Effect of Peer Group Support Educational Intervention on the HgA1c Level and Self-care Behaviors of Adolescents with Type 1 Diabetes Referred to Zahedan Diabetes Clinics

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Abstract

Background: Diabetes is a chronic and costly disease that is very common in adolescents. Improving self-care behaviors will be a motivation to continue treatment. On the other hand, peer support and education have been used as an effective method in reducing behavioral and attitudinal disorders caused by chronic diseases.

Objectives: Determining the effect of peer group support educational intervention on the HgA1C level and self-care behaviors of adolescents with type 1 diabetes.

Methods: This quasi-experimental research was conducted on adolescents aged 11-18 years with type 1 diabetes who were referred to the Diabetes Clinic in Zahedan city, Iran, in 2019. A total of 189 samples were included in the study using the convenience sampling method and were randomly assigned to two intervention groups and one control group (63 people in each group). The researcher used two methods of educational intervention, including peer support intervention and individual training by the researcher. Individuals in the intervention groups were subjected to separate educational interventions during 4 sessions of 60 minutes, one session every week. The control group received routine care. Demographic information, self-care behaviors, and HbA1c questionnaires were completed and recorded before, immediately, and 2 months after the end of the intervention. The data were analyzed using the Shapiro-Wilk test, chi-square test, repeated measures analysis of variance, one-way analysis of variance, and Bonferroni post hoc test using the SPSS version 26 software. The significance level of the tests was considered 0.05.

Results: Peer support training significantly improved self-care behavior ($P < 0.001$) and decreased HbA1c level ($P < 0.001$) in the intervention group compared to the control group. Moreover, in the intervention group, the self-care score and HbA1c level were significantly different between the pre-test, post-test, and follow-up stages ($P < 0.001$). The permanence of the effect of peer education in the follow-up phase was not confirmed for the variables self-care ($P < 0.001$) and HbA1c ($P < 0.001$).

Conclusions: Our findings showed that using peer groups and the experiences of similar people as educators can improve self-care behaviors and also record lower average glycosylated hemoglobin in type 1 diabetic patients. Therefore, it is recommended that peer support training be used as an effective method in diabetes and other chronic diseases.

Keywords: Diabetes Mellitus Type 1, Self-care Behaviors, Peer Groups, Adolescent, HgA1C Level

1. Background

All over the world, diabetes is a common, chronic, and costly disease that causes the death of four million people every year (1). Diabetes is a group of metabolic diseases characterized by increased blood sugar due to defects in insulin secretion, insulin action, or both. Chronic hyperglycemia of diabetes is associated with long-term damage and dysfunction of various organs, especially eyes, kidneys, nerves, heart, and blood vessels (2). Diabetes is

diagnosed once, but its lifelong treatment is complex and requires multiple steps for treatment. A person should be committed to the continuous control and correction of blood sugar and diet (3).

Diabetes type 1 is one of the most common chronic diseases diagnosed in childhood and adolescence, and its annual prevalence in adolescents and young adults is increasing (4). Controlling diabetes in this period is considered a big challenge because adolescents with type 1 diabetes experience many problems, including social

stigma, lack of self-care behaviors, conflict with parents, decreased performance, depression, and anxiety (1). On the other hand, adolescence is one of the most critical periods of people's lives, during which a person crosses the border of childhood to a new stage and is usually accompanied by deep personality and physiological changes (5). Seven basic self-care behaviors in people with diabetes lead to optimal outcomes. These behaviors are healthy eating, physical activity, blood sugar control, medication regimen adherence, problem-solving skills, healthy coping skills, and risk reduction behaviors (6). In a study on 133 children aged 7 - 14 years in Tehran, Mazal and his colleagues (1999) found that only 25% of the children had a good level of self-care, while the rest had a weak (47%) and moderate (28%) levels of self-care. The results of this study showed that the level of self-care in children is low, and they need education (7). One of the most important factors in the death of diabetic patients is the lack of self-care. Self-care behaviors are considered important from both health and economic points of view and reduce costs (8). One of the most critical goals of health and treatment systems is to encourage adolescents to observe self-care behaviors by different educational methods, and the self-care behaviors of adolescents with type 1 diabetes can be improved.

