

Evaluation of the Effect of Training on the Health Literacy, Self-Care, and HbA1c of Type 2 Diabetic Patients

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Abstract

Received: 21 Feb 2024
Accepted: 03 Aug 2024

Keywords:

Health literacy
Diabetes mellitus
Training, HbA1c
Self-care
Clinical librarian

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Introduction: Type 2 diabetes is a significant health problem. Improving health literacy helps control complications in people with type 2 diabetes. This study aimed to investigate the impact of training on health literacy, self-care, and HbA1c blood tests of people with type 2 diabetes.

Methods: A semi-experimental study was conducted with a group before and after the intervention. Two hundred thirty-two patients from Tafihan Medical Center, Shiraz, Iran, were selected based on criteria. A clinical librarian conducted a three-month education. HELIA and SDSCA questionnaires measured health literacy, self-care, and HbA1c. Descriptive statistics and the Wilcoxon test analyzed the data.

Results: Before the intervention, the health literacy of most of the participants was insufficient (46.1%). While after the intervention, the health literacy of most of the participants improved to an adequate level (52.2%). The HbA1c mean was 8.49 ± 1.01 before and 6.88 ± 1.42 after the intervention. The self-care average was 47.5 before the intervention and 96.7 after the intervention. Before the intervention, the self-care level was 53.9% semi-optimal, and after the intervention, it was 79.3% optimal. Statistical tests on changes were significant. Improved health literacy enhances self-care and HbA1c in type 2 diabetes patients.

Conclusion: Providers must assess health literacy and develop interventions to enhance the health of type 2 diabetic patients, as health literacy influences self-care and HbA1c control. Health literacy should be crucial to education and healthcare in order to improve outcomes.

Introduction

Health Literacy" was introduced into the health care system in 1974. Health literacy is defined as a broad scope of knowledge and skills in acquiring, processing, understanding, and using health information (1). The World Health

Organization (WHO) defines health literacy as individuals' cognitive and social skills in acquiring, understanding, and using health information, which promotes and maintains health (2). Enhancing health literacy to improve health status has drawn



increasing attention since 2003 (3) and has become a global issue (4). People with low levels of health literacy understand written and spoken health information less and do not use available medical information to improve their health (5).

Moreover, health literacy plays a crucial role in reducing the complications of chronic diseases such as diabetes (6) since the increase in the patient's knowledge and information about these diseases leads to better control of their irreversible complications (7). Diabetes develops if the pancreas cannot produce enough insulin or the body fails to use the insulin produced in the body effectively (8). This condition is known as one of the most common chronic diseases worldwide, and it is called by the WHO the "Silent Epidemic" (9). Diabetes is categorized into insulin-dependent, non-insulin-dependent (type II diabetes or diabetes mellitus), and gestational (10).

The prevalence of this disease is growing worldwide, and it is predicted that the number of diabetics worldwide will increase from 20.8 million in 2000 to 42.3 million by 2030 (11). Furthermore, the prevalence of this disease is increasing rapidly in Asian countries (12). Type 2 diabetes is the most common type of diabetes and accounts for almost 90% of diabetic patients (10). A complex network of factors is involved in developing type 2 diabetes (13). Preventing the occurrence and management of type 2 diabetes requires training, lifestyle changes, and long-term healthcare management. A previous study shows that patients control and care for type 2 diabetes (14). The insufficient literacy of people with type 2 diabetes concerning diet and adequate physical activity is known as the most important predisposing factor for developing complications and mortality of people with type 2 diabetes because of patients themselves (15). The chronic nature of this disease imposes a heavy economic burden on the health system (16). According to the predictions made by the WHO's experts, the prevalence rate of type 2 diabetes in the world was equal to 9.3% in 2019 (17). The damage and losses caused by type 2 diabetes have been studied in numerous studies (18-19).

Increased health literacy may increase the general

health of people with type 2 diabetes and prevent its prevalence, and HbA1C reduces blood sugar levels. (20). HbA1c is a blood test used to diagnose type 2 diabetes. It is also used to monitor blood glucose control in people with diabetes. HbA1c is short for glycated hemoglobin. In Iran, 28%, 15%, and 57% of people have sufficient, borderline, and insufficient health literacy, respectively. The low level of health literacy appears to be more common in elders, immigrants, illiterate people, low-income individuals, people with low mental health, and those with chronic diseases such as type II diabetes (2). People with type 2 diabetes can prevent the disease's progression by enhancing their health literacy (21). Training programs can increase the knowledge, attitude, and performance of diabetic patients and reduce treatment costs (22). An increase in health literacy can increase the quality of life of diabetic patients and reduce their blood sugar levels (23).

