HEALTH PROMOTION

# Monitoring the utilization and effectiveness of Iron and Vitamin D supplementations program and its predictive factors in high schools' girls in Qom, Iran

ROGHAYE AHANGARI[1], ABOLFAZL MOHAMMADBEIGI[2], SEPIDEH MIRAJ[1], NASER RAJABI[3], ROGHAYEH MOHAMMADPOUR[4]
[1] Department of Obstetrics and Gynecology, School of Medicine, Qom University of Medical Sciences, Qom, Iran;
[2] Professor of Epidemiology, School of Health, Qom University of Medical Sciences, Qom, Iran;
[3] MSc of Epidemiology, Health vice chancellor, Qom university of medical sciences, Qom, Iran;
[4] MSc student of Health Education and Promotion, School of Health, Qom University of Medical Sciences, Qom, Iran

Keywords

Iron deficiency • Supplementation program • Vitamin D • Deficiency • High school • Iran

Summary

**Background.** *Iron and Vitamin D3 deficiency is one of the major global health problems in teenagers and adolescent population. This study was aimed to monitor the utilization and predictive factors of Iron and Vitamin D Supplementations Program (IVDSP) in high schools' girls.*
**Methods.** *In a cross sectional study, the pattern of Iron and D3 consumption based on IVDSP on 400 high schools' girl in Qom, Iran assesses. Data collection was used by a reliable and standard researcher based questionnaire and daily, weekly, monthly and seasonally consumption of complementary minerals in schools were gathered. Data analysis conducted using SPSS version 20 (SPSS Inc., Chicago, IL, USA) by chi square, independent t-test and multivariate logistic regression.*
**Results.** *The mean age of subjects was 15.14 ± 1.52 years and ranged from 12 to 18 years old. The total weekly prevalence of D3 and Iron consumption in high schools' girls was calculated 36.73% and the weekly prevalence of Iron and monthly prevalence of Vitamin D3 consumption was 33.75% and 40.5%, respectively. The most common causes of non-consumption were bad taste 49.31%, Iranian made drug 20.27%, drug sensitivity 19.82% and drug interaction 10.60%, respectively.*
**Conclusions.** *The inadequate and incomplete rate of IVDSP in Qom was high and more than 60% of distributed supplementations have been wasted. Results showed that students who were participated in educational orientation classes were more successful and eager in Iron and Vitamin D3 consumption. Therefore, more educational explanatory interventions for both students and her parents recommended to increase the efficiency of the program.*

## Introduction

Iron and Vitamin D deficiency is one of the major global health problems, which is also common in the adolescent population and can have a negative impact during phases of rapid growth, increasing susceptibility to infection, autoimmune and other chronic disease and also impair mental development and learning [1, 2]. Anemia due to Iron deficiency is a prevalent disorder in high school girls and is defined based on hemoglobin concentration lower than 12 gr/dl in women [3] while the optimum level of Vitamin D is 30 ng/ml [4]. In the absence of adequate level, about 20-25 μg (800-1,000 IU), the oral Vitamin D supplementation is required daily to achieve sufficient levels in adults and children [5]. Current estimates indicate that Vitamin D deficiency (VDD) is a common health problem, affecting 1 billion people globally [6]. Also, more than two billion people suffer from Iron deficiency anemia as the most common nutritional deficiency in the world [7]. According to the estimate of the World Health Organization, 25% of students suffer from Iron deficiency anemia and in developing countries, the prevalence of Iron deficiency anemia in students and adolescents has been reported from 29.9% to 79.6% [8, 9] and it is reported 13.9% in Iranian population with age less than 18 years in a meta-analysis study [10].
The need for Iron during adolescence, which according to the definition of the WHO is between the ages of 10 and 19 years, increases 2 to 3 times due to physiological and physical changes in girls. The prevalence of Iron deficiency anemia in this age group and especially in girls after puberty due to menstrual bleeding and growth spurt is increasing. Therefore, high-risk groups of Iron deficiency anemia are menstruating girls, pregnant women, and the elderly people [11-14]. Lack of micronutrients, including Iron and Vitamin D, has major effects on human health and economic and social development [14]. This shortage can lead to a waste of educational and health care resources, a decrease in productivity due to an increase in maternal mortality and morbidity, and ultimately a decrease in physical and mental capacity in a large part of society [15]. Complementary therapy, supplementation programs, nutrition education, and food fortification