Peer training is one of the types of training methods in this field. Considering that diverse training approaches have different effects, the effectiveness of peer training should be compared with other techniques. The use of peer educators as part of the care model in chronic diseases can be an integral part of self-care programs, and the use of this method, especially concerning diabetes, may be a useful method to improve blood sugar control (9). Support takes place by exchanging experiences in the group and with a peer who has a history of this disease and has completed a training course. Peer mentors are selected from those who have a history of the illness or problem and have received training in communication skills, including listening, helping participants know their values and life goals, assertiveness skills, and problem-solving skills (10). During peer support group meetings, in addition to examining caregiving challenges, group members can gain different perspectives by using the experiences of others, making changes in their family life, and having a more active approach to their lives (11). A sense of empathy and social identity, created due to the peer and patient membership in the same group, makes it easier for patients to accept information from peers and share their problems and secrets with them (12, 13).

Studies have investigated the effectiveness of peer group support in promoting the use of breast milk, self-care in chronic heart patients, dealing with anxiety caused by heart surgery, improving the quality of life in cancer patients, medication adherence, and reduction of depressive symptoms in patients with acquired immunodeficiency syndrome (14, 15).

As mentioned, peer support and training have been used as effective methods in reducing behavioral and attitudinal disorders caused by various diseases in many countries. Nurses should consider solutions and interventions that can reduce the complications and problems of diabetes in adolescents with type 1 diabetes. Therefore, they must pay attention to the effectiveness of using peer education to improve self-care in this disease. However, few studies have investigated the effect of this method on HgA1C level and self-care in adolescents with type 1 diabetes. According to the search results in various databases in Iran, limited research has investigated the mentioned topics despite their importance. Therefore, the present research examines the effect of the mentioned intervention on both HgA1C level variables and self-care behaviors for the first time in Iran. In addition to the novelty of the title and topic, this was the first study on the investigated geographical, spatial territory, and target statistical population.

2. Objectives

The present study aimed to assess the effect of peer group support educational intervention on the HgA1C level and self-care behaviors of adolescents with type 1 diabetes referred to Zahedan Diabetes Clinic in 2019.

3. Methods

3.1. Study Design and Setting

This three-group ((two intervention groups and one control group) First, we decided to conduct the study in two groups (one control and one intervention group) but to prevent any kind of bias; we conducted the study in three groups (one control group and two intervention groups), which was more time-consuming and difficult.) a quasi-experimental study with a pretest-posttest design was performed on 189 adolescents aged 11 - 18 years with type 1 diabetes referred to the Diabetes Clinic of Ali ibn Abi Taleb Hospital in Zahedan, Iran, in 2019.

3.2. Samples and Process

Initially, the sample size was estimated based on the mean and standard deviation of the diabetes-related stigma score in the study of Puryaghoob et al., with a confidence interval of 95% and a statistical test power of 80% based on the following formula. Finally, 46 people were estimated for each group (16). However, to increase

the accuracy and ensure the adequacy of the sample size, and considering the possible dropout and the three groups of the study, this number was multiplied by 1.4, and the number of samples in each group was considered 63 people and a total of 189 respondents.

$$n = \frac{(Z_{1-\alpha/2}) + (Z_{1-\beta})^2 \ (S_1^2 + S_2^2)}{\left(\bar{X_1} - \bar{X_2} \right)^2}$$
$$= 45/32$$

$Z_{(1-\alpha/2)} = 1/96$, $S_1 = 19/39$, $(\bar{X_1}) = 77/47$, $Z_{(1-\beta)} = 0/85$, $S_2 = 19/96$, $(\bar{X_2} = 89/08)$