Moreover, providing proper conditions for training patients and increasing their awareness can reduce the health system's costs. Self-care programs and convincing people with type 2 diabetes to follow the relevant self-care protocols would efficiently reduce treatment costs (16). In 2020, Gomes et al. considered training people with type 2 diabetes as the main component of increasing health literacy in these patients, as well as controlling the complications of the disease, and emphasized the effect of education in improving health literacy (9). Libraries and clinical librarians are exceptional resources for advancing research and practice in health literacy. They are nearly ubiquitous, generally perceived as trustworthy and helpful, and collectively experienced in general health and patient education (24).

The Diabetes Literacy and Numeracy Education Toolkit (DLNET) comprises 24 interactive modules covering standard diabetes care topics that can be customized to individual patient needs and used by all members of the multidisciplinary diabetes care team. Therefore, given the complications of type 2 diabetes in the world and Iran, the emphasis of numerous studies on the influence of training on the level of health literacy of people with type 2 diabetes (1, 9, 11). According to the researchers' findings, no studies have yet explored the impact of the DLNET

Toolkit on patients with type 2 diabetes in Iran. The present study aimed to evaluate the effect of training the DLNET Toolkit on the health literacy, self-care, and HbA1c of Patients with type 2 Diabetes.

Methods

The present research was a semi-experimental study with a group before and after the intervention.

People with type 2 diabetes in the Tafiha Medical

Center of Shiraz were included in the research population. Using the following equation, the sample size was estimated to be 232 people, similar to some studies in this field (16, 25-26). The study population consisted of 790 individuals diagnosed with diabetes, selected based on the sample size calculation formula of 210. However, due to a reduction in the sample size, the statistician recommended increasing the sample to 232 participants.

$$N = 2C \times \left[\frac{\sqrt{SD_1^2 + SD_2^2}}{m_1 - m_2} \right]^2$$

Where SD is the standard deviation, and M implies the mean. The value of C was considered 7.5 at a significance level of 0.05 and with a test power of 80. Regarding the number of people with type 2 diabetes referring to Tafiha Medical Center of Shiraz, 232 patients were selected due to the possibility of sample dropout.

The patients were selected using convenience sampling, adhering to specific inclusion and exclusion criteria. According to the ethics approval issued by the Iran University of Medical Sciences, patient data access was allowed in the Tafiha Medical Center of Shiraz. The researcher identified patients who visited the clinic for blood sugar testing according to the inclusion and exclusion criteria, and the study objectives were explained to the patients. The study included 232 patients who consented to participate in the training sessions and receive the required training from the researcher. The informed consent was obtained from all participants.

The inclusion criteria included: 1. 20-60-year-old patients referred to the clinic, 2. diagnosis of type II diabetes by endocrinologists, 3. diagnosis of type II diabetes at least one year before the research, 4. ability to understand the Persian language, 5. conscious willingness and consent to participate in the research, and 6. referring to the clinic and having a medical file with the treating physician.

The exclusion criteria included: 1. Suffering from physical disabilities (blindness, deafness, muteness,

spinal cord injury, stroke) and severe disease complications (nephropathy, retinopathy, and neuropathy), 2. having mental retardation or other psychological disorders such as mood disorders and anxiety before being diagnosed with diabetes (by reviewing the patient file), 3. unwillingness to participate in the study.

The present study applied the HELIA questionnaire to determine the patient's health literacy and applied a demographic questionnaire to determine age, gender, education level, economic status, marital status, the duration of developing the illness, as well as the evaluation and determination of health literacy and HbA1c before and after the training intervention. HELIA Health Literacy Questionnaire consists of five dimensions: accessibility rate (6 questions), reading skills (4 questions), comprehension (7 questions), assessment skills (4 questions), and decision-making and behavior (12 questions). The Cronbach's alpha for the HELIA questionnaire was calculated by Ansari et al. (27) to be 0.72 for these five factors, which is considered satisfactory.

