Pattern of dietary supplement consumption among Iranian high school girls and related factors

Abolfazl Mohammadbeigi[1], **Narges Mohammadsalehi**[2], **Esmail Moshiri**[3], **Azadeh Asgarian**[2], **Sima Afrashteh**[4], **Salman Khazaei**[5], ***Hossein Ansari**[6]

Abstract
Introduction: Adolescence is a critical period of life especially in high school girls due to large physical, social, and psychological changes.

Objectives: To assess prevalence and frequency of consumption of dietary supplements among Iranian high school girls and related factors.

Method: A cross-sectional study was carried out on 638 high school girls in Qom city, Iran in 2017. The girls were selected by multi-stage sampling from 16 high schools. Data were collected using a validated reliable questionnaire that included demographic characteristics and the dietary supplement consumption including ferrous sulphate, folic acid, iron + folic acid, calcium, vitamin E, calcium + vitamin E, zinc, vitamin C, multivitamin and vitamin D. Statistical analysis used SPSS software, Chi square test, independent t-test and multivariate binary logistic regression.

Results: Overall monthly prevalence of dietary supplement consumption was 65.3% (417/639). Consumption for calcium was 43.2%, for vitamin E

[1]*Research Centre of Gastroenterology and Hepatology,* [2]*Research Centre for Air Pollutants, Qom University of Medical Sciences, Qom, Iran,* [3]*Department of Anaesthesia, School of Medicine, Arak University of Medical Sciences, Arak, Iran,* [4]*Department of Public Health, Vice chancellor of Health, MSc of Epidemiology, Bushehr University of Medical Sciences, Bushehr, Iran,* [5]*Department of Epidemiology, School of Public Health, Hamadan University of Medical Sciences, Hamadan, Iran,* [6]*Health Promotion Research Centre, Department of Epidemiology and Biostatistics, Zahedan University of Medical Sciences, Zahedan, Iran*
Corresponding author: ansarih88@gmail.com

https://orcid.org/0000-0003-2755-7864

39%, vitamin D 36.5% ferrous sulphate 35.2%, calcium plus vitamin E 32.6%, iron plus folic acid 25.4%, folic acid 22.4%, multivitamin 20.5%, zinc 17.4% and vitamin D 8%. The annul prevalence of ferrous sulphate, calcium and vitamin E was 50% higher and the minimum prevalence was in vitamin D and zinc consumption. The regression model showed that income level of family and the SRH score were the most important related factors of dietary supplement consumption.

Conclusions: According to our results, the monthly dietary supplement consumption prevalence in Iranian high school girls is good, but the daily intake of mineral supplement is weak.

Introduction:
Adolescence is a sensitive period of life where they experience physical, social, and psychological changes due to pubertal hormones[1,2]. Most adolescent girls have an inadequate micronutrient intake[2-4]. Micronutrient deficiency in adolescent girls may cause impaired growth and development, adverse effect on childbearing, reproductive related complications, cardiovascular and chronic diseases[2,3,5]. Moreover, previous studies have shown an association between the nutrient intake and mental health in adolescence[1,6].

The recommended dietary reference intakes (DRIs) for supplementation in adolescent girls are 800–2000 IU/day vitamin D[7], 65mg vitamin C, 400mcg folate, 15mg iron, 1300mg calcium and 9mg zinc[8,9]. Several factors are related to dietary supplement use such as demographic characteristics, body mass index, pubertal status sun exposure, as well as healthy food consumption with adequate minerals by fruits, vegetables, carbohydrates and proteins[10-12]. Previous studies have shown positive associations between physical activity, calcium intake and bone mass density in females[12,13]. However, fast-food and junk food consumption are inversely related to dietary supplement intake. Some minerals synthesized by human body such as folic acid cannot be produced and have to be obtained through the diet[14].

Iranian studies showed that zinc and vitamin D deficiencies in adolescent women were 8% and 85%[15] respectively, and that daily intake of some minerals in adolescent girls of a central city in Iran was less than 75% recommended DRI for vitamin B12, vitamin A, folate, calcium, zinc, and fibre[8]. According to recent Iranian studies, prevalence of mineral deficiencies in high school adolescent girls and young women was high[16,17]. Overall prevalence of iron deficiency in a meta-analysis study in Iran was 26.9% and was higher in young females[4]. Anaemia prevalence due to iron and folic acid deficiency in females was higher than males in Mashhad[18]. Thus, need for dietary supplementation in adolescent high school girls is rational.