https://doi.org/10.15167/2421-4248/jpmh2024.65.1.3154

with Iron compounds are the WHO strategies for control and prevent Iron and Vitamin D deficiency, are [8]. Furthermore, Iron and Vitamin D Supplementation Program (IVDSP) was implemented in all high school' girls during the past 20 years in Iran improve the health of students through nutritional education and supplemental assistance. According to this program, 16 Table ts of Ferfolic and 9 Table ts of Vitamin D3 (50,000) are distributed among students over 12 years of age on a weekly and monthly basis [12]. Despite the reports of several studies that show the positive effect of the supplement program in reducing the level of Vitamin D and Iron deficiency, a national report and some other researches show the lack of correct use of Iron supplements and the high prevalence of anemia and Vitamin D deficiency among Iranian teenagers [16-20]. Therefore, the present study was designed and conducted to monitor the utilization and predictive factors of Iron and Vitamin D Supplementations Program (IVDSP) in high schools' girls.

## Materials and methods

In a cross sectional study, 400 girl students in high schools of Qom, Iran recruited to monitor the Iron and D3 Complementary Therapy program in June 2023. Sample size calculation was done by using the type one error, $\alpha = 0.05$, success rate of program in a recent study in Semnan, Iran equal 16.5%, and the precision proportion as d = 0.04 based on following formula which use for prevalence estimation studies [21].

The minimum sample size for this study has been calculated 350, but due to clustering sampling method and considering the design effect equal 1.35, overall 486 questionnaires were distributed and finally, data of 400 girls' students were analyzed. We used cluster sampling method to select the high schools from different districts of Qom city and in each district, one high school selected. In the next stage, one class selected randomly and all consent students recruited for study. Verbal informed consent was taken from all participants.

Inclusion criteria was girls who living in Qom and studying in governmental high school. Girls who were studying in high schools without complete distribution of Iron and Vitamin D complementary, girls who were transferred from other high schools during the educational year, and girls who were using foreign complementary drugs were excluded form study.

Data collection was used by a reliable and standard researcher based questionnaire that was used in our recent study [22]. The prepared questionnaire including two different sections. First section contains demographic characteristics such as age, menarche age, nationality, marital status, weight, height, BMI, high school level, educational major, parents' education and parents' job and socioeconomic status. The second section of questionnaire including some questions that evaluate the complementary consumption pattern in high school girls' students. The daily, weekly, monthly and seasonally consumption of complementary in schools including Iron and Vitamin D3 consumption as well as home consumption including folic acid, Calcium, Zinc, Vitamin C, Multi Vitamin, Vitamin B, and Other complementary drugs were gathered. The reliability of used questionnaire of Iron and Vitamin D supplementations program in current study was 0.780 ($\alpha = 0.780$; CI 95%: 746-0.811).

### Ethical consideration

All the students were free to participate in this study and verbal informed consent taken from all included subjects. Moreover, the authors were assured all participants that their information will be confidential. In addition, the study protocol was approved by ethical committee of Qom University of Medical Sciences by IR.MUQ.REC.1401.048 at 10.05.2022.

### Statistical analysis

The primary outcome in current study was the weekly Iron and Vitamin D3 supplement consumption in high schools. Therefore, girls who have consumed Iron and Vitamin D3 supplement weekly in their schools categorized as consumed and compared with other students. Therefore, monitoring and effectiveness of Iron and Vitamin D supplementations program evaluated by regular and on time of these two supplements.

Statistical analysis conducted using SPSS version 20 (SPSS Inc., Chicago, IL, USA). First, we used descriptive statistics to show the demographic characteristics of subjects and prevalence rate of different supplement consumption. Chi square test was used to assess relationship between supplement consumption and qualitative variables such as contribution in explanatory sessions, and consumption surveillance. Independent t-test was used to evaluate difference of mean and standard deviation of quantitative variables such as age, menarche age, BMI, weight and height between two different groups (consumed and not consumed). P-value lower than 0.05 considered as significant.

