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The Prevalence and Predictors of Dietary Supplements Use among Female University Students in Tehran, Iran

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ABSTRACT

Background: Proper nutrition is essential for maintaining health, and supplements can help fulfill the need for essential nutrients. However, improper use of supplements may lead to some adverse effects. Determining the prevalence of dietary supplement (DS) usage and examining potential predictors of consumption among Iranian female university students in Tehran were the objectives of this study.

Methods: This cross-sectional study, conducted in 2023, involved 400 female students aged 18-32 years. Through self-administered questionnaires, this study evaluated body image (BI) discrepancy, nutritional knowledge (NK), weight management knowledge (WMK), DS use, and sociodemographic and health-related factors. A trained team observed the process. Anthropometric indices, including body mass index (BMI) and waist-to-height ratio (WHtR) were recorded.

Results: A total of 74.6% of participants used supplements in the past 3 months, with higher usage among medical students (79.1%). The commonly used supplements were vitamin D (71.3%) and iron (59.3%). Medical students had greater nutritional and weight management knowledge ($p<0.05$); but had more BI dissatisfaction compared with non-medicals students (28.5% vs. 41.3%). Logistic regression revealed that age ($p<0.001$, OR=1.39) and the NK score ($p<0.01$, OR=1.11) were positively associated with supplement use. Healthier diet ratings were correlated with lower supplement use ($p<0.01$).

Conclusion: University students, particularly those in medical fields, had a higher rate of DS use. Identifying the predictors of DS use is important for developing health education programs that address the benefits and risks and achieve better health outcomes.

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Introduction

A dietary supplement (DS) is defined as a product, excluding tobacco, intended to enhance the diet. It contains one or more dietary ingredients, such as vitamins, minerals, herbs or other botanicals, amino acids, and other substances or their components that can be taken by the mouth as a pill, capsule, tablet, or in liquid form (1). The consumption of dietary supplements has a growing trend worldwide; while the researches in Iran in 2017 indicated that DS market was at 60% of the global average that reveals a significant growth (2). Findings from the PERSIAN Guilan Cohort Study in Iran revealed that 25% of Iranian adults consumed DSs (3). Sotoudeh *et al.* (2015) reported that approximately 43.2% of medical interns aged 23-25 years at Tehran University in Tehran, Iran used supplements (4).

Similarly, a study among university students in Ardabil, Iran demonstrated a 66% prevalence of DS use (5). Individuals who preferred to use supplements probably had different lifestyle and socio-demographic characteristics when compared to non-users. For example, Sicinska *et al.* (2022) showed that some factors including gender, physical activity, body mass index (BMI), cigarette smoking and the presence of chronic diseases were associated with DS use in university students (6). Nutritional knowledge and being uncertain about proper access to food may be also other predictors of taking supplements (7).

While dietary supplements can address nutritional deficiencies and compensate for nutrient inadequacies (8), improper use may lead to adverse effects. These include interactions with medications or food, allergic reactions, heavy metal poisoning, reactions to contaminants, and toxicities, all of which can potentially endanger health status (9), particularly if consumed above the tolerable upper intake level (10). Given the widespread use of DSs in Iran and the lack of regulation over consumer purchases, there is a clear need for studies on consumption patterns and the factors influencing their use.

According to the fact that a higher percentage of women tend to use dietary supplements (11), this research can inform targeted health interventions and educational programs that can provide specific nutritional needs of women globally. We needed to highlight the reason why we chose only female students instead of both sexes in order to remove any biases related to hormonal interactions, such as menstruation in girls or specific preferences of boys in having a body shape with high muscular strength or endurance. We also excluded students who were professional athletes. So this study aimed to describe both the prevalence of dietary supplement use in this population and examine the DS usage in relation to demographic data, anthropometric measurements, health status, and some other nutritional factors. Additionally, the study compared the pattern of DS usage and the predictors between medical and non-medical subgroups of university students.

Materials and Methods

A cross-sectional study was conducted from April to December 2023 among female students aged 18-32 years at Islamic Azad University, Tehran Medical Sciences, Tehran, Iran. The sample size was determined based on the basis of the reported prevalence of supplement use (35%) among the Iranian population from a previous study (12). The following formula was used for calculation: $n=(Z_{1-\alpha/2})^2pq/d^2$ where: n was the minimum sample size, $Z_{1-\alpha/2}$ was the confidence interval constant at the 95th percentile confidence interval from a table for two-tailed study=1.96, *p* was the estimate of the prevalence of DS use, and d was the precision value (0.05). Therefore, a total of 364 cases were needed, but a larger sample size was used to account for potential sample losses. Pregnant or lactating subjects were not included in this study. Ultimately, data from 400 students met the necessary criteria for analysis. Before beginning the study, the participants were informed about its objectives and asked to complete a written consent form. All procedures involving research study participants were approved by the Committee of Islamic AZAD Tehran Medical Sciences University (IR.IAU.PS. REC.11402.011). This study was conducted according to the guidelines laid down in the Declaration of Helsinki.

