

Effect of Web-based education on knowledge and preventive behaviors of Iron Deficiency Anemia among high school girls

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Abstract

Aim: Iron deficiency anemia is one of the largest public health problems in the world, especially in developing countries. Adolescent girls are among high-risk groups so that 25% of students suffer from iron deficiency anemia. The objective of this study was to evaluate the impact of web-based education on the knowledge and preventive behaviors on iron deficiency anemia among high school girls. Material and Method: The present study was an interventional study conducted on the 104 high school girl students, who randomly placed in two control and experimental groups (52 people in each group) in 2016. The experimental group received a Web-based education. Data were collected through a questionnaire and conducting Hemoglobin (Hb) and Serum Ferritin(SF) experiments before and 4 months after the intervention. The results were analyzed using the statistical Chi-square, paired t-test independent t-test through SPSS-19. Results: Before the educational intervention, the mean score of knowledge and preventive behaviors of iron deficiency anemia in both groups was not significantly different (P>0.05). However, a significant increase was observed in the experimental group compared to the control group after education (P<0.001). The rate of ferritin and hemoglobin in the experimental group increased compared to before the study (P<0.001), while the significant increase was not seen in the control group (P>0.05). Discussion: The results of this study showed that Web-based education program improves awareness and preventive behaviors of iron deficiency anemia if girl adolescents. In addition, it had a positive impact on improving the rate of Hb and serum ferritin in them.

Keywords

Educational Intervention; Girls; Iron Deficiency Anemia; Iran.

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Introduction

Iron Deficiency Anemia (IDA) is one of the most important and widespread public health issues in the world that has a negative impact on the health of many children and women in developing countries [1]. Iron deficiency plays a major role in the occurrence of anemia so that iron deficiency accounts for approximately 75% of anemia [2]. Studies in Iran show that the prevalence of iron deficiency in different regions of the country is between 2.4% to 36.5% [3]. The World Health Organization (WHO) defined iron deficiency as a nutritional disorder that affects about 80% of people in the world [4]. Also, according to the WHO, 25% of students in developing countries are suffering from iron deficiency anemia [5]. In Iran, several studies have reported that the prevalence of anemia among female high school is between 30-55% [6]. Iron deficiency anemia is associated with complications such as increased risk of maternal mortality, preterm delivery, low birth weight [7-8]. In addition, it disrupts the attention of teenage girls and decreases educational opportunity, work efficiency, and physical strength as well as increases the risk of infection [9]. Since the main cause of iron deficiency anemia in developing countries is getting low iron from food sources, and the low content and bioavailability of iron [10], nutritional education is one of the most important measures for prevention of IDA [11]. Therefore, the promotion of nutritional knowledge in the community through education in reducing malnutrition and improvement and reduced complications are considered a necessity for the developing world and our country [12]. The aim of this study was to evaluate the effectiveness of web-based training in iron deficiency anemia among female high school.

Materials and methods

This study used an interventional design which was carried out on 104 female high school students aged 16-17 years old in two experimental (n=52) and control groups (n=52) in 2016 in Andimeshk. The sample size was determined with a 95% confidence level and power of 80%. This study used a multistage random sampling method. For this purpose, a list of high schools in Andimeshk was firstly prepared, and two high schools were chosen randomly. 52 students from the first school and 52 students from the second school were enrolled as test and control groups, respectively. Inclusion criteria were: onset of menstruation, lack of hereditary anemia, lack of acute infection during the sampling, providing an address and phone number for the follow-up call, access, and ability to use the Internet. Exclusion criteria were: unwillingness to participate in the study. Data collection was carried out via Hemoglobin (Hb) and Serum Ferritin (SF) tests and completing the questionnaire, which took place before and 4 months after the intervention. A 2 cc of blood in the brachial artery in the non-fasting state was taken from each of the subjects by laboratory expert. A 1 cc of the blood was transferred to a CBC tube (Cell Blood Count) containing anticoagulant solution with EDTA (Ethylene Diamine Tetra Acetic Acid) and 1 cc of blood also was transferred to the tubes for evaluating serum ferritin. Blood samples were sent to the laboratory immediately. Hemoglobin tests were carried out using Cyanmethemoglobin method by cell counter KX-21N Sysmex (Japan) using Pars Azmoon kit (Iran). Serum ferritin was measured by ELISA method (Mindray, MR96A, South Korea) and using Padtan Elm Company (Iran). According to the WHO, anemia is defined as levels of Hb<12 g /dL and iron deficiency is defined as a level of SF<12 µg/L and those with both anemia and iron deficiency were defined as iron deficiency anemia. The questionnaire was composed of two sections. The first section is included demographic questions and the second section included knowledge questions (24 items) which were scored with options (Yes=1), (No and I Do not know=0) in a range of (0-24; preventive behaviors (12 items) were scored for 4 Likert scale (always=3, often=2, sometimes=1, never=0). The scores ranged from 0-36. The validity was confirmed by obtaining the opinions of experts and specialists and re-test was used to determine the reliability (Cronbach's alpha=0.74). For implementing an educational intervention, a website was set up for this study. During a briefing session, how to use the website and educational contents were trained for the experimental group, and an exclusive username and password were given to them. Username and password were found invalid for students after 4 weeks, and the course was ended. Students contacted the researcher via email and asked their questions during this period. The educational program was included the definition and importance of iron deficiency anemia, symptoms, risk factors, diagnosis, complications, prevention, food sources of iron and the role of nutrition in prevention and treatment. 4 months after the intervention in both experimental and control groups, questionnaires and blood tests were performed again. Data were collected and analyzed using statistical tests of Chi-Square, Paired T-test, Independent T-test software SPSS19.

