

# A Survey of Iron Supplementation Consumption and its Related Factors in High School Students in Southeast Iran, 2015

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## Abstract

**Background:** This study aimed to estimate the prevalence of iron supplement consumption and its associated factors among high school students in Iran.

**Methods:** A mixed-methods (quantitative-qualitative) study was conducted in Zahedan, southeast Iran, in 2015. The sample comprised 400 high school students from different areas of Zahedan who were randomly selected. A standard questionnaire and semi-structured interview were used to collect data in the quantitative and qualitative phases, respectively. The data were analysed using SPSS software with one-way ANOVA and Pearson's chi square. Additionally, content analysis was used for the qualitative analysis.

**Results:** In total, 38.2% of the students had not consumed iron supplements in the past 16 weeks, and students in third grade had the highest non-consumption rate ( $P=0.006$ ). There was a significant positive relationship between iron tablet consumption and grade point average in the last year ( $P = 0.003$ ). Digestive problems, influence of family and friends, students' reluctance, and poor environmental situations were the most important factors related to students' refusal to take tablets.

**Conclusions:** Most students did not take or irregularly consumed iron supplements. Based on the digestive problems of the students, improving the taste and quality of iron tablets is recommended.

**Keywords:** iron-deficiency, anaemia, students, female, Iran

## Introduction

The World Health Organization (WHO) defines anaemia as levels of haemoglobin under 12 gr/dl in women and under 13 gr/dl in men (1). Iron deficiency anaemia is a major public health issue (2) that affects two billion people worldwide (3). Approximately 25% of the population is anaemic, and 50% of all anaemia cases are due to iron deficiency (4).

A sufficient amount of iron is critically important for the normal function of the vital

organs of the human body. Iron deficiency leads to growth delays, fatigue, cognitive disorders, poor concentration, asthenia, attenuation of the immune system and subsequently mortality (4).

WHO surveys from 1993 to 2005 show that 25% of 5- to 15-year-old children, 41.8% of pregnant women and 15.3% of women aged 15 to 60 were anaemic (5). Moreover, WHO reports demonstrate that the highest prevalence of iron deficiency anaemia was among 15- to 45-year-old women compared to the other age groups in society (6). Studies on iron deficiency anaemia in women of childbearing age in Nepal, Norway and

Lebanon have shown prevalences of 6%, 3% and 13.5%, respectively (7).

Girls during menstruation, pregnant women and the elderly constitute high-risk groups for iron deficiency anaemia. Iron supplementation is a preventive strategy that has been used with female students in high schools in some countries including Iran (4).

Jalambadani et al. (8) in a study in 2015 on the effects of providing planned behaviour theory-based education on iron tablet consumption in Iran showed that the education positively influenced the consumption of iron tablets. However, a study on the investigation of iron tablet consumption in Iran showed that this programme was not satisfactory (9).

As anaemia is important for women as future mothers, and as iron supplementation programmes are costly, this study aimed to determine the rate of consumption of iron supplement tablets and its related factors in female high school students in Zahedan. The results of the study could provide information to health practitioners and health policymakers for the development of or modifications to iron supplementation programmes.

## Materials and Methods

A quantitative-qualitative study was conducted in 2015 in Zahedan, which is the capital of Sistan and Balochestan, the vastest province in Iran, and a region of poverty in Iran. The iron supplementation programme is operated by the Ministry of Education in Iran; in this programme, an iron tablet is provided for free to female students in high schools each week for a 16-week period, and they are instructed to take the tablet at school. Each tablet contains 60 mg of iron sulphate. This amount of iron supplementation improves girls' iron stores (8).

### Participants

All female students in Zahedan high schools constituted the study population. Approximately 400 students were selected through a two-stage cluster sampling method. First, the researcher clustered Zahedan into five regions, including the North East, North West, South East, South West and the Centre. In each region, two high schools were selected randomly, and four clusters of 10 students were then selected randomly from each high school (40 students in four grades in each school). After selecting the schools and coordinating between the school managers

and the Zahedan School of Public Health, the researchers visited the schools for data collection. Additionally, in the qualitative phase of the study, 31 students were selected using purposive sampling with maximum variation. According to purposive sampling principles, which is the most commonly used sampling method in qualitative research, the researchers selected students who were able to respond to the research questions based on their goals (10).