Dimensions examined in the health literacy HELIA questionnaire:

- Accessibility rate score: 6-30
- Reading skills score: 4-20
- Comprehension skills score: 7-35
- Assessment skills score: 4-20
- Decision-making skills score: 12-60

Here are the levels of health literacy and their

corresponding ranges on a scale of 0-100:

- Insufficient: 0-50
- Not quite sufficient: 50/1-66
- Sufficient: 66/1- 84
- Excellent: 84/1-100

Moreover, the standard Summary of Diabetes Self-Care Activities (SDSCA) questionnaire was employed to evaluate the self-care and HbA1c before and after the intervention. This questionnaire has been used in numerous studies, and its validity and reliability have been confirmed accordingly (14-15). The questions in the questionnaire cover some items, including diet (5 questions), exercise (2 questions), blood sugar control (2 questions), foot care (5 questions), and regular use of medications (1 question). The questionnaire used investigated the demographic information as long as the five dimensions of self-care and the level of HbA1C in the patients' blood.

Cronbach's alpha for the SDSCA questionnaire was found to be 0.79 for these five factors, indicating a satisfactory level of reliability.

In addition, the questions were scored as either 0 or 1. A score of 1 was given for each self-care behavior the patient performed daily, while a score of 0 was assigned if the behavior was not performed every day. The highest total score in this questionnaire was 105, indicating the highest quality of self-care. The guidelines for classifying quartiles in the questionnaire were as follows:

- Scores below the first quartile (0-34): Poor self-care
- ; scores in the second and third quartiles (35-42): Moderate self-care;
- scores in the fourth quartile (higher than 42): Good self-care (16).

Patients' pre-intervention health literacy and self-care and HbA1c levels were measured using a pre-test. The training intervention was performed to enhance the health literacy level. The researcher attended the Tafihan Medical Center of Shiraz during the study for three months (from

November 21, 2020, to February 18, 2021). During this period, 24 face-to-face 30-45 min training sessions were held in small groups of 13-20 people on Sundays and Wednesdays. In these sessions, the researcher held an educational class for the patients, and the health literacy of the patients increased with the help of the DLNET training model and valuable educational resources in the field of type 2 diabetes. This tool is designed for people with low literacy about diabetes, and its content is customized based on individual needs. The educational contents of this tool were provided to patients in the form of face-to-face and remote (booklet) training (28).

Moreover, the researcher presented other available and valuable educational resources and treatment guidelines for type 2 diabetes, such as brochures and books to the patients. The intervention to enhance health literacy was performed for three months, and the researcher followed up with the patients for three months. One month after the end of the intervention, as a post-test, the HELIA questionnaire was used to evaluate and determine the level of health literacy, self-care, and HbA1c.

The data obtained from the questionnaires were analyzed in the SPSS software (Version 21) using the descriptive statistics method and the frequency distribution table before and after the intervention. The mean and standard deviation before and after the intervention were expressed. The normality of the data was determined using the Kolmogorov-Smirnov test. Due to the non-normality of the research data, Wilcoxon's non-parametric test was employed to examine the changes before and after the intervention.

Results

As presented in Table 1, most study participants were women aged 40-49. They were single and had an average literacy level. Additionally, they had been living with type 2 diabetes for 2-3 years, and their blood sugar levels were below 100.

Table 1. Background information of the study participants

Variable		Number (%)
Age	20-29	50 (21.6)
	30-39	80 (34.5)
	40-49	61 (26.3)
	50-60	41 (17.7)
Gender	Female	125 (39.1)
	Male	106 (33.1)
Marital status	Single	118 (50.9)
	Married	85 (36.6)
	Divorce	8 (19.8)
Education level	Illiterate	55 (23.7)
	Elementary	49 (21.1)
	High school	75 (32.3)
	Academic	53 (22.8)
Employment status	Unemployed	60 (25.9)
	Housewife	38 (16.4)
	Employees	43 (18.9)
	Retired	29 (12.5)
	Self-employed	62 (26.7)
Duration of suffering from diabetes	Less than one year	54 (23.3)
	1-1.9 years	54 (23.3)
	2-2.9 years	80 (34.5)
	3-4 years	20 (8.6)
	Higher than four years	16 (6.9)

Table 2. Level of health literacy in people with type 2 diabetes before and after the training intervention

