



Investigating the nutritional status of iron deficiency in youth girl students

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Background: Iron deficiency is a nutritional problem, especially in adolescent girls. Therefore, the present study aims to investigate the nutritional status of iron deficiency prevention in this population group; So that the results are used to reduce this nutritional problem. **Materials and Methods:** This is a descriptive cross-sectional study that was conducted on 700 peoples of high school girl students in Iran. Data was collected using a standard food frequency questionnaire (FFQ) and its validity and reliability were already measured. 292 peoples among whom the students who completed the FFQ questionnaire randomly were selected to have CBC and ferritin serum test. Nutritionist IV software (N4) and SPSS 18 software, at 95% confidence level are used for data analysis. **Results:** The results of the study showed that the mean age of students was 14.34 ± 14.9 years and most of their fathers had diploma education; as with mothers, most of them had a high school diploma. Most of the fathers were employees and most of mothers were housewives. Most of the students were the second child of the family, and 65.3% of students lacked a family history of iron deficiency. The results of the study also showed that 43.6% of Students who filled the FFQ questionnaire were with nutritional iron deficiency and 43.5% of all students undergoing blood tests suffered from iron deficiency. **Conclusion:** The findings of the present study indicate the inadequate iron intake status and high frequency of iron deficiency in the study population. Therefore, paying more attention to nutritional patterns and improving healthy lifestyle are advised to change their nutritional status.

INTRODUCTION

Iron deficiency is considered to be one of the biggest health problems and one of the most common nutritional issues in the world (1-3); according to the World Health Organization, of every 10 people with anemia, 9 people live in developing countries where iron deficiency is the most common cause and, is responsible for nearly 50% of the world's most common anemia and the most common type of blood-related illness (4-6). In these countries, the prevalence of anemia in children and youth is reported to be 2 / 29% to 79.6% (3), which indicates the magnitude of the problem in this demographic group, indicating inadequate iron intake, general malnutrition or low levels of dietary iron (7). Iron deficiency is followed by many complications, including reduced physical activity and physical growth, decreased learning ability, decreased immune status, weakness, general fatigue, heart rhythm, etc. This is a nutritional problem in the juvenile age group

that are ate the stage of growth (8 and 9). Of course, iron deficiency and anemia in youth girls have been reported more than those in boys (10). According to a study in one of the Iranian cities, the prevalence of anemia and iron deficiency in youth girls was reported to be respectively 13.5% and 34.7% (11) the cause of which, in addition to rapid physical growth and inadequate iron absorption intake is due to loss of blood in menstrual periods (12).

In general, the World Health Organization considers iron deficiency and anemia as a nutritional disorder (2) for which, given the importance of the problem of iron deficiency in youth girls, the role of nutrition and nutritional behavior in preventing it, and the existence of health promotion programs are a good practice to study and improve the nutritional behavior of these girls, who are the future mothers of the country. Therefore, the present study aims to investigate the nutritional status of iron deficiency prevention in youth girls; so that the results can be presented for an interventional plan for preventing iron deficiency in this population group should be used.

MATERIALS AND METHODS

This is a descriptive cross-sectional study that was conducted on high school girl students in Hamadan from September to November 2016.

Sample size with regard to prevalence of 73% of poor nutritional status associated with iron deficiency in youth girls (13) and taking into account the study of Delvarianzadeh et al. (14) and an acceptable error of 45.3% and confidence level of 95% and adding 10% drop in the

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Table 1 Frequency distribution of iron deficiency among first-grade high school girls of Hamadan province divided educational establishments and grade of iron deficiency

Frequency of iron deficiency		Mild iron deficiency		Moderate iron deficiency		Sever iron deficiency		Frequency of healthy people		Total number of people with iron deficiency		Total healthy and afflicted people	
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Educational establishments	7 th grade of education	22	7.5	6	2	1	0.3	58	19.9	29	9.9	87	29.8
	8 th grade of education	42	14.4	14	4.8	11	3.7	39	13.3	67	23	106	36.3
	9 th grade of education	28	9.6	3	1	0	0	68	23.3	31	10.6	99	33.9
Total		92	31.5	23	7.8	12	4.1	165	56.5	127	43.5	292	100