Objectives
To assess the pattern and prevalence of mineral consumption and frequency of dietary supplement consumption among high school girls and related factors in Qom city, Iran in 2017.

Method
A cross-sectional study was carried out in high school girl students in Qom, a central province of Iran, in 2017. Multi-stage sampling was used for subject selection. Of all girls' high schools in a deprived area of Qom, 16 were selected. In each school, eligible subjects were selected among different majors from governmental versus non-governmental schools. Finally, 40 students were selected by simple random sampling from each school. Verbal informed consent was taken from all subjects and the study protocol was approved by the ethical committee of Qom University of Medical Sciences.

Data were collected using a standard self-administered questionnaire in Persian. The content validity was assessed by an expert team. Reliability of questionnaire was evaluated by Cronbach's alpha and estimated to be 0.871 in a pilot study on 50 students. Sample size was calculated based on mineral supplement consumption equal to 66.8% in a recent study[15] and alpha error 0.05. Thus, minimum sample size calculated was 320 and by considering design effect equals 2, we assessed 640 high school girls, 639 completing questionnaires. The researcher made questionnaire in current study was developed in 2 sections including demographic characteristics such as age, marital status, mother's job and education, and family' income level.

The primary outcome in our study was the dietary supplement consumption in recent month. Therefore, overall dietary supplement consumption evaluated for each subject takes at least one mineral in recent month. Frequency of consumption was assessed in 4 time schedules, namely, every day, every week, every month, and sometimes in year. The dietary supplement consumption regarding all mineral supplements was evaluated for the most common usage minerals including ferrous sulphate, folic acid, iron + folic acid, calcium, vitamin E, calcium + vitamin E, zinc, vitamin C, multivitamin and vitamin D and was assessed in recent month. This questionnaire was assessed by self-reported health (SRH) and self-reported fitness (SRF) in a five point Likert scale. The two questions were "How do you assess your general health status?" and "How do you assess your body fitness status?" The subjects' responses varied from very good = 5, good = 4, moderate = 3, weak = 2 and very weak = 1.

Statistical analysis utilised SPSS software. Prevalence rate of dietary supplement consumption and status of subjects regarding SRH and SRF were presented using descriptive statistics. Chi square test was used to assess relationship between supplement consumption and qualitative variables. Independent t-test was used to evaluate difference of mean and standard deviation between two groups (consumed and not consumed). Multivariate binary logistic regression was used to determine most important related factors of dietary supplement consumption. Marital status, maternal education, family income level and SRH score were the variables included in the regression model. $p < 0.05$ was considered significant.

Results
The demographic characteristics of the studied high school girls in Qom city are shown in Table 1.

Table 1: *Demographic characteristics of studied high school girls in Qom city (n=639)*

Variable	Number (%)
Marital status	
Single	616 (96.4)
Married	23 (03.6)
Major	
Experimental sciences	246 (38.5)
Human sciences	175 (27.4)
Mathematical/Skill sciences	218 (34.1)
Mother's job	
Staff	31 (04.9)
Homemaker	574 (90.4)
Other	30 (04.7)
Mother's education	
Illiterate	105 (16.5)
Elementary	290 (45.7)
High school	168 (26.5)
College	72 (11.3)
Income level (per month)	
Less than 250$	312 (53.4)
250-499$	144 (24.7)
500-750$	64 (11.0)
More than 750$	64 (11.0)

The mean age of subjects was 15.77±0.73 years and ranged from 15-18 years. In addition, the mean ages of menarche and body mass index (BMI) were 12.70±1.34 years and 20.85±3.29 kg/m², respectively. The overall monthly prevalence of dietary supplement consumption was calculated as 65.3% (417/639).

In addition, the prevalence of mineral supplement consumption in one recent month (Figure 1) was estimated for calcium 43.2%, vitamin E 39%, vitamin D 36.5%, ferrous sulphate 35.2%, calcium plus vitamin E 32.6%, iron plus folic acid 25.4%, folic acid 22.4%, multivitamin 20.5%, zinc 17.4% and vitamin D 8%. Moreover, the annul prevalence of dietary supplement consumption among high school girls of Qom city is presented in table 2. The annual prevalence of ferrous sulphate, calcium and vitamin E was 50% higher and the minimum prevalence was in vitamin D and zinc consumption. Nevertheless, the frequency of dietary supplement consumption varied among different mineral consumption as shown in table 2.
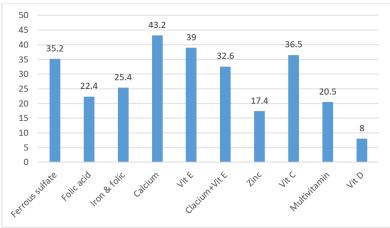