Samples were first selected through the convenience sampling method out of adolescents aged 11 - 18 years with type 1 diabetes. Next, the samples were randomly assigned to the intervention and control groups through a card lottery. The inclusion criteria entailed: (1) Being diagnosed with diabetes at least three months before the study, (2) being in the age range of 11 - 18 years, (3) having no history of mental illness, drug addiction, disability, or debilitating diseases, (4) informed consent, (5) living in Zahedan city, (6) being able to read and write, (7) not having to participate in similar studies. Furthermore, the inclusion criteria for the peer (group leader) were having HbA1c less than 7, a score of 70 in the self-care questionnaire, and having the competence of group leadership to observe self-care behaviors and hyperglycemia control, according to the clinic doctor.

The exclusion criteria were absence from more than one session and the patient's condition becoming critical during the implementation of the intervention.

To conduct the study, necessary arrangements were made with the officials and specialized diabetes clinics. Afterward, the researcher went to the research environment, introduced herself to the people who met the criteria for entering the study, explained the research objectives, and obtained informed consent from them for participation in the research.

After completing the sample size calculation and grouping (Figure 1), demographic data questionnaires and self-care surveys were completed by these people, and pre-intervention HbA1c level was recorded from their files. Next, with the help of the Diabetes Clinic manager, four people were selected as peer leaders. Peers did not exist in any of the intervention and control groups. For the selected people, a four-hour training course was held about the supportive peer group, effective communication, problem-solving skills, information about type 1 diabetes, its symptoms and complications, self-care, ways to reduce the complications of the disease, the impact of the disease on the family, types of family structure, and other subjects around the methods of

adaptation and healthy life with diabetes. The task of the leader of the peer group was to manage the meetings held by guiding people toward the anticipated topic, presenting individual experiences, and finally summarizing the topics that were raised. Moreover, if any of the members of the peer group faced a question or problem during the weekly meetings, this problem was brought up in the meeting, and the experiences of other members of the group were also sought. Peer group support was performed in two dimensions of informational support (learning problem-solving and effective communication skills, familiarity with type 1 diabetes and its complications and problems, self-care and ways to improve it, and the expression of experiences by each person and the participation of other people in this experiences) and emotional support (reducing the feeling of stigma in the individual and strengthening and encouraging people). The researcher was responsible for preparing the content, planning the meetings (according to Tables 1-3), supervising their implementation, and managing the meetings. Supportive educational intervention was completed for one group of the two intervention groups by the researcher and the other group by peers. Each group of 63 people was divided into seven groups of 9 participants. According to the previous studies, the sessions for the intervention group were held for approximately one hour for each group weekly for 4 weeks at Zahedan Diabetes Clinic. The control group benefited from the clinic's common educational interventions. At the end of 4 weeks (immediately after the end of the intervention), questionnaires were completed again by both intervention and control groups, and the HbA1c level was measured and recorded. In the third time (follow-up), which was 2 months after the end of the intervention, all the participants completed the questionnaires in person when visiting the clinic, and HbA1c was taken from their files at this stage. In each session, a booklet of the presented subjects was prepared and given to the intervention groups, and at the end of the study, after completing the third questionnaire, an educational package was given to the control group.

3.3. Instruments and Data Collection

The data were collected using the demographic characteristics questionnaire and Tobert and Glasgow's diabetes self-care questionnaire (2002).

3.3.1. Demographic Questionnaire

The demographic characteristics included the year of birth, gender, number of years of diabetes, number of children in the patient's family, economic status, patient's