sample was equal to 700 (208 in the seventh grade, 255 in the eighth grade, and 237 in the ninth) to determine the nutritional status associated with iron deficiency. In order to select the samples, a list of first-grade high school girls was prepared in Hamadan high schools, and then the schools were divided into two groups according to their location in the city or the suburbs and were numbered on the paper. Among the numbers randomly, four schools were selected in the city and the same number in the suburbs. Then, from each school, a class was selected randomly from each grade (7th, 8th and 9th grade), and from students in each class, proportional to the sample size, the required numbers were selected in a simple random manner (In the city: 140 from the seventh grade, 174 from the eighth grade, 160 from the ninth grade; in the suburbs: 68 from the seventh grade, 81 from the eighth grade and 77 from the ninth grade). Class students and their parents signed informed written consent and data was collected using a standard FFQ that was localized to Iran country and its validity and reliability were already measured (15) that using Spearman correlation coefficient, value of relative validity was 0.42 & using Intra class correlation coefficient, value of reliability was 0.59; then, to find out the numerical amount of iron intake through food, the data were entered into Nutritionist IV (N4) software, and the amount of iron intake by SPSS 18 software, at 95% confidence level was analyzed. Comparing the mean of received amounts with DRI determined that the iron micronutrient content was less than 75% of the recommended dose (DRI) was considered as a "nutritional deficiency" and greater or equal to 75% of the recommended dose (DRI) was considered as "nutritional iron adequacy"(16).

In order to determine the prevalence of iron deficiency in high school female students, using the study Mozaffari et al. (11) who reported an iron deficiency prevalence among 34 percent of girls in school girls, with an acceptable error of 5.8 percent and 95% confidence level and adding the 10% drop in the sample, 292 (87 in the seventh grade, 106 in the eighth grade and 99 in the 9th grade) were determined among whom the students who completed the FFQ questionnaire randomly were selected to have CBC and ferritin serum test (13) and then the researcher, having received informed consent from the selected students and their parents, referred the students to the laboratory to have specific tests.

Of the eligible subjects, the test was taken from 9 to 11 am. The results of the laboratory tests were also analyzed at 95% confidence level using SPSS18 software. In this study, mild iron deficiency was serum ferritin less than mg / dL 25 (18) and normal values of hemoglobin, hematocrit, MCV and MCH; the mean iron deficiency was serum ferritin less than 25 mg / dL, MCV smaller than and equal to fL80 and MCH smaller than and equal to 27 g / dL and normal hemoglobin and hematocrit; severe iron deficiency was serum ferritin less than 25

mg / dL, MCV smaller than and equal to fL80 and MCH smaller than and equal to 27 g / dL, hemoglobin less than g / dL12 and hematocrit less than 35% (18). After identifying the results of the lab and analyzing them, the researcher informed the students' parents of the problem of the persistence of severe iron deficiency in order to protect the human dignity, and in the case of moderate and mild iron deficiency, in addition to informing parents and students, they were given information on foods preventing from iron deficiency.

The inclusion criteria for completing the questionnaire were: 1. First-grade female student. 2. No illness and unpleasant events that prevent from participating in the study. 3. No major and intermediate thalassemia (13), heart disease, kidney disease, and any disease that requires its own diet. 4. Not having a history of severe bleeding (requiring blood transfusion) or surgery (other than outpatient surgery) in the last three months (17). The criteria for leaving the study were not to complete the FFQ questionnaire.

The criteria to enter the study for conducting the blood test were as follows: 1. All the cases in the criteria to enter the study to complete the questionnaire. 2. Non-donating blood in the last three months (19). 3. Non-infectious diseases, inflammatory diseases and acute colds. 4. Completion of at least one week from the participant's period date (20). Exclusion criteria for screening blood were to be treated with iron or other vitamin-mineral supplements at the time of the test (20).

FINDINGS

The results of the study showed that the mean age of students was 14.34 ± 14.9 years and most of their fathers had diploma education (36.1%), and only 20% of fathers had university education; as with mothers, most of them (33.4% %) had a high school diploma and 32.9% had university education. Most of the fathers (39.6%) were employees and 64.4% of mothers were housewives. Most of the students (36.9%) were the second child of the family, and 49.1% of the students' families had income ranging from one to two million tomans per month and 65.3% of students lacked a family history of iron deficiency.

The results of the study also showed that 43.5% of all students undergoing blood tests suffered from iron deficiency, with the highest levels of iron deficiency found in the eighth grade (23%). (Table 1)

According to the results of this study, the prevalence of nutritional iron deficiency among educational establishments was statistically significant ($P_{\text{value}} < 0.05$); this means that the highest frequency of nutritional iron deficiency was observed in the 8th grade of education (23.6%), and there was a statistically significant difference in nutritional iron deficiency frequency among school locations in the city or suburbs ($P_{\text{value}} < 0.05$), which was higher in urban schools than suburban schools (29.7% in urban schools) Vs. 13.9% in suburban schools). The overall

Table 2 Frequency distribution of nutritional iron deficiency among first-grade high school girls of Hamadan province divided educational establishments and school locations