### Instrumentations

In the quantitative phase of the study, a standard questionnaire was used to collect data (4). The questionnaires were completed by students under the supervision of a researcher. The questionnaire included demographic questions, parents' occupation and level of education, students' Grade Point Average (GPA) in the previous year, number of siblings, and rank of birth. Complete iron tablet consumption was defined as students taking all tablets that they had received in all distributions for 16 weeks or four months; otherwise, the consumption was considered incomplete. Finally, students who had not consumed more than one tablet (no consumption condition) were included in the qualitative stage of the study.

In the qualitative phase, we used a semi-structured questionnaire with three questions. The questions concerned the extent of students' tablet consumption, reasons for non-consumption and factors affecting their iron consumption. In this section, we interviewed students who had consumed the least amount of iron tablets. They were interviewed about their reasons for not taking iron tablets, and the students' responses were recorded by an audio recorder. The students were given an informed consent form. The interviews continued until we had achieved data saturation (31 students). Interviews were semi-structured and were conducted by setting an appointment and letting the participants select the location in the schools. Interviews generally lasted between 20 and 40 minutes depending on the conditions and the willingness of the participants.

Interview data were reviewed several times to obtain an overall impression of their content. Content analysis with coding was then performed, obtaining 483 initial codes that were merged and classified according to their similarities. This process continued throughout the study.

Data integrity was maximised through a continuous iterative analysis of the gathered information by multiple team members and external peer reviewers. To achieve data trustworthiness and rigor and ensure the credibility of the continuous data analysis (transcribing interviews on paper and reviewing the transcripts to develop main themes), peer checks and member checks were performed. Moreover, for confirmability, rich and substantive descriptions of the findings were provided.

### Data analysis

In the quantitative phase, descriptive statistics, Pearson's chi-square and one-way ANOVA were used to determine the associations of main variables and demographic variables. SPSS, version 21, was used to analyse the data, and the level of significance was considered to be 0.05.

In the qualitative component, content analysis was used to process the data throughout the study. Qualitative content analysis is a specialised method used to process qualitative data to determine the presence of certain words and concepts. After becoming familiar with the scope and diversity of content, the researchers identified key concepts and issues and adjusted the thematic framework accordingly. Then, data from the individual and group interviews were reviewed and annotated based on the obtained thematic framework, and these data were arranged according to their corresponding theme. Finally, by comparing the relationships, concepts, contradictions and ideas, desired themes were extracted from the findings manually by two researchers, who had no conflicts of interest with the students or relevant institutions.

## Results

This study was conducted with 400 female high school students. Students' mothers were housewives in 66% of the study sample, 53% of the students' fathers had received a diploma for upper education, and most of the fathers were employed (88.5%). Moreover, the grade point average in the previous year of most students was upper 16 out of a possible 20 (75.2%), and most of them were the first child in their families (38.2%). The one-way ANOVA indicated a positive significant relationship between iron supplement consumption and GPA in the

previous year ( $P = 0.003$ ,  $F = 1.078$ ). This means that students who had a higher GPA consumed iron supplements more than students who had a lower GPA. Further analyses were conducted using Tukey's test. The results of Tukey's test showed that students who had a GPA from 10 to < 16 had lower tablet consumption than those with a GPA 16 to < 18 and above 18 ( $P = 0.003$  and  $0.029$ , respectively). Moreover, there were no differences in the consumption of tablets between students with a GPA of 16 to < 18 and those with a GPA above 18 ( $P = 0.671$ ). In addition, chi-square test showed that the students' school grade was associated with iron tablet consumption ( $P = 0.006$ ); namely, 40 percent of the students in third grade did not consume any iron tablets. Details of other demographic variables are shown in Table 1.

According to Table 2, 153 of the students (38.2) declared that they had not consumed 16 tablets in the 16 previous weeks, or four months. Moreover, 123 of the students (30.8) who used 1 to 15 tablets were considered irregular users (e.g., 10 and 15 of them did not use 14 and 15 of the tablets, respectively). Therefore, 69.0% of the students did not use any tablets or used them irregularly, and 124 of the students (31.0) received complete iron supplementation. Details of the tablet consumption among students are shown in Table 2.

Table 3 shows the major reasons for refusal to consume the iron supplement tablet among high school female students in Zahedan.

As shown in Table 3, the findings of the qualitative phase indicated that digestive difficulties, influence from family and friends and environmental problems were the main reasons for non-consumption of the iron tablets among high school students in Zahedan. Other reasons are shown in Table 3 based on their importance.