Table 1. Introducing the Meetings

List of Meetings	The Content of the Meetings
1	Acquainting the researcher with the participants and the participants with each other, building trust through a detailed explanation of the goals and the way of conducting the study, describing the roles and responsibilities of the researcher, group leader/researcher, and other participants in the research, preparing a list and prioritizing common issues and problems of affected patients according to research objectives, and determining the time to deal with the listed problems
2	Educating the members through lectures by the group leader/researcher about type 1 diabetes and its common complications, self-care and ways to reduce diabetes complications, diabetes-related stigma, medical methods of controlling the disease, raising the most important problems listed by the leader, and encouraging members to share experiences related to the topic
3	The explanation of the group leader/researcher regarding problem-solving methods and how to use them when facing the problems and complications of diabetes, cooperation with parents, continuing the discussion about other problems listed under the guidance of the group leader, sharing the experiences and methods of dealing with problems related to diabetes. The leader/researcher requests the participants to prepare a list of their strengths regarding facing the disease and its complications and stigma to be presented in the next meeting. Finally, summarizing the topics presented in the meeting led by the leader/researcher
4	Discussing the influential methods of communication and effective factors in reducing social stigma, presenting the experiences of the leader and participants regarding communication challenges, self-care challenges, reducing factors regarding the stigma related to diabetes, and methods of better adaptation to the disease. Summarize the presented information and provide new roles for the challenges that have arisen regarding the stigma related to diabetes and self-care.

Table 2. Mean and Standard Deviation of the Variables of Diabetic Teenagers in the Control and Intervention Groups [a]

Variables	Control Group	Peer Group	Education Group	Test Result
Age (y)	13.85 ± 1.89	14 ± 1.97	13.97 ± 2	P = 0.91, df = 2, f = 0.096
Duration of illness (y)	2.99 ± 1.72	3.41 ± 2.19	2.86 ± 2.06	f = 1.29, df = 2, P = 0.28
The number of children in the family of the affected person	3.05 ± 0.91	2.75 ± 0.88	2.91 ± 0.79	f = 1.92, df = 2, P = 0.15
Family history				$\chi^2 = 1.72$, df = 2, P = 0.42
Yes	44 (71)	48 (76.2)	42 (65.6)	
No	18 (29)	15 (23.8)	22 (34.4)	
Gender				$\chi^2 = 0.5$, df = 2, P = 0.78
Male	37 (59.7)	38 (60.3)	35 (54.7)	
Female	25 (40.3)	25 (39.7)	29 (45.3)	
The economic situation				$\chi^2 = 4$, df = 4, P = 0.41
Weak	22 (35.5)	23 (36.5)	16 (25)	
Medium	15 (24.2)	12 (19.1)	12 (18.8)	
Good	25 (40.3)	28 (44.4)	36 (56.2)	
Education level				$\chi^2 = 0.06$, df = 2, P = 0.96
Elementary	8 (12.9)	6 (9.5)	5 (7.9)	
First high school	37 (59.7)	36 (57.2)	38 (59.3)	
Second high school	17 (27.4)	21 (33.3)	21 (32.8)	

[a] Values are presented as No. (%) and mean ± SD.

Table 3. Comparison of the Mean and Standard Deviation of Self-care Score Before and After Intervention in Three Groups [a]

Groups	Pre-test	Post-test	Follow Up	Repeated Measures ANOVA (P-Value)
Control	42.56 ± 3.43	42.90 ± 3.38	41.73 ± 5.20	0.14
Peer	42.44 ± 3.37	49.57 ± 7.65	47.51 ± 7.01	< 0.001
Education	42.20 ± 3.08	5.27 ± 6.95	46.32 ± 5.63	< 0.001
One-way variance test (P-value)	0.82	< 0.001	< 0.001	