## Results

In this study we assess 486 students in high schools of Qom, Iran and finally the questionnaires of 400 students received (response rate = 82.30%). The mean age of subjects was 15.14 ± 1.52 years and ranged from 12 to 18 years old. The mean of BMI was 20.44 ± 3.14 kg/m$^2$ and the mean of weight and height was 52.12 ± 8.62 and 159.66 ± 7.19 cm, respectively. The mean of self-rated health was 7.82 ± 2.13 that varied from 1 to 10 (used 10 Point-Likert scale of self-rated heath) and approximately 10% of high school girls reported the SRH lower moderate (quit weak and weak). More details of demographic variables of participations depicted in Table I.

**Tab. I.** Descriptive statistics of demographic continues variables of participations in study.

| Variables | N | Minimum | Maximum | Mean | Std. Deviation |
|---|---|---|---|---|---|
| Age, year | 400 | 12.00 | 18.00 | 15.14 | 1.52 |
| Menarche age, year | 373 | 9.00 | 16.00 | 12.95 | 1.25 |
| BMI, kg/m$^2$ | 400 | 12.49 | 37.28 | 20.44 | 3.14 |
| Weight, kg | 400 | 30.00 | 83.00 | 52.12 | 8.62 |
| Height, cm | 400 | 130.00 | 175.00 | 159.66 | 7.19 |
| Self-rated health score | 400 | 1.00 | 10.00 | 5.82 | 2.13 |

**Tab. II.** Descriptive statistics of demographic categorical variables of participations in study.

| Variables | | Frequency | Valid percent |
|---|---|---|---|
| High school level | First high school | 221 | 55.25 |
| | Second high school | 179 | 44.75 |
| Educational major | Experimental | 107 | 26.8 |
| | Human science | 47 | 11.8 |
| | Mathematical | 15 | 3.8 |
| | Technical science | 12 | 3.0 |
| | None | 219 | 54.8 |
| Nationality | Iranian | 290 | 72.5 |
| | Other | 110 | 27.5 |
| Marital | Single | 380 | 95.0 |
| | Married | 20 | 5.0 |
| Mother education | Illiterate | 48 | 12.0 |
| | Elementary | 162 | 40.5 |
| | Diploma | 105 | 26.3 |
| | Bachelor | 70 | 17.5 |
| | MSc & Upper | 15 | 3.8 |
| Father education | Illiterate | 27 | 6.8 |
| | Elementary | 151 | 37.8 |
| | Diploma | 126 | 31.5 |
| | Bachelor | 65 | 16.3 |
| | MSc & Upper | 31 | 7.8 |
| Mother job | Physician/Manager | 22 | 5.5 |
| | Staff | 28 | 7.0 |
| | Housekeeper | 316 | 79.0 |
| | Unemployment/ Free | 32 | 8.0 |
| | Retried | 2 | .5 |
| Father Job | Physician/Manager | 19 | 4.8 |
| | Staff | 72 | 18.0 |
| | Unemployment/ Free | 276 | 68.9 |
| | Retried | 24 | 6.0 |
| | Died | 9 | 2.3 |
| Socio Economic Status | Low Income | 82 | 20.5 |
| | Lower average income | 164 | 41.0 |
| | Average income | 78 | 19.5 |
| | Upper average income | 76 | 19.0 |

According to demographic characteristics (Tab. II), 26.8% studying in experimental major and 72.5% were Iranian. Socioeconomic status of participated studies showed that only 21.3% of students' mothers and 24.1% of students' fathers have college academic education and only 12.5% of students' mothers and 22.8% of students' fathers have professional jobs. Finally, 38.5% have average and upper average income in society. From all studied students, 132 (33%) reported a type of background disease including depression (17.5%), hypothyroidism (4.5%) and other diseases (11%).

Our effectiveness results of program execution showed that the prevalence of both D3 and Iron consumption (complementary consumption in high schools) was calculated 36.73% (126 students). The weekly prevalence of Iron and Vitamin D3 consumption was 33.75% and 6.25% and the monthly prevalence for Iron and Vitamin D3 consumption was estimated as 57% and 40.5%, respectively (Tab. III). Our results showed that the most important causes of un-consumption were bad taste (49.31%), Iranian made drugs (20.27), drug sensitivity (19.82%) and drug interaction (10.60%), respectively.