This study was conducted through the completion of self-administered questionnaires and consisted of the following sections: (i) socio-demographic characteristics; (ii) health, anthropometric status and dietary evaluation; (iii) DS usage; (iv) body image; as well as (v) nutritional knowledge and weight management knowledge. Demographic data were age, field of study, marital status, employment status, and health-related characteristics. Anthropometric indices were BMI and waist-to-height ratio (WHtR). The students reported their usual weight and height, and BMI (kg/m²) was calculated by dividing weight by the square of height. By BMI justification, participants were classified as underweight (<18.5 kg/m²), normal-weight (18.5-24.9 kg/m²), overweight (25-29.9 kg/m²), or obese (≥30 kg/m²). Waist circumference was measured to the nearest 0.1 cm using a tape measure at the iliac crest's uppermost lateral border (13) by a trained team. Then, WHtR was calculated by

dividing waist circumference (cm) by height (cm), and a cutoff value of 0.5 was considered optimal (14, 15). Health questions provided data on the history of chronic diseases and medicine use. In one question, we asked the participants to rate their diet referred to as dietary self-evaluation (DSE) by evaluating its quality as unhealthy, moderately healthy, and unhealthy.

DS use was evaluated by the demand-induced strain compensation questionnaire (DiSQ) questionnaire from previous studies (16, 17). To ensure the clarity and accuracy of the original meaning, the questionnaire was first translated into Persian and then back-translated into English. Content validity was also assessed by an expert panel of five specialists in nutrition and pharmacology. The reliability of the Persian version of the questionnaire was tested via SPSS software, yielding a Cronbach's alpha of 0.94. The questionnaire asked about DS use over the last three months; while the list of supplements was multivitamin-mineral (MVM), B-complex or one of the B vitamins, other vitamins and minerals, omega-3 fatty acid, and probiotics. They were also asked to mention the names of the supplements that were not included in the list on the form. Each participant was required to specify the generic name of the supplement.

BI was determined by using a figure rating scale originally developed in 1983 (18). The scale features of nine schematic figures were numbered 1-9 that illustrated a range from underweight to overweight (Figure 1). Respondents were asked to choose their current and desired body sizes based on the figure. A discrepancy score was subsequently calculated by subtracting the desired body size score from the current body size score. A negative score showed that the individual perceived themselves as more overweight, whereas a positive score reflected that they perceived themselves as thinner than reality. A score of zero illustrated satisfaction with body size.

To evaluate nutritional knowledge, a 25-item questionnaire was employed. This questionnaire was adapted and modified from the Food and Nutrition Knowledge, Attitude, and Practice questionnaire, while its reliability was checked in a previous study (19). Thirteen questions were asked about food groups, four questions were requested about food function, two questions covered energy balance and the remaining questions were about general nutritional knowledge. Each question offered five possible answers (e.g., which of the following foods had the highest amount of fiber: a. fruits and vegetables; b. milk and dairy products; c. poultry and red meat; d. seafood; e. I do not know). Each question when answered correctly was given one point and incorrect answers received 0 point. The total score for this section was obtained by adding the points. The sum of the scores from correct answers classified nutritional knowledge into high, medium, and low categories based on tertiles.

Weight management knowledge was assessed using a 12-item inventory consisted of objective questions. This inventory was adapted and modified to suit the study's requirements (20). The questions were multiple-choices, each with only one correct answer. The participants received one point for each correct answer. Scores ranging from 0 to 6 points were classified as having a "low" level of knowledge; the scores ranged from 7 to 9 points indicated a "moderate" level of weight management knowledge, and scores ranged from 10 to 12 points were considered to represent a "high" level of weight management knowledge. The minimum acceptable value for Cronbach's alpha (0.7) was assigned to this questionnaire.

The collected data were organized and analyzed via the statistical software (SPSS Inc., version 25, Chicago, IL, USA). The data was presented as

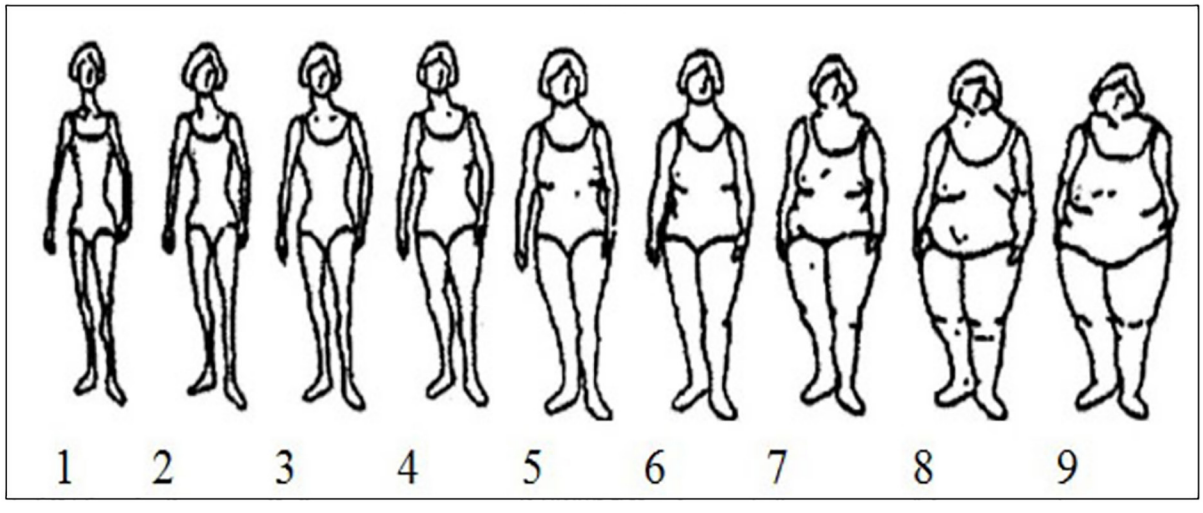