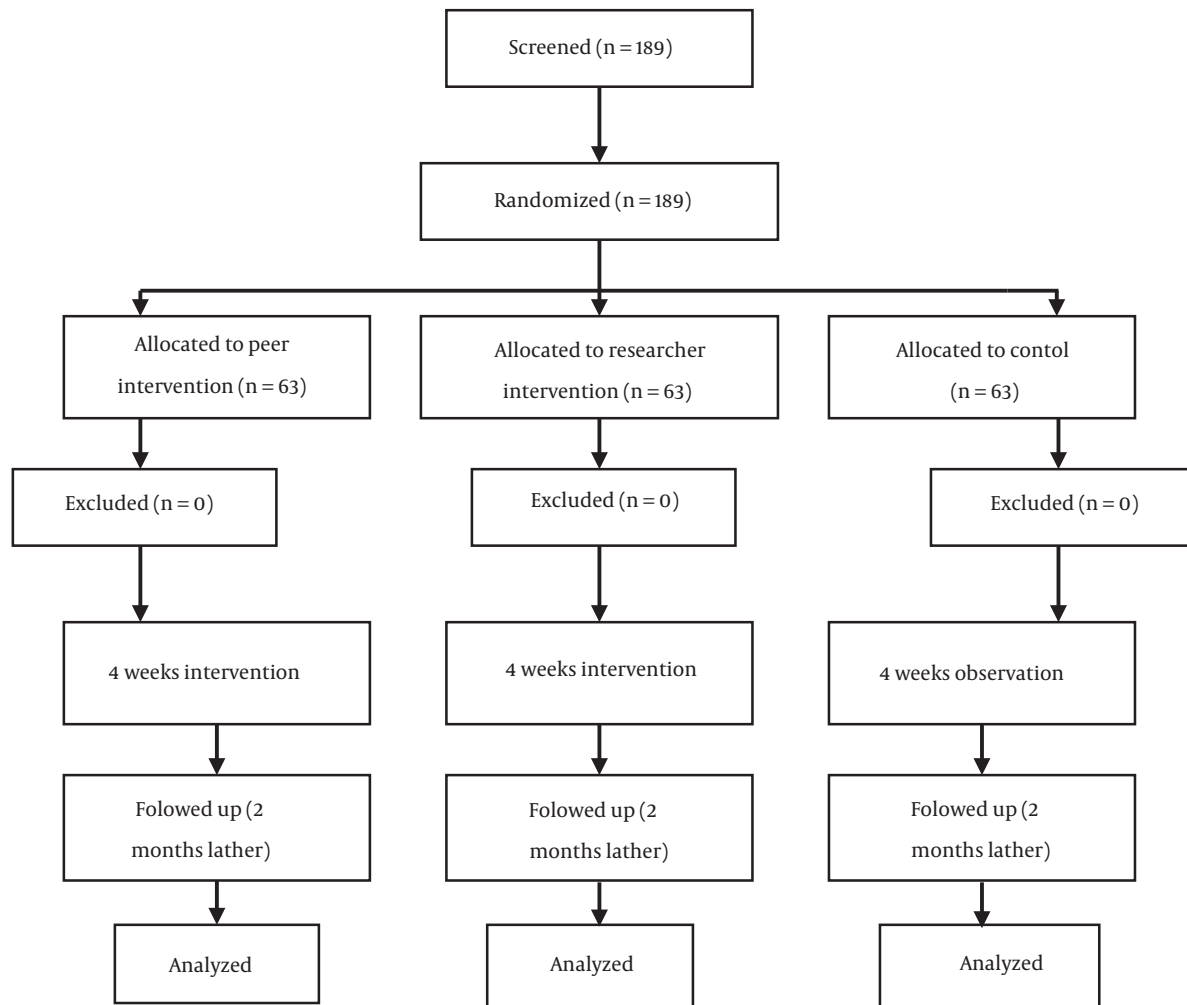[a] Values are presented as mean ± SD.

Figure 1. CONSORT diagram of the participants' flow through each stage of the present research

education level, and the history of diabetes in the family and relatives.

3.3.2. Self-care Questionnaire

To measure self-care, Tobert and Glasgow's diabetes self-care questionnaire (2002) was used. The questions of this questionnaire allow people to report the quality of self-care activities related to their diabetes in the last 7 days. Having a healthy diet, injecting insulin or taking pills correctly, taking blood sugar tests, exercising, taking foot care, and smoking are among these behaviors.

For scoring the questions of this scale, a person who had no self-care behaviors in the mentioned fields in the past 7 days got a score of zero, and a person who had performed daily and complete care in all 7 days got a score of 70. To determine the level of the desirability of the self-care situation, in addition to the average score scale, the range of obtained scores (0 - 70) is divided into three parts, and an overall compliance score is obtained by adding up the scores of each question. The validity and reliability of this tool have been checked and confirmed in previous studies, and its Cronbach's alpha coefficient was estimated at 0.68 (17).