We assessed the relationship between of complementary consumption with demographic variables and the results in Table IV showed that contribution of students in explanatory sessions ($p = 0.003$), contribution of students in school sessions ($p = 0.001$) were predictor variables for better complementary consumption in high schools. However, contribution of girls' parents in sessions and executive of consumption surveillance were not significant variables for complementary consumption in high schools' girls.

Comparing the mean of age, menarche age, BMI, weight and height between two different groups of students in high schools based on complementary consumption (Tab. V) showed that the menarche age in complementary consumption group was statistically significant than other group ($p = 0.043$), but there was not significant difference between two groups regarding to age, BMI, weight and height.

The binary multivariate logistic regression showed that lower age and contribution in explanatory sessions for supplementary consumption were the most positive important predictors of IVDSP success. Based on our results age (AOR = 0.732, CI95%: 0606-0883, $p = 0.001$) and contribution in explanatory sessions (AOR = 0.161, CI 95%; 0.072-0.356, $p < 0.001$). Based on these results by increasing the age the IVDSP success decrease, but

**Tab. III.** The daily, weekly, monthly and seasonally prevalence of complementary consumption in girls' high schools.

| Variables | No n (%) | Yes, n (%) | | | | |
|---|---|---|---|---|---|---|
| | | Every day | Every week | Every month | Every season | Seldom |
| **High schools consumption** | | | | | | |
| Iron consumption | 68 (17.00) | 18 (4.5) | 117 (29.25) | 93 (23.25) | 4 (1.00) | 100 (25.0) |
| Vitamin D3 | 141 (35.25) | 5 (1.25) | 20 (5.0) | 137 (34.25) | 3 (0.75) | 94 (23.50) |
| **Home consumption** | | | | | | |
| Folic acid | 295 (73.75) | 3 (0.75) | 25 (6.25) | 41 (10.25) | 1 (0.25) | 35 (8.75) |
| Calcium | 312 (78.00) | 16 (4.0) | 18 (4.50) | 17 (4.25) | 0 (0.00) | 37 (9.25) |
| Zinc | 300 (75.00) | 10 (2.50) | 20 (5.0) | 19 (4.75) | 2 (0.50) | 49 (12.25) |
| Vitamin C | 230 (57.50) | 9 (2.25) | 21 (5.25) | 28 (7.0) | 10 (2.50) | 102 (25.50) |
| Multi Vitamin | 286 (71.50) | 10 (2.5) | 8 (2.0) | 10 (2.50) | 6 (1.50) | 80 (20.0) |
| Vitamin B | 309 (77.25) | 0 (0.00) | 2 (0.50) | 14 (3.50) | 4 (1.0) | 71 (17.75) |
| Other complementary drugs | 355 (88.75) | 2 (0.50) | 1 (0.25) | 10 (2.50) | 3 (0.75) | 29 (7.25) |

**Tab. IV.** The relationship between of complementary consumption in high schools' girls with demographic variables.

| Variable | | Complementary consumption | | | p value |
|---|---|---|---|---|---|
| | | Yes, n(%) | No, n (%) | Total | |
| Students contribution in explanatory session | Yes | 24 (25.30) | 71 (74.70) | 95 (23.75) | 0.003 |
| | No | 15 (37.50) | 25 (62.50) | 40 (10.00) | |
| | No educational Session | 87 (32.80) | 178 (67.20) | 265 (66.25) | |
| Parents contribution in explanatory session | Yes | 15 (25.90) | 43 (74.10) | 58 (14.50) | 0.341 |
| | No | 19 (27.10) | 51 (72.90) | 70 (17.50) | |
| | No educational Session | 92 (33.80) | 180 (66.20) | 272 (68.00) | |
| School session programs | Yes | 58 (44.30) | 73 (55.70) | 131 (32.75) | 0.001 |
| | No | 12 (24.50) | 37 (75.50) | 49 (12.25) | |
| | No educational Session | 56 (25.50) | 164 (68.50) | 220 (55.00) | |
| Consumption surveillance | Yes | 17 (26.60) | 47 (73.40) | 64 (16.00) | .465 |
| | No | 75 (33.90) | 146 (66.10) | 221 (55.25) | |
| | Sometimes | 34 (29.60) | 81 (70.40) | 115 (28.75) | |

contribution to explanatory programs enhancing the IVDSP prosperity.