Results

In this study, 104 female high school students aged 16-17 years old were included in two experimental (n=52) and control groups (n=52). The results of this study showed that there was no statistically significant difference between the two groups in terms of job and education (Table 1). The results also that the

Table 1. Characteristics demographic of the Intervention and Control Groups

Variables		Intervention group n (%)	Control group n (%)	P value
Father's education	Lower than diploma	16(30.8)	17(32.7)	0.162
	Diploma and Upper than diploma	36(69.2)	35(67.3)	
Mather's education	Lower than diploma	13(25)	22(42.3)	0.064
	Diploma and Upper than diploma	39(75)	30(57.7)	
Father's job	Employed	50(96)	49(94.2)	0.675
	Not employed	2(4)	3(5.8)	
Mather's job	Employed	2(4)	0(0)	0.361
	Not employed	50(96)	52(100)	

two groups had no significant difference in the mean scores of knowledge before intervention (p>0.05). However, the scores of the experimental group were increased compared with the control group 4 months after the intervention (p>0.05). After the intervention, the experimental group had a significant increase in the mean score of knowledge than before the intervention, while no significant difference was observed in the control

group before and after training (p<0.05). The findings revealed that after the training, the average score in preventive behaviors of iron deficiency anemia had a statistically significant increase in the experimental group compared with the group before training and also compared to the control group after the intervention (p<0.001) (Table 2). Before and after the training,

Table 2. Comparison of the mean scores of knowledge and preventive behaviors before and after the intervention between two groups

Variables	Research time	Experimental group Mean (SD)	Control group Mean (SD)	p-value*
Knowledge	Before Intervention	12.04±2.25	12.86±2.87	0.088
	After Intervention	18.66±3.09	13.42±2.21	0.043
	p-value**	0.000	0.112	
Preventive behaviors	Before Intervention	12.06±3.76	11.17±3.06	0.060
	After Intervention	24.38±2.73	10.80±3.06	<0.001
	p-value**	0.000	0.335	

* Independent T-test ** Paired T-test

comparing the mean serum ferritin in the experimental group showed that the mean ferritin level was obtained 44.88 in the experimental group and 45.42 in the control group before the intervention, respectively. Independent t-test showed no significant difference between the two groups before the intervention (p=0.911). The results indicated that after the intervention, the mean serum ferritin for the experimental group and the control group was obtained 57.80 and 47.23, respectively. After the intervention, the independent t-test showed a significant difference between the two groups (p=0.045). Before the educational intervention, the mean hemoglobin was not significantly different between the two groups (p=0.986), but the average level of hemoglobin in the experimental group was significantly higher than the control group after training (p=0.024). Furthermore, no significant difference was observed in the mean in the control group before and after the intervention (p=0.178), while the mean was found to be significantly increased in the experimental group after the intervention (p<0.001) (Table 3).

Table 3. Comparison of mean score of Hemoglobin and Serum Ferritin between groups before and after the intervention

Variables	Research time	Experimental group Mean (SD)	Control group Mean (SD)	p-value*
Hemoglobin	Before Intervention	12.66±0.97	12.67±0.86	0.986
	After Intervention	13.02±0.82	12.64±0.86	0.024
	p-value**	0.0001	0.178	
Serum Ferritin	Before Intervention	44.88±15.45	45.42±13.65	0.911
	After Intervention	57.80±13.25	47.23±19.54	0.045
	p-value**	0.0001	0.508	

* Independent T-test ** Paired T-test

Discussion

Today Iron deficiency anemia is one of the most common public health problems in developed and developing countries [13]. Teenage girls are identified as a group at risk of iron deficiency and the prevalence of the disease in the group will increase after puberty due to the onset of menstruation [14]. On the other hand, the lack of prevention and control of iron deficiency can have an adverse effect on the health of girls and women, followed by serious economic and social damages [15]. So, training and improving knowledge of the target group as one of the strategies recommended in order to deal and prevent iron deficiency, are of particular significance in this respect. Therefore, this study was designed to determine the effect of the educational intervention based on knowledge and preventive behavior of iron-deficiency anemia among female high school in Andimeshk city.