School locations		city				suburbs				Total number of people with nutritional iron deficiency	Total number of healthy people	Total healthy and afflicted people	Test result (Differences in the frequency of nutritional iron deficiency Between educational establishments): $\chi^2 = 82.943$, $P_{value} < 0.001$			
frequency		Frequency of people with nutritional iron deficiency		Frequency of healthy people		Frequency of people with nutritional iron deficiency		Frequency of healthy people								
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Num ber		Per cent		
Educational establishments	7 th grade of education	58	8.3	82	11.7	24	3.4	44	6.3	82	11.7	126		18	208	29.7
	8 th grade of education	111	15.9	63	8.9	54	7.7	27	3.9	165	23.6	90		12.8	255	36.4
	9 th grade of education	39	5.5	121	17.3	19	2.8	58	8.3	58	8.3	179		25.6	237	33.9
Total		208	29.7	266	37.9	97	13.9	129	18.5	305	43.6	395	56.4	700	100	
Test result (Differences in the frequency of nutritional iron deficiency Between School Locations): $\chi^2 = 2.810, P_{value} = 0.048$																

Table 3 Frequency distribution of iron deficiency among first-grade high school girls of Hamadan province divided educational establishments and school locations

School locations		city				suburbs				Total number of people with iron deficiency		Total number of healthy people		Total healthy and afflicted people		Test result (Differences in the frequency of iron deficiency Between educational establishments): $\chi^2 = 26.393$, $P_{value} < 0.001$
frequency		Frequency of people with iron deficiency		Frequency of healthy people		Frequency of people with iron deficiency		Frequency of healthy people								
		Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent			
Educational establishments	7 th grade of education	14	4.8	44	15.1	15	5.1	14	4.8	29	9.9	58	19.9	87	29.8	
	8 th grade of education	48	16.5	24	8.3	19	6.5	15	5.1	67	23	39	13.4	106	36.4	
	9 th grade of education	22	7.5	44	15.1	9	3.1	24	8.1	31	10.6	68	23.2	99	33.8	
Total		84	28.8	112	38.5	43	14.7	53	18	127	43.5	165	56.5	292	100	
Test result (Differences in the frequency of iron deficiency Between School Locations): $\chi^2 = 3.098, P_{value} = 0.047$																

result was that the highest prevalence of nutritional iron deficiency was related to the eighth grade in schools within the city (13.6%). (Table 2)

Other results of the study showed that the prevalence of iron deficiency among educational establishments was statistically significant ($P_{value} < 0.05$) and the highest frequency of iron deficiency was found in the eighth grade of education level (23%). Also, the prevalence of iron deficiency among different places of school placement showed a statistically significant difference in the city or suburbs ($P_{value} < 0.05$), and the prevalence of iron deficiency in urban schools was higher than in the suburban schools (28.8% in urban schools versus 14.7% in suburban schools). (Table 3)

DISCUSSION

In this study, 43.5% of students were suffering from different degrees of iron deficiency, the severe type of which, called anemia, was observed

in 4.1% of students and mostly in the eighth grade (3.7%) which, compared with the study conducted in Turkey (21) and Indonesia (22), is statistically significant but consistent with other studies in Iran (13 and 23) that can reflect the impact of environmental, cultural and nutritional factors on the incidence of iron deficiency (11).

The study of nutritional iron deficiency status showed that a significant proportion of youth students with nutritional iron deficiency suffered from nutritional iron deficiency significantly more in urban schools than in suburban schools, which could be due to the prolonged sales of fast foods and all types of snacks in the city, and the fact that more students in the city, have access to such shops, which, given the increased availability of pocket money to suburban students before entering school, they take snacks to school and cause their reluctance to eat home-made foods. After the school closes, they lose the main meal at home that can contain iron. The prevalence of iron deficiency was

significantly higher in the eighth grade than the other levels in the study. Considering the higher prevalence of iron deficiency in the students of this educational background and the results of linear regression analysis ($P_{\text{value}} < 0.05$), nutritional iron can be considered as a powerful predictor of iron deficiency in youth girls. The high prevalence of nutrient iron deficiency in this study is consistent with other studies in Iran (14, 24-26), but it is statistically significant for studies conducted in Hawaii (27) and Minnesota (28), which has a role in the culture of nutrition and dietary patterns in the nutritional iron status.

CONCLUSION

The findings of the present study indicate the inadequate iron intake status and high frequency of iron deficiency in the study population, which confirms the role of nutrition in the occurrence of iron deficiency. Therefore, paying more attention to nutritional patterns, improving healthy lifestyle and raising awareness and improving nutritional performance among youth girls of this country who are the future mothers of the country are advised by appropriate education with their age that is attractive enough to change their nutritional status.

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Article Keywords

Iron deficiency, adolescent girl

Abbreviations

[FFQ: Food Frequency Questionnaire, DRI: Dietary Reference Intake, CBC: Cell Blood Count, MCV: Mean Corpuscular Volume, MCH: Mean Corpuscular Hemoglobin]

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Authors Contribution

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