## Discussion

Our results showed that the overall utilization of IVDSP in high schools' girls is only 36.73%. The weekly prevalence of Iron and monthly prevalence of Vitamin D3 consumption was estimated 33.75% and 40.5%, respectively. Different studies in Iran showed that the utilization of this program in female high school students is weak. In Karimi et al. study on 440 middle school and high school female students from different areas of Semnan city [12], the results showed inappropriate consumption of Iron supplements, which was in line with the results of our study. Another study in Yazd girls showed that only 53.9% of middle school girls and 16.5% of high school girls consumed supplements completely [23]. In addition, in another mixed method (quantitative and qualitative) study by Khamarnia et al. in Zahedan on 400 randomly selected high school students from different regions, most of the students received Iron supplements irregularly or did not use them [13]. Dubik et al. study in Tamal Metropolis, Ghana also showed that 60% of the girls students did not take Iron and folic acid pills, which is consistent with the results of our study [24]. However, different results in a wide variety of students' selection are the most reasons. On the way, all studies showed that the efficacy of this program in Iran is insufficient and more activities is necessary to increase the efficiency of IVDSP.

Bad taste, Iranian made drug, drug sensitivity and drug interaction were the most common causes of non-consumption, respectively. In a similar qualitative study by Alami et al. the perceived challenges of the national plan of Iron supplement in schools assessed and target community of students, parents, school administrators and school health instructors interviewed in Gonabad city. They found that the bad taste of Iron pills was one of the main influencing factors in not taking Iron pills by students [25], which was consistent with the results of the present study. Another study in Zahedan bad taste and quality of Iron pills were the related factor of no usage Iron supplementation and they recommended the improvement of taste and quality of Iron pills for better consumption [13].

VDD prevalence estimated 76% in adolescents and approximately 93.9% of girls and 85.3% of

Tab. V. Comparing the mean of continues variables between two different groups of students in high schools based on complementary consumption.

| Variable | Complementary consumption | | p value |
|---|---|---|---|
| | Yes, Mean ± SD | No, Mean ± SD | |
| Age | 15.24 ± 1.58 | 15.10 ± 1.49 | 0.382 |
| Menarche age | 14.59 ± 1.07 | 11.32 ± 1.32 | 0.043 |
| BMI | 20.55 ± 3.06 | 20.38 ± 3.18 | 0.624 |
| Weight | 52.65 ± 9.17 | 51.87 ± 8.36 | 0.400 |
| High | 159.86 ± 6.50 | 159.57 ± 7.50 | 0.695 |

pregnant women affected to this disorder [26, 27]. In addition, a systematic review and meta-analysis showed that the overall prevalence of Iron deficiency anemia in the Iranian population under 18 years of age was estimated at 13.9% and the overall prevalence of Iron deficiency was 26.9% [10]. Another study in the first and third grades of high schools in Yasuj city, showed this rate 32.3% and in the third grade, as 41.9% [28]. Several researches show that students with Iron deficiency anemia have significant differences in terms of doing schoolwork, recognition, problem solving, sensory and motor abilities, and memory power compared to healthy students [8]. The consequences of Iron deficiency anemia in adolescence have a negative impact on a person's reproductive performance in the future and the risk of low birth weight, premature birth, and abortion [12, 29]. Since millions of people suffer from Iron deficiency, this problem has a significant impact on economic and national development by reducing the quality of life of people, and it can be said that prevention of Iron deficiency and anemia caused by it has the greatest benefits for public health [8].