Variable	Score range	Mean±SD before the intervention	Mean±SD after the intervention	Wilcoxon test results
Accessibility rate score	6-30	17.3±6.3	20.96±5.86	(P<0.001)
Reading skills score	4-20	11.5±4.3	13.93±4.1	(P<0.001)
Comprehension skills score	7-35	20.1±7.3	22.14±6.8	(P<0.001)
Assessment skills score	4-20	11.4±4.2	13.28±3.62	(P=0.01)
Decision-making skills score	12-60	32.3±13.4	35.04±10.3	(P<0.001)
Total score	33-165	57.51±20.15	65.89±16.57	(P<0.001)



According to Table 2, the overall health literacy score of the participants before the training was 57.51 ± 20.15 , and it reached 65.89 ± 16.57 after the training. A significant difference was found

between the health literacy scores before and after the intervention($P<0.001$). The scores also increased in all dimensions of health literacy after the training compared to before ($P<0.001$).

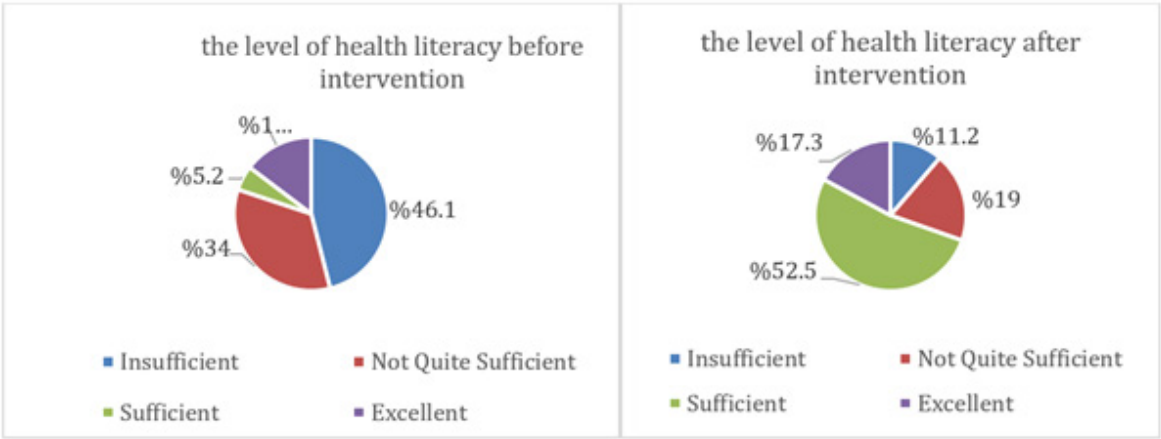


Figure 1. Frequency distribution of the participants' levels of health literacy before and after the training intervention

Figure 1 demonstrated that before the intervention, the highest frequency rate of the health literacy level was insufficient (46.1%), and the lowest one was

sufficient (5.2%). After the intervention, the lowest frequency rate was insufficient (11.2%), and the highest frequency rate was sufficient (52.5%).

Table 3. Comparison of differences in self-care variables before and after the training intervention

Variable	Score range	Mean±SD before the intervention	Mean±SD after the intervention	Wilcoxon test results
Adherence to a diet	6-30	23.17±5.4	30.45±3.05	(P<0.001)
Blood sugar test	4-20	7.5±2.4	11.18±1.8	(P<0.001)
Timely use of drugs	7-35	3.8±2.2	6.6±0.7	(P<0.001)
Performing physical activity	4-20	8.3±2.7	11.43±1.8	(P<0.001)
Foot care	12-60	23.17±5.4	25.17±5.9	(P=0.001)
Overall self-care	33-165	47.5±11.4	96.7±9.6	(P<0.001)

According to the results before the training intervention to promote health literacy, as shown in Table 3, the overall self-care score was equal to 47.5 ± 11.4 before the intervention; the score increased to 96.7 ± 9.6 after the intervention. As

a result, this study can conclude that patients' self-care is at an acceptable level. The findings from the current study show that the training has significantly enhanced self-care practices overall ($P<0.001$).