3.4. Ethical Considerations

This study was approved under the ethical approval code of IR.ZAUMS.REC.1399.201 at Zahedan University of Medical Sciences.

3.5. Statistical Analysis

Data analysis was completed using SPSS 26 software. First, frequency, percentage, mean, and standard deviation were determined by descriptive statistics. The results of the Shapiro-Wilk test showed that the research data had a normal distribution. Therefore, parametric tests were used for data analysis. To compare the average score of a variable in one group between three consecutive times, repeated measures analysis of variance (ANOVA) was used. The average scores of the three groups were compared between the pre-test and post-test times by the one-way analysis of variance. Moreover, the chi-square test was utilized to compare qualitative demographic variables between three groups. The level of significance in this study was considered P < 0.05.

4. Results

The chi-square test showed that these three groups (control, peer, and education groups) have statistically significant differences in terms of average age, duration of diabetes in adolescents, number of children in the family of patients, and family history in different groups. On the other hand, gender, economic status, and level of education did not have statistically significant differences (P > 0.05).

According to the statistical tests, the first hypothesis was confirmed (Table 2). The hypothesis was that the average score of self-care in adolescents with type 1 diabetes before, immediately after, and 2 months post-intervention is different between the intervention and control groups.

According to the statistical tests, the average score of HbA1c in teenagers with type 1 diabetes in the pre-exam stage was significantly different between three different groups (P=0.002). Consequently, for a more detailed examination of pre-test values (control, peer, and education group values), the covariance test was used (Table 4).

5. Discussion

The results of the present study showed that in the control group, the scores of this variable did not change significantly in the three stages and had the same status.

Meanwhile, in the peer educational intervention group, according to the repeated measures ANOVA, the peer educational intervention can significantly improve self-care behaviors in diabetic adolescents. The significant decrease in this score over time may show that the self-care behaviors of the patients have declined significantly after 2

months of intervention. This can be due to various reasons, such as forgetting training with the passage of time or non-continuity of the intervention to institutionalize and stabilize learning. It can be concluded that the stability of this intervention depends on the continuation and repetition of these trainings over time.

Furthermore, conducted by the researcher, according to the results of repeated measures ANOVA and the two-by-two time comparison of the scores in the educational group, the educational intervention of the researcher significantly improved self-care behaviors in diabetic adolescents. This score decreased significantly over time, and it can be concluded that the sustainability of this intervention also depends on the continuity and sufficiency of institutionalizing these trainings.

A two-by-two comparison of the average self-care scores over time shows that in both peer and individual interventions, the average self-care scores were higher in the post-test and follow-up, compared to the pre-test stage, which shows the positive effect of both types of intervention on improving the self-care of diabetic patients in all stages. On the other hand, the two-by-two comparison of the groups in terms of self-care score revealed no significant difference between the intervention by peers and the educational intervention by the researcher. According to the diagram, it should be said that the level of stability and resistance of peer intervention in improving the self-care of teenagers with diabetes was higher than the method of education by the researcher.

The results of the present research were consistent with the study of Heisler et al. under the title "Peer Support in the Self-care of Patients with Diabetes." The aforementioned research showed that peer education led to increased self-care, correct use of medications, and reduced insulin needs in the peer group compared to the control group (18). However, their study was different from the present investigation in terms of the community, the number of people in the research sample, gender, and the duration and type of intervention. They studied 244 men with diabetes who underwent educational intervention by peers for 6 months using a telephone platform. One of the strengths of the aforementioned research is the relatively long duration of the intervention, and in the current research, the importance of the impact of the intervention time on the sustainability of the change and its effectiveness was confirmed. There are also studies inside the country that have investigated the effect of peer educational intervention on various diseases. Moreover, in the study of Ahmadi et al. entitled "Investigation of the Effect of Peer Education on Self-care Behaviors of Patients with Diabetes", the effect of this education on improving