Despite the efforts of the Ministry of Health, Treatment and Medical Education in implementing free Iron supplement programs for adolescent groups, especially girls, the utilization and consumption of Iron and Vitamin D3 is low and this program was being unsuccessful [27]. Nevertheless, due to implementation of IVDSP, the consumption of Iron and Vitamin D is approximately 40%, while the monthly home consumption of other complementary micronutrients such as folic acid, calcium, zinc, Vitamin C, multi Vitamin and Vitamin B was lower than 8%. In addition, results of different studies in Iran showed that, the IVDSP has significant effect on decreasing the Iron deficiency and VDD and change multiple behavioral intention in female high school girls and prevent from worse outcomes in pregnancy in the future [30, 31].

This study was the first investigation to evaluate the effectiveness and utilization of IVDSP in Qom as strength, but some limitations were existing. Mineral interactions due to consumption foreign Iron or Vitamin D caused underestimation of estimates in our study. Some female high school' girls were using non-Iranian micronutrients and didn't use Iranian kind which distributed in schools. Moreover, the pattern of mineral distribution and micronutrients consumption manner was different among schools. High schools that have weekly distribution showed higher consumption in compared to schools that distributed all micronutrients' rations of students one time at first or monthly.

## Conclusions

The inadequate and incomplete rate of IVDSP in Qom was high and more than 60% of distributed Iron and Vitamin D3 supplementations have been wasted. Our results showed that socioeconomic variables such as patents job and economic status of students are related factors of consumption of supplementations, but students who were participated in educational orientation classes were more successful and eager in Iron and Vitamin D3 consumption. However, regular weekly distribution of micronutrients suggested by authors for enhancing the IVDSP efficacy. Therefore, more support and educational explanatory interventions for both students and their parents recommended to increase the efficiency of the program.

## Acknowledgements

The researchers thankful the Vice Chancellor of Research and Technology Development at Qom University of Medical Sciences, for financial support this work. The authors also grateful for all high schools' teachers and the girls' families who participated in this study and cooperate in data collection.

## Conflict of interest statement

None declared.

## Financial/non financial disclosures

None declared.

## Authors' contributions

All the authors assume responsibility for all content of the manuscript. All the authors contributed significantly to the conceptualization, drafting, and final editing of the manuscript.

## References


[1] del Balzo V, Vitiello V, Germani A, Donini LM, Poggiogalle E, Pinto A. A cross-sectional survey on dietary supplements consumption among Italian teen-agers. PLoS One 2014;9:e100508. https://doi.org/10.1371/journal.pone.0100508.

[2] Gallagher CM, Black LJ, Oddy WH. Micronutrient intakes from food and supplements in Australian adolescents. Nutrients 2014;6:342-54. https://doi.org/10.3390/nu6010342.

[3] Alkhaldy HY, Hadi RA, Alghamdi KA, Alqahtani SM, Al Jabbar ISH, Al Ghamdi IS, Bakheet OSE, Saleh RAM, Shehata SF, Aziz S. The pattern of Iron deficiency with and without anemia among medical college girl students in high altitude southern Saudi Arabia. J Family Med Prim Care 2020;9:5018-25. https://doi.org/10.4103/jfmpc.jfmpc_730_20.

[4] Al-Daghri NM, Al-Saleh Y, Aljohani N, Sulimani R, Al-Othman AM, Alfawaz H, Fouda M, Al-Amri F, Shahrani A, Alharbi M, Alshahrani F, Tamimi W, Sabico S, Rizzoli R, Reginster JY. Vitamin D status correction in Saudi Arabia: an experts' consensus under the auspices of the European Society for Clinical and Economic Aspects of Osteoporosis, Osteoarthritis, and Musculoskeletal Diseases (ESCEO). Arch Osteoporos 2017;12:1. https://doi.org/10.1007/s11657-016-0295-y.

[5] Holick MF, Chen TC. Vitamin D deficiency: a worldwide problem with health consequences. Am J Clin Nutr 2008;87:1080S-6S. https://doi.org/10.1093/ajcn/87.4.1080S.

[6] Hagenau T, Vest R, Gissel TN, Poulsen CS, Erlandsen M, Mosekilde L, Vestergaard P. Global Vitamin D levels in relation to age, gender, skin pigmentation and latitude: an ecologic meta-regression analysis. Osteoporos Int 2009;20:133-40. https://doi.org/10.1007/s00198-008-0626-y.

