ± SD	
Intervention group	80 (41)	85 ± 30.12	76 (37)	81.10 ± 29	4 (2)	4.17 ± 2.10	0.000[a]
Control group	81 (49)	86 ± 36.83	70 (49)	79 ± 34.82	6 (5)	7.04 ± 6.43	0.000[a]
P value	0.82[b]		0.28[b]		0.000[b]		

[a] Statistical significance of differences calculated using Wilcoxon test. [b] Statistical significance of differences calculated using Mann-Whitney test.

effect on HbA1c of the participants in the intervention group (Tab. IV).

Table V shows that the amount of physical activity (IPAQ) was higher in the intervention group than in the control group after the training and this difference was statistically significant. The comparison of the mean difference indicates that there was an increase in the intervention group and the participants of this group increased their daily activities during the training period and this increase is significant (Fig. 3).

Table VI indicates that the amount of LDL was more in the intervention group than in the control group after the training and this difference is significant. The comparison of the difference between the average of the groups shows that the difference was more in the control group. During the training period, the average difference between the two groups is an indication of the effect of the training (Fig. 3).

Discussion

This study aimed to evaluate the effect of training through two popular social networks in Iran ("Telegram" and "Soroush") and the metabolic control of people with Type 2 diabetes.

The results of the study showed the positive effect of the intervention based on virtual social networks on the level of awareness of the participants in the intervention program. Several studies have shown the effectiveness of such interventions on the level of awareness of patients [25-27]. Patients' satisfaction with the process of receiving information through virtual social networks has increased their interest and, as a result, increased awareness.

The results revealed that the level of HbA1c has decreased significantly in the intervention group after the training through the social network. This is consistent with the studies done by Shaya et al. in Baltimore which was on the study of the effect of training of the patients with Type 2 diabetes through the social network [15]. The results also were consistent with what was reported by Sadeghian et al. on the significant effect of Type 2 diabetes patients' self-care on the decrease of the HbA1c [7]. Similarly, the results are in line with the studies of Heisler et al. which led to the decrease of the HbA1c level [14].

Another important variable that was investigated in this study was the rate of physical activity of the participants. According to the present study, the amount of physical activity increased significantly in the intervention group after the training. This is in line with a similar study done by Amini et al. in which they concluded that electronic and long-distance training can affect the body mass index and the rate of physical activity and can lead to the increase of physical activity [16].

The other variable which was scrutinized in this study was the comparison of the amount of blood LDL before and after the training in the two groups, According to the present study, the amount of LDL, decreased in the intervention group after the training and this decrease is significant and the result of the virtual training. This also is in line with the study done by Rezaei et al. in Aligoudarz which indicated that virtual training could have a positive effect on reducing LDL [28]. Besides, the studies of Goodarzi et al. aligns this study and confirms that the long-distance training can lead to a decrease in the LDL [29].

The amount of blood's HDL was also measured in the

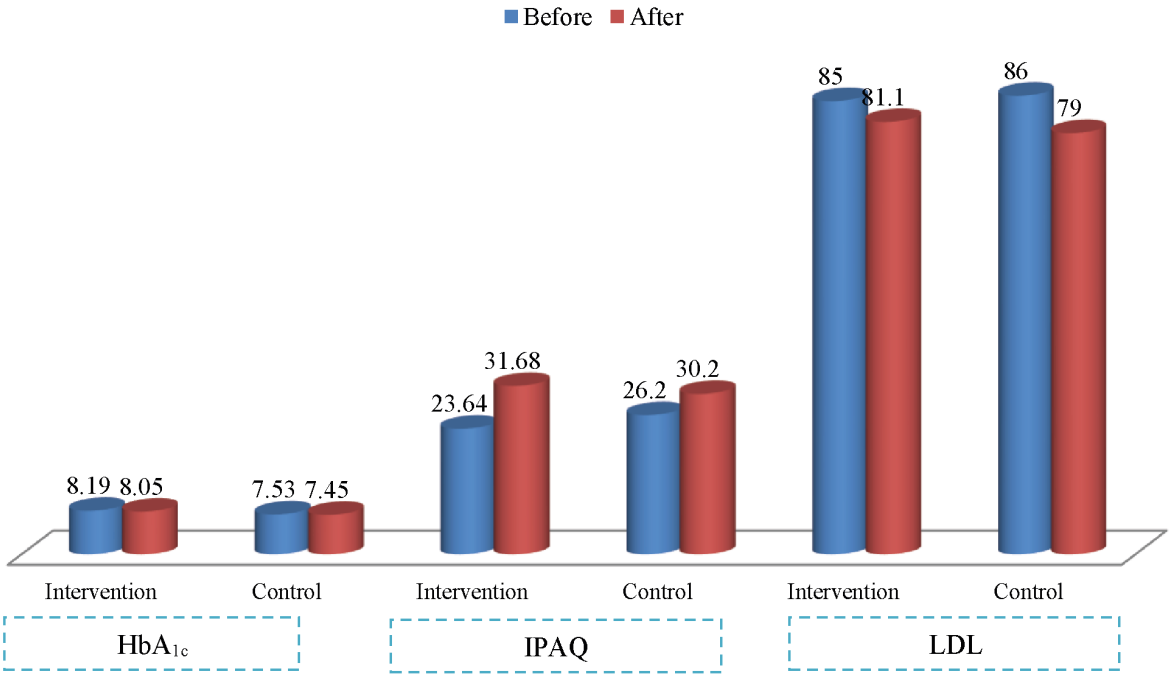


Fig. 3. The comparison of mean for HbA1c, IPAQ and LDL before (baseline) and after the intervention program in two groups.

two groups before and after the intervention. According to the results, the amount of the HDL increased significantly in the intervention group after the training which proves the effectiveness of the virtual training on increasing the HDL level. This is in line with the study of Wolf et al. which was done on 62 patients by a web-based intervention. The result of the web-based training showed that long-distance training could increase the blood HDL level [30].

According to the study of Abbasi-Shavazi et al., information support is one of the most important aspects of social support in a virtual supporting community for MS patients. According to these researchers, access to supporting information is one of the main reasons the patients join these communities. They assert that the patient cooperation in the virtual supporting communities can empower the patients to have an effective confrontation to the different challenges they may face and the virtual supporting communities which are related to the illness can be a supplementary source of social support for the patients with chronic diseases [31]. One of the main limitations of the present study was sample size. It may not be perfectly representative of other patients in Iran. Therefore, our results should be applied to other populations with caution.

Conclusions

Changes in lifestyle and challenges of the patients' attendance in diabetes training sessions, declared that use of social networks can be useful to train diabetes patients remotely, and it is feasible to send training messages to help them improve their diabetes care. Social networks could be used as a modern and useful tool for the training of people with diabetes. The results confirm that the patients have more tendency toward long-distance training through social networks than traditional and face to face training. They also use more interesting training information. Moreover, the use of social networks, particularly "Telegram" and "Soroush" applications is effective in increasing the patients' participation in improving the health level, controlling and managing the illness, and the patients' quality of life.

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Ethics approval and consent to participate

The collection and analysis of this data was approved by the University of Shahid Sadoughi University of Medical Sciences (approval no. IRSSU.SPH.REC.1396.61).

Consent for publication

The written informed consent to the publication of this article was obtained from the patient.

Availability of supporting data

Not applicable.

Conflict of interest statement

The authors declare that they have no conflict of interest.

Authors' contributions

Study design and statistical analysis and interpretation of the data: HAS and AD Drafting of the manuscript: MKS and FF critical revision of the manuscript for important intellectual content: HAS and FF. All the authors have read and approved the final manuscript.

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