Figure 1: *The monthly usage of mineral supplementation in high school girls of study*

Table 2
Prevalence and frequency of dietary supplement consumption among Qom high school girl students (n=639)

Pattern of consumption of mineral and vitamin supplements	Supplement consumption		Frequency of supplement consumption	
	Never n (%)	Yes n (%)	Every day n (%)	Every week n (%)
Ferrous sulphate	265 (41.5)	374 (58.5)	70 (11.0)	102 (16.0)
Folic acid	412 (64.5)	227 (35.5)	39 (06.1)	66 (10.3)
Iron + folic acid	379 (59.3)	260 (40.7)	48 (07.5)	68 (10.6)
Calcium	288 (45.1)	351 (54.9)	37 (05.8)	102 (16.0)
Vitamin E	311 (48.7)	328 (51.3)	43 (06.7)	76 (11.9)
Calcium + vitamin E	355 (55.6)	284 (44.4)	35 (05.5)	78 (12.2)
Zinc	458 (71.7)	181 (28.3)	29 (04.5)	43 (06.7)
Vitamin C	331 (51.8)	308 (48.3)	28 (04.4)	88 (13.8)
Multivitamin	418 (65.4)	221 (34.6)	34 (05.3)	55 (08.6)
Vitamin D	504 (78.9)	135 (21.1)	19 (03.0)	15 (02.3)

The association of demographic characteristics with dietary supplement consumption was assessed and presented in table 3. According to these results, a significant difference was showed by Chi Square test in two groups based on maternal education and income level of family. Moreover, independent t-test showed that the mean of SRH and SRF scores was statistically significant between girls who have dietary supplement consumption and others (p<0.05). Nevertheless, there was no significant difference between two groups regarding, age, BMI, menarche age, educational major, marital status and maternal job (p>0.05).

The multivariate logistic regression (table 4) showed that the most important related factors of dietary supplement consumption among Qom high school girls were the income level of family and the SRH score. Based on our results, by increasing the level of family income the odds of supplement consumption increased to 50% in second level in comparison to first level. Moreover, the odds ratio of girls in highest level income was 2.1 in comparison to first income level. The SRH score showed a significant direct relationship with supplement consumption. By increasing one score in SRH, the odds of supplement consumption increased to 61%.

Table 3: *Related factors of dietary supplement consumption among Qom high school girls*

Variable	No supplement consumed	Supplement consumed	p-value
Marital status n (%)			
Single	210 (34.1)	406 (65.9)	0.069†
Married	12 (52.2)	11 (47.8)	
Educational Major n (%)			
Experimental	85 (34.6)	161 (65.4)	0.564†
Human	56 (32.0)	119 (68.0)	
Mathematical	81 (37.2)	137 (62.8)	
Mother's job n (%)			
Staff	07 (22.6)	24 (77.4)	0.103†
Housemaker	213 (35.3)	391 (64.7)	
Mother's education n (%)			
Elementary/illiterate	152 (38.5)	243 (61.5)	0.004†
High school	57 (33.9)	111 (66.1)	
College	13 (18.1)	59 (81.9)	
Income level of family n (%)			
Less than 249$	127 (40.7)	185 (59.3)	0.001†
250-499$	43 (29.9)	101 (70.1)	
More than 500$	29 (22.7)	99 (77.3)	
Age (mean ± SD)	15.75±0.75	15.79±0.72	0.577‡
SRH Score mean ± SD (median, IQR)	1.56±0.75 (1.1, 1-2)	1.91±0.94 (1.5, 1-2)	0.001‡
SRF Score mean ± SD (median, IQR)	1.88±0.97 (1.5, 1-3)	2.13±1.06 (2, 1-3)	0.003‡
BMI (mean ± SD)	21.13±3.45	20.96±3.25	0.586‡
Menarche age (mean ± SD)	12.72±1.30	12.69±1.36	0.848‡

† Chi Square test

‡ Independent t-test

Table 4: *Results of multivariate logistic regression of related factors of dietary supplement consumption among Qom high school girls*