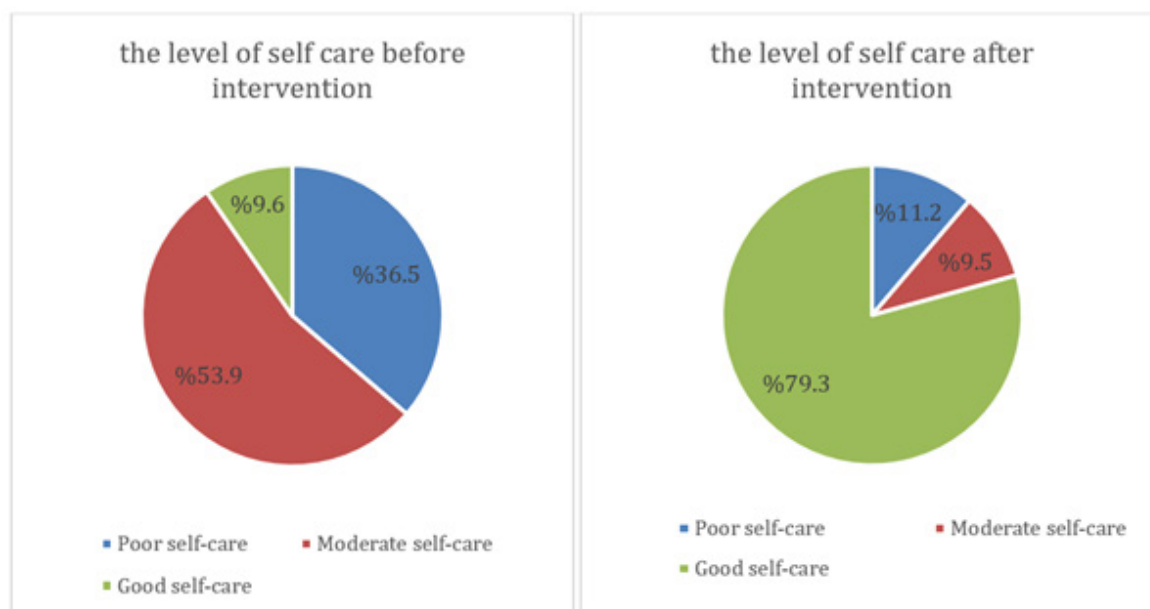


Figure 2. Frequency distribution of the participants' levels of self-care before the training intervention

According to Figure 2, the self-care level of 36.5% of participants before the intervention was found to be a Poor self-care level, and 9.6% were at a Good level. Before the intervention, the Moderate self-care level was higher than other levels (53.9%).

After the intervention, 79.3% of patients had a Good self-care level, and 11.2% had a Poor self-care level. Furthermore, the value of Good self-care level of self-care was higher than other levels (79.3%).

Table 4. Changes in the level of HbA1c before and after the health literacy training intervention

Level of HbA1c	Lowest	Highest	Mean $\pm$ SD	Wilcoxon test results
Before the intervention	4.30	11	8.49 $\pm$ 1.01	(P<0.001)
After the intervention	4.00	11	6.88 $\pm$ 1.42	

According to Table 4, after the health literacy educational intervention, the patients' HbA1c levels decreased to 6.88 $\pm$ 1.42.

Discussion

In the present study, patients' health literacy increased from insufficient to sufficient after the health literacy intervention. Moreover, patients' self-care improved from semi-optimal to optimal. Additionally, HbA1c levels decreased following the intervention. These findings demonstrate the impact of education on improving health literacy in people with type 2 diabetes. Previous research has shown that clinical librarians positively influence patient health literacy. Accordingly, the results of

this study align with those past findings (29-32). Vassilakaki and Moniarou-Papaconstaninou (33), in their study in 2023, found that clinical librarians can help improve the health knowledge of people with type 2 diabetes. Lotfi et al. (16) conducted a study in 2023, "Cost-Effectiveness of Health Literacy Enhancement Intervention on Patients with Type II Diabetes." According to their findings, improving health literacy can have many benefits, such as improving patients' quality of life with type 2 diabetes and reducing their treatment costs. Ansari et al. (27) conducted a study in 2020 to evaluate the level of health literacy of people with type 2 diabetes. According to their findings, the frequency rate at the insufficient level of health literacy was higher than

at other levels, which is consistent with the results of the present investigation before the health literacy intervention.