## Discussion

This study showed that 69% of the students had not consumed any iron supplements or had irregularly consumed them. This finding could be associated with the poverty, deprivation and culture in the province of Sistan and Balochistan. Halterman et al. (11), in a study in America on school-aged children and adolescents, indicated that the prevalence of iron deficiency was highest among adolescent girls. The average math scores were lower in children with iron deficiency than in those with normal iron status. Mansson et al. (12) found that in

**Table 1.** Demographic information of female high school students in Zahedan in 2015

Student variables	Dimensions	N (%)	Iron Tablet Consumption			P-value
			Yes n (%)/ Mean± SD	No n (%) /Mean ± SD	Irregular n (%) /Mean ± SD	
School grade of student	1	100 (25)	23 (5.8)	36 (9.0)	41 (10.2)	0.006 <sup>a</sup>
	2	100 (25)	43 (10.8)	39 (9.8)	18 (4.5)	
	3	100 (25)	29 (7.2)	40 (10.0)	31 (7.8)	
	4	100 (25)	29 (7.2)	34 (8.5)	37 (9.2)	
Fathers' education	Illiterate	21 (15.2)	4 (1.0)	11 (2.8)	6 (1.5)	0.547 <sup>a</sup>
	Under diploma	143 (35.8)	38 (9.5)	38 (9.5)	34 (8.5)	
	Diploma_ Collegiate	196 (49.0)	82 (20.5)	100 (25.0)	87 (21.8)	
Father's job	Unemployed	17 (4.2)	3 (0.8)	7 (1.8)	7 (1.8)	0.920 <sup>a</sup>
	Employee	184 (46.0)	57 (14.2)	70 (17.5)	57 (14.2)	
	Self-employment	170 (42.5)	54 (13.5)	61 (15.2)	55 (13.8)	
	other	29 (7.2)	10 (2.5)	11 (2.8)	8 (2.0)	
Mother's job	Housewife	265 (66.2)	82 (20.5)	100 (25)	84 (21)	0.300 <sup>a</sup>
	Working at home	35 (8.8)	16 (4.0)	9 (2.2)	10 (2.5)	
	Employee	99 (24.8)	26 (6.5)	40 (10)	33 (8.2)	
Birth rank of the student in the family	1	153 (38.2)	45 (11.3)	53 (13.3)	55(13.8)	0.290 <sup>a</sup>
	2	100 (25.0)	40(10.0)	34(8.5)	26(6.5)	
	3	63 (15.8)	16(4.0)	28(7.0)	19(4.8)	
	>4	84 (21.0)	23(5.8)	34(8.5)	27(6.8)	
Grade point average of the previous year	10 to < 16	99 (24.8)	4.0 ± 3.2	10.6 ± 6.4	8.9 ± 7.8	0.003 <sup>b</sup>
	16 to < 18	149 (37.2)	8.9 ± 7.9	7.2 ± 7.1	7.5 ± 7.4	
	18 to 20	152 (38.0)	7.3 ± 6.1	8.5 ± 7.1	6.0 ± 5.2	
Number of children in family	1	13 (3.2)	6.1±4.2	10.8±7.5	3.0±1.2	0.658 <sup>b</sup>
	2	114 (28.5)	7.2±5.2	8.3±7.0	8.0±6.2	
	3	79 (19.8)	9.0±7.4	8.1±7.0	8.4±6.1	
	>4	194 (48.5)	6.4±5.1	8.7±7.1	6.7±5.4	

<sup>a</sup>Pearson chi square test; <sup>b</sup>one way ANOVA test

upper secondary school students, symptoms of vertigo/dizziness were significantly more common among students with iron deficiency. Studies have shown that iron supplementation is effective in reducing symptoms of vertigo/dizziness, irritability, depressive symptoms, and indisposition (12). A study in France showed that 'general health' was significantly lower in an iron-deficient group (13). Another study in India on the physical work capacity of female college students indicated that a combined deficiency in energy and iron had greater adverse effects than that of energy or iron deficiency alone (14). Studies in India, Kenya and Indonesia showed an improvement in growth after iron supplementation. However, studies in Mexico, Bangladesh and Thailand reported no benefit of iron supplementation on growth (15). Given the high percentage of students who had not consumed iron tablets in high schools, health practitioners, health policy makers and school managers need to pay more attention to this issue.

Based on the students' responses, digestive problems, influence from family and friends and environmental problems were the main reasons for the non-consumption of iron tablets. One study showed that an iron supplement programme faced barriers such as a low level of knowledge about the effectiveness of iron supplementation, limitations to supply and distribution and side effects (16). Side effects include diarrhoea, constipation, nausea, vomiting, and gastric distress, which can lead to low patient compliance, low adherence, and general ineffectiveness (17). Recent studies have introduced intermittent iron supplementation as a promising strategy to reduce iron deficiency (18). Moreover, Soemantri et al. (19) and De-Regil et al. (20) both reported that weekly supplementation was more effective than daily supplementation. Another challenge can be consumer's low level of compliance with iron supplementation, which could be the result of a low level of knowledge of anaemia (20). In addition, consumer's lack of awareness could also be the result of health providers' low knowledge and insufficient counselling skills. To address these problems, Information, Education and Communication (IEC) programmes using multimedia have successfully modified consumer behaviour in some cases (20).