[7] Stevens GA, Paciorek CJ, Flores-Urrutia MC, Borghi E, Namaste S, Wirth JP, Suchdev PS, Ezzati M, Rohner F, Flaxman SR, Rogers LM. National, regional, and global estimates of anaemia by severity in women and children for 2000-19: a pooled analysis of population-representative data. Lancet Glob Health 2022;10:e627-39. https://doi.org/10.1016/S2214-109X(22)00084-5.

[8] McLean E, Cogswell M, Egli I, Wojdyla D, de Benoist B. Worldwide prevalence of anaemia, WHO Vitamin and Mineral Nutrition Information System, 1993-2005. Public Health Nutr. 2009;12:444-54. https://doi.org/10.1017/S1368980008002401.

[9] Abidoye RO, Akande PA. Nutritional status of public primary school children: a comparison between an upland and riverine area of Ojo LGA, Lagos State Nigeria. Nutr Health 2000;14:225-40. https://doi.org/10.1177/026010600001400404.

[10] Akbari M, Moosazadeh M, Tabrizi R, Khatibi SR, Khodadost M, Heydari ST, Tahami AN, Lankarani KB. Estimation of Iron deficiency anemia in Iranian children and adolescents: a systematic review and meta-analysis. Hematology. 2017;22:231-9. https://doi.org/10.1080/10245332.2016.1240933.

[11] Mansourian M, Shafieyan Z, Qorbani M, Rahimzadeh Bazraki H, Charkazi R, Asayesh H, et al. Effect of nutritional education based on HBM model on anemia in Golestan girl guidance school students. J Health Educ Health Promot 2013;1:49-54.

[12] Karimi B, Zaker RH, Ghorbani R. Intake of Iron supplement and its related factors in jounior and high school girl students of the Iraninan population. Koomesh 2014;15:316-24.

[13] Khammarnia M, Amani Z, Hajmohammadi M, Ansari-Moghadam A, Eslahi M. A survey of Iron supplementation consumption and its related factors in high school students in Southeast Iran, 2015. Malays J Med Sci 2016;23:57-64. https://doi.org/10.21315/mjms2016.23.5.8.

[14] Mengistu G, Azage M, Gutema H. Iron deficiency anemia among in-school adolescent girls in rural area of Bahir Dar City Administration, North West Ethiopia. Anemia 2019;2019:1097547. https://doi.org/10.1155/2019/1097547.

[15] Naghibi SA, Ahmadi M, Afkhaminia F. Assessment of the Knowledge, Attitude, and performance of Female Junior High School Students of Neka, Iran, about Iron deficiency anemia in 2016. J Health Res Commun 2018;4:79-88.

[16] Tabrizi R, Moosazadeh M, Akbari M, Dabbaghmanesh MH, Mohamadkhani M, Asemi Z, Heydari ST, Akbari M, Lankarani KB. High prevalence of Vitamin D deficiency among Iranian population: a systematic review and meta-analysis. Iran J Med Sci 2018;43:125-139.

[17] Alipoor R, Gholami MS, Rajabi R, Anari MJ, Vaziri MS, Vajdi S, Shamshirian A. The prevalence of Iron deficiency anemia among high school students in Iran: a systematic review. Intern. Med Med Investig J 2017;2:1-6. https://doi.org/10.24200/imminv.v2i1.45.

[18] Ghazizadeh H, Rezayi M, Emadzadeh M, Tayefi M, Abdollahi Z, Timar A, Shaghi F, Saberi-Karimian M, Ferns GA, Elmadfa I, Meyer AL, Ghayour-Mobarhan M. Prevalence of Vitamin D deficiency in Iran: a systematic review and meta-analysis. J Cardiothorac Medicine 2022;10:945-73. https://doi.org/10.22038/jctm.2022.65411.1377.

[19] Faghih S, Abdolahzadeh M, Mohammadi M, Hasanzadeh J. Prevalence of Vitamin D deficiency and its related factors among University students in Shiraz, Iran. Int J Prev Med 2014;5:796-9.