Ong-Artborirak et al. demonstrated a significant relationship between health literacy and increasing the knowledge and self-awareness of people with type 2 diabetes (34), which is in line with the results of the present study. Moreover, Vandebosch et al. evaluated the effect of training and health literacy promotion in diabetic patients. They indicated that training and health literacy promotion led to better management and control of diabetes and its complications (35). According to the results of the present study, patients' health literacy levels have increased from insufficient to sufficient levels, along with the increased mean value of health literacy skills, suggesting better control of the disease in these patients. Niknami et al. investigated the relationship between health literacy and self-management in people with type 2 diabetes. Their findings revealed that a 22.5% increase in health literacy could increase self-management behaviors in people with type 2 diabetes (36). Gomes et al. 2020 assessed the relationship between health literacy and glycemic control in people with type 2 diabetes. They indicated a significant relationship between health literacy and blood sugar control (9). The complications of the disease decreased as the level of health literacy increased, which is in line with the results of the present study. According to a review study performed by Caruso et al. (37), health literacy interventions have improved at least some aspects of health literacy and behavioral consequences, which is consistent with the results of the present investigation.

In a systematic review in 2019, Abdullah et al. demonstrated that one-third of people with type 2 diabetes have insufficient health literacy, and there is a direct relationship between the level of health literacy and the progression of type 2 diabetes over time (38). These findings are consistent with the results of the present study, in which the mean values of patients' health literacy skills increased with the increased level of health literacy. According to Gurtoo et al., health literacy interventions in people with type 2 diabetes can increase health literacy and

change patient's health behaviors (39). Khoshnoodi Fard et al. indicated that training for people with type 2 diabetes is recommended for controlling and reducing the complications of the disease (40).

Moreover, Nacanabo demonstrated that health literacy would improve the quality of life of people with type 2 diabetes (41). According to Ağralı and Akyar (42), Flood et al. (43), and Butayeva et al. (44), an increase in health literacy reduces the patient's blood sugar levels and increases the disease knowledge and control skills in people with type 2 diabetes. Furthermore, Zeidi et al. indicated that training people with type 2 diabetes increased the patients' level of health literacy (45), which aligns with the findings of the present investigation.

Conclusion

Based on the findings of the current research, education of patients with type 2 diabetes increases health literacy, increases self-care, and decreases in HbA1c patients with diabetes. As a result, those in charge of health should place the promotion of health literacy at the top of the treatment of patients with type 2 diabetes. Clinical librarians are crucial in enhancing the health literacy of these patients, and doing so can lead to better self-care and fewer complications. To address this, coordinating managers in this field and increasing the hiring of health literacy specialists, such as clinical librarians, is essential. Additionally, many people with type 2 diabetes lack sufficient knowledge about the condition. Given that improving their understanding will require ongoing efforts over several years.

The results revealed that training people with type 2 diabetes increases health literacy and self-care levels and decreases the HbA1c level among the patients. Therefore, it is suggested that the country's health and education systems plan for continuous training of people with type 2 diabetes. Establishing communication between people with type 2 diabetes, providing accountable training systems to prevent and provide a prognosis, and conducting research in this regard can also be considered in the mentioned planning. Future research can focus mainly on examining the effectiveness of evidence-

based interventions to improve health literacy in patients. Setting standards for measuring health literacy is essential for performing future research. Furthermore, systematic reviews seem necessary to better understand the effects of health literacy on people with type 2 diabetes.

Limitations

One limitation of the research was the patients' unwillingness to cooperate with the researcher, which was solved with the researcher's persuasion. The results are related to the people with type 2 diabetes in the Tafihan Medical Center of Shiraz, Iran. Moreover, generalizations with other patients must be performed cautiously and with sufficient knowledge.

Declaration

Acknowledgment

We appreciate the support of the Vice Chancellor for Research of Iran University of Medical Sciences, the management of Tafihan Medical Center of

Shiraz, Iran, and all those who contributed to this study.

Conflicts of Interests

The authors declared no conflict of interest.

Ethical Statement

This study was approved by the ethics committee of the Iran University of Medical Sciences (IR.IUMS.REC.1399.424).

Funding and support

This study was supported as a doctoral dissertation by grant No. (IR.IUMS.REC.1399.424) from the Research Deputy of the Iran University of Medical Sciences, Iran.

Authors' contributions

Lotfi M. collected the data. Sedghi Sh. analyzed the data. Panahi S. designed and drafted the manuscript. All authors contributed to the other study's processes and approved the submitted version.

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