Several studies have shown that increasing the level of knowledge is one of the first steps to move towards behavior change; therefore, having sufficient knowledge about nutrition can be the basic foundation for healthy eating behaviors [16-17]. In contrast, the low awareness level is a risk factor of malnutrition and anemia [18]. In general, every effort which will be made to establish a health behavior requires having sufficient knowledge as the first key element [19]. Based on the results obtained, the mean score of knowledge has increased significantly after the intervention compared with the control group, which is a positive effect of educational program on improving the knowledge and behavior of students in the experimental group. The findings of the study were consistent with the results of the study by Mehrabian et al., regarding the raising awareness of female high school students and reported successful training in promoting awareness about iron deficiency [1]. The findings of the study by Fathizadeh et al. are also consistent with the results of this study, demonstrating the effectiveness of education in raising awareness of female students [2]. Also, the findings of the study by Fallahi [11] are in agreement with our findings indicating the effectiveness of educational interventions in increasing the knowledge regarding the iron deficiency anemia. Additionally, in the study by Ivan Bagha et al. among female students in the secondary school in Khalkhal, it was suggested that educational interventions did not significantly increase the level of awareness [13], which could be due to different target groups in the study. Kanal et al., have also shown in their study that the educational program improves and increases awareness of female students concerning the causes, consequences, and ways to prevent anemia, which is in line with the results of our study [20].The findings of our study have shown that web-based training led to increased levels of preventive behaviors of iron deficiency anemia among female high school and the performance of the experimental group was improved compared to the control group after the intervention and significant difference was observed between the mean performance score in two groups. Fathizadeh observations [2] demonstrated that the behavior of girls in the experimental group regarding the prevention of iron deficiency anemia has improved and there was a significant difference between their behavior before and after the intervention. The results of the study by Mehrabian [1] also revealed that using of training programs improved eating behaviors among female high school with regard to the iron deficiency anemia. Moreover, the study by Sadeghifar [14] and Shakoori [21] has confirmed that an educational program could improve and promote preventive behavior of iron-deficiency anemia. Bandura contends that behavior is the strongest source of information adequacy because it is directly inferred by subtle experiences. By implementing these practices, people will develop and refine the skills that are important in the continued

fulfillment of behavior [22]. The studies conducted by Hosseini [23], Fallahi [11] and Rao [24] confirmed the above findings and verified the effectiveness of educational interventions on modifying nutritional behavior. The results of this study indicate the positive impact of education on improving blood iron indicators. Four months after the intervention, a significant increase was observed in ferritin and hemoglobin levels in the experimental group, but no significant change was found in the control group. The results of the study by Mehrabian et al., also showed increased ferritin levels among female high school [1]. In a study conducted by Halimatou Alaofe and colleagues on teenage girls in Benin, the results showed that after the implementation of the educational program, hemoglobin and serum ferritin levels in the intervention group were increased significantly [25]. The results of the study by Hafzan et al., on Malaysian adolescents showed that a significant improvement has been observed in hemoglobin and ferritin levels in teens 3 months after the training which confirms our findings [26]. Similar results can be observed in the studies by Fallahi [11] and Duncan [27] showing that training and change in eating habits can be the perfect solution for the promoting blood indices and reducing iron deficiency anemia. A follow-up study 4 months after the intervention was the strength of this study. The limitations of the present study were that no similar study has the in Khuzestan and Andimeshk cities in this respect. Another limitation of the study was completion of self-report questionnaires by students. Overall this study has shown that the implementing of educational program has promoted the level of awareness and prevention of iron deficiency and also improved blood indices in the studied girls. Girls are the future mothers of our society, and nutritional education has a direct and positive impact on their health. Students are supposed to learn best and in comparison, with other activities in the field of health, educational activities are less expensive. With regard to the consequences of iron deficiency especially in girls, providing persistent training and using modern techniques such as web-based approach can have an important role in the prevention and disease.

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Competing interests

Authors have declared that no competing interests exist.

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