The students reported that the iron capsules and tablets were difficult to swallow, with some of them saying "I hate pills", "I don't take the iron pills at all" and "I am reluctant to take

the pills every day". Therefore, it is believed that syrups and drops may be more effective. However, their bad taste, staining of teeth, poor compliance, difficulty being monitored and risk of overdose are some limitations of syrups and drops. According to the experiences of other countries such as India and Indonesia, counselling on how to prevent side effects can successfully improve compliance (20). Improving the taste of tablets, providing an appropriate distribution of tablets and ensuring better conditions for taking tablets are suggested to improve iron supplementation programmes.

Additionally, a significant relationship was observed between iron supplement consumption and GPA in the previous year. Lower GPAs led to a lower tendency to take tablets. These findings clearly indicate that family culture, level of education, students' insufficient knowledge and lack of a health teacher impact the consumption of iron supplements. A study conducted on the effects of providing planned behaviour theory-based education on iron tablet consumption in Iran indicated that education positively influenced the consumption of iron tablets (8). Therefore, it is suggested to hold workshops in schools aimed at preventing iron deficiency anaemia and improving iron tablet consumption.

**Table 2.** Frequency of non-consumed iron tablets by the students in high schools in Zahedan

Number of tablets	Number of the students who not consumed iron tablets; n (%)
1	2 (0.5)
2	11 (2.8)
3	9 (2.2)
4	6 (1.5)
5	14 (3.5)
6	11 (2.8)
7	7 (1.8)
8	14 (3.5)
9	4 (1.0)
10	9 (2.2)
11	2 (0.5)
12	7 (1.8)
13	2 (0.5)
14	10 (2.5)
15	15 (3.8)
16	153 (38.2)

**Table 3.** Reasons of non-usage iron supplementation among the female students in high schools of Zahedan

Theme	Subtheme	Code
Digestive difficulties	Tab's bad taste	Special taste; bad taste; A little bad taste; bitter taste; I don't like the taste
	Nausea	Nausea; Disgusting; Sometimes disgusting
	Vomiting	I vomit; I have vomited once or two times; I vomited
	Digestive difficulties	Stomach ache
	Dysphagia	I feel it is trapped in my throat
	Headache and vertigo	Vertigo after intake; Sometimes vertigo after intake; Headache and vertigo
Influence of people	Physician prescription	I follow the physician prescription; The physician has prescribed
	The influence of friends	Friends; I don't eat like my friends; Some students are reluctant to eat because other students don't eat
	The influence of family	Family
Personal low performance	Consult with physician	Physician diagnosis
	Forgetting	I forget to take it
	Indolence	Indolence in consumption
	Lack of motivation	I don't have any motivation to take it
	Lack of information	I'm not sick; They are not effective; I don't need it at all
	Illness	It make me sick
	Reluctance to take pills	I don't like it; I hate it; I hate pills; I don't take iron pills at all; I am reluctant to take pills every day
Environmental causes	Inappropriate delivery	In appropriate delivery; only one or two times since the beginning of the term
	No delivery	Less than four times delivery since the beginning of school; They don't give us iron pills at all; The school don't give us Iron pills
	Inappropriate situation of school	Inappropriate situation of school

## Conclusion

Most of the students did not use or irregularly used iron supplementation in Zahedan high schools. Moreover, digestive problems, influence of others, students' reluctance and poor environmental situations were the factors most related to iron tablet consumption in students. Improving the taste and quality of tablets, students' and parents' knowledge about iron supplementation, and supervision by health teachers in schools as

well as providing appropriate environmental conditions for consuming iron tablets appear to have a positive impact on iron supplementation programmes.

## Ethical Approval

In this study, ethical issues, including the confidentiality of the information, the right to withdraw from the study, and informed consent from participants for the interviews and for recording interviews, were considered from

the beginning to the end of the study while maintaining the participants' anonymity and confidentiality. The study was approved by the Ethics Committee of Zahedan University of Medical Sciences (ZAUMS).

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## Conflict of Interest

No

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## Authors' Contributions

All authors were involved in the research, draft and editing this manuscript.

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