	B	S.E.	Wald	P value	OR	CI 95% OR	
						Lower	Upper
Family income							
Less than 249$					1		
250-499$	0.407	0.222	3.363	0.067	1.503	0.972	2.322
More than 500$	0.722	0.246	8.639	0.003	2.059	1.272	3.334
SRH Score	0.485	0.107	20.581	0.000	1.615	1.499	1.759

Discussion:

The overall monthly prevalence of dietary supplement consumption in our study was 65.3%. Estimated monthly prevalence for calcium was 43.2%, for vitamin E 39%, for vitamin D 36.5%, for ferrous sulphate 35.2%, for calcium plus vitamin E 32.6%, for iron plus folic acid 25.4%, for folic acid 22.4%, for multivitamin 20.5%, for zinc 17.4% and for Vitamin D 8%, respectively. These results showed that the dietary mineral supplement use in Iranian high school girls is good based on the mineral deficiencies in our communities. The results of a systematic review and a multicentre study in 13 European countries based data of national surveys showed that inadequate intake of selected nutrients was highly prevalent[20,21]. These included vitamin C intake from 8-40%; vitamin D from 47-100%; vitamin B12 from 0-40%; folic acid from 10 - 91%; calcium from 0 - 61%; iron from 0-18% and zinc from 1 - 31% in adults aged 19 to 64

years[21]. Similar data are available from the United States[22]. Moreover, a community based cross-sectional study in five schools in Udupi Taluk on 422 adolescent girls revealed that most adolescent girls had greatly insufficient intake of numerous micronutrients including iron and calcium[2]. Another study in an Australian university population showed that more than 70% of participants used at least one type of dietary supplement in the past 6 months[10].

The Belgian Food Consumption survey on the Belgian adult population showed that more than 10% of the study subjects used at least one of two 24-h dietary recall days[23,24]. In our study 44.9% of subjects reported that they used at least one type of dietary supplements from 10 different ones in recent 24 hours. Although some dietary supplements prescribing and using occurred during illness or injury[10], in our study the prevalence of

affecting diseases was low. Moreover, overuse of nutrient supplements may have negative results and inverse benefit. The uncontrolled mineral supplement use could cause neurological, gastrointestinal, liver and kidney toxicity[23].

Vitamin D deficiency was fourfold commoner in female students than in male students (72.1% versus 18.3%)[16]. Another study showed that prevalence of mild, moderate and severe vitamin D deficiency among adults of Isfahan was 19.6%, 23.9%, and 26.9% respectively and that it was more prevalent among females and youth[17]. Another study in Turkish girls showed mineral intakes less than two-thirds of the RDA in 26.8% compared to 59.1% in Spanish adolescent girls[14].

Adolescence is a critical period that causes major alterations in the human body including gaining 20% of their height and 50% of their weight and skeletal mass[12]. Therefore, the mineral consumption has a facilitator role in growth and metabolism[12,14], and vitamin intake is essential for growth and development of adolescents. However, a Cochrane review showed that mineral supplementation in young females, especially in low- to middle-income countries, before marriage and pregnancy, is important and could decrease the prevalence of low birth weight and preterm delivery[6].

Based on our results the weak perception of participants in our study about their health status and the low income level were significant factors that were the most important predictors of insufficient mineral use. Similar results were shown in other studies[11,19,25,26]. The Oner study in 704 adolescent Turkish girls showed that based on logistic regression analysis, low income level increases the mineral deficiency 2.4 fold[14]. In addition, the Barnes *et al* study in Australian university population showed that the common reasons for using of a specific dietary supplement were the general health status[10]. Our results also showed that the self-rated health is the most important predictor of dietary supplement consumption.

Despite some limitations in our study, this research elicited some important information regarding mineral consumption prevalence and the important factors related with insufficient intake of mineral. According to our results, educational programmes for improving the nutritional habits including consuming high-quality protein from meat and milk products, enough fruits and vegetables to maintain daily vitamin, mineral, and fibre requirements are needed and major changes are essential in health care that provided for adolescent girls and those proportion of unmarried high school girls. However, nutritional education is an effective factor to motivate adolescents in using healthy food choices. However, there is need for regular sensitizing nutritional programs at school, especially in girls' high school, to prevent reproductive related complications in their future life.

Conclusions
According to our results, the monthly dietary supplement consumption prevalence in Iranian high school girls is good, but the daily intake of mineral supplement is weak.

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