[20] Ahadi Z, Asl LN, Ghardashi Z, Khosravi HM. Comparison of knowledge, attitude and practice of women toward Iron deficiency anemia and consumption of Iron supplements in Yazd and Orumiyeh. Jundishapur J Health Sci 2012;4:57.

[21] Naing L, Nordin RB, Abdul Rahman H, Naing YT. Sample size calculation for prevalence studies using Scalex and ScalaR calculators. BMC Med Res Methodol 2022;22:209. https://doi.org/10.1186/s12874-022-01694-7.

[22] Mohammadbeigi A, Mohammadsalehi N, Moshiri E, Asgarian A, Afrashteh S, Khazaei S, Ansari H, et al. Pattern of dietary supplement consumption among Iranian high school girls and related factors. Sri Lanka J Child Health 2020;49:41-7. https://doi.org/10.4038/sljch.v49i1.8897.

[23] Movahedi AF, Ahadi F. Prevalence of Iron deficiency anemia in high school girls in Semnan City. Journal of Shahid Sadoughi University of Medical Sciences Yazd 2005;12:14-14.

[24] Dubik SD, Amegah KE, Alhassan A, Mornah LN, Fiagbe L. Compliance with weekly Iron and folic acid supplementation and its associated factors among adolescent girls in Tamale Metropolis of Ghana. J Nutr Metab 2019;2019:8242896. https://doi.org/10.1155/2019/8242896.

[25] Alami A, Zarei F, Tehrani H, Hosseini Z, Jafari A. Perceived challenges of the Schools Iron Aid National Plan from stakeholder perspectives. Tehran University Medical Journal 2019;77:257-66.

[26] Vearing RM, Hart KH, Darling AL, Probst Y, Olayinka AS, Mendis J, Ribeiro H, Thakur S, Mendes M, Charlton K, Lanham-New SA. Global perspective of the Vitamin D status of African-Caribbean populations: a systematic review and meta-analysis. Eur J Clin Nutr 2022;76:516-26. https://doi.org/10.1038/s41430-021-00980-9.

[27] Aghapour B, Kheirouri S, Alizadeh M, Khodayari-Zarnaq R. Vitamin D deficiency prevention policies in Iran: a retrospective policy analysis. Front Nutr 2023;10:1249402. https://doi.org/10.3389/fnut.2023.1249402.

[28] Zohrabi T, Zohrabi M, Paknahad Z, Zandi GK, Negintaji A. The effect of Iron folic acid supplementation and dietary Iron

intake in high schools female students. Armaghane-Danesh 2015;19:817-827.

[29] Hosseini M, Shojaeizadeh D, Chaleshgar M, Pishva H. A study of educational intervention on knowledge, attitude, practice about Iron deficiency anemia in female adolescent students. Journal of Gorgan University of Medical Sciences 2006;8:37-43.

[30] Alami A, Ghelichi Ghojogh M, Hosseini Z, Jafari A. Effectiveness of Iron and Vitamin D supplementary intervention program in high school girl students. Iran J Health Educ Health Promot 2023;11:20-30.

[31] Alami A, Tavakoly Sany SB, Tehrani H, Lael-Monfared E, Hosseini Z, Jafari A. The effect of educational intervention on Iron and Vitamin D consumption based on the theory of planned behaviour in Iranian adolescent girls: a quasi-experimental study. Int J Health Promot Educ 2019;57:316-31. https://doi.org/10.1080/14635240.2019.1632732.

Received on December 16, 2023. Accepted on February 15, 2024.

**Correspondence:** Sepideh Miraj, Department of Obstetrics and Gynecology, School of Medicine, Qom University of Medical Sciences, Qom, Iran. E-mail: beigi60@gmail.com, miraj.sepideh@gmail.com

**How to cite this article:** Ahangari R, Mohammadbeigi A, Miraj S, Rajabi N, Roghayeh Mohammadpour R. Monitoring the utilization and effectiveness of Iron and Vitamin D supplementations program and its predictive factors in high schools' girls in Qom, Iran. J Prev Med Hyg 2024;65:E36-E42. https://doi.org/10.15167/2421-4248/jpmh2024.65.1.3154