Table 4. Comparison of the Mean and Standard Deviation of HbA1c Score Between Pre- and Post-intervention in Three Groups

Groups	Pre-test	Post-test	Follow up	Repeated Measures ANOVA (P-Value)
Control	9.94 ± 1.11	9.87 ± 1.23	10.2 ± 1.06	0.062
Peer	10.09 ± 1.35	8.74 ± 0.56	9.20 ± 0.64	< 0.001
Education	10.69 ± 1.29	8.96 ± 0.69	9.26 ± 0.71	< 0.001
One-way variance test (P-value)	0.002	< 0.001	< 0.001	

self-care behaviors was confirmed. Their research sample included 80 patients with type 2 diabetes (19). Regardless of the different target populations, it should be said that the results of their study are in line with the current research. The study by Edraki et al. entitled "Effect of Peer Education on Self-care Behaviors and Average Glycosylated Hemoglobin in Adolescents with Type 1 Diabetes" showed that 3 months after the intervention, the intervention group had higher levels of self-care behaviors and lower glycosylated hemoglobin levels than the average reported. As a result, peer education can improve self-care behaviors and improve glycosylated hemoglobin status in adolescents with diabetes (20). The results of the latter research are also in line with our findings. However, in the present study, to measure the effectiveness of peer education compared to other methods, the method of individual education (education by the researcher) was also considered as a separate intervention so that by creating a comparative approach, a more comprehensive view of peer education was achieved. As a result, the studies above confirm each other and are in line with the present research. However, in rare investigations, the effect of peer education on improving self-care has not been confirmed. For example, Abdullahzadeh and Rahmani, in research entitled "Effect of Peer Education on Self-care Activities and Self-efficacy Related to Self-esteem in Adolescents with Type 1 Diabetes," showed that peer education has a great effect on the self-care behaviors of adolescents with type 1 diabetes. In contrast, it had a positive effect on their self-confidence, and in the end, it is recommended that more studies be conducted on the impacts of peer education on other adolescent behaviors (21). In general, the majority of the research conducted in this field has confirmed the positive effect of peer support training on improving people's self-care, and this result was also confirmed in the present study. The studies conducted on people with diabetes have limited variables, which are mostly descriptive (survey), and few studies have been performed with a peer-based approach through face-to-face education and parallel education by the researcher. Therefore, according to the title of the research, until now, no specific and single study has evaluated the effect of peer support educational intervention and education by the researcher on self-care behaviors and HgA1c level of teenagers with type 1 diabetes. In addition, this research is innovative in terms of the intervention protocol (simultaneous research in three groups and at three times with three variables) and the scope of the study.

5.1. Conclusions

Nurses are members of the healthcare team who have long and close contact with patients. Moreover, there are not many medical and nursing staff. Therefore, nurses can use peer education methods in addition to formal training as a non-medicinal approach that is free of charge and people like to use. This method can be more effective than other techniques and creates more lasting effects by using the experiences of similar people. It has different advantages, such as being easy, low-cost, effective, and based on life experiences. Moreover, it does not need special equipment for training.

5.2. Research Limitations

Among the limitations of the current research are the implementation of the study in only one field and the limited sample size. Moreover, the sampling method (convenience sampling) can limit the generalizability of the findings. There is a time limit in the study to investigate the extent of durability and longer effectiveness in a time interval of 4 months or more after the intervention. Self-reporting in completing the questionnaires may include abuse by teenagers, which can be controlled to some extent by observing the behavior and checking the results of the experiments.

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Footnotes

Authors' Contribution: Study concept and design, acquisition of data, analysis, and interpretation of

data, statistical analysis: M.GH. and K.S. Drafting of the manuscript, critical revision of the manuscript for important intellectual content: K.S. Administrative, technical, and material support and study supervision: F.GH.

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Data Availability: The data presented in this study are uploaded during submission as a supplementary file and are openly available for readers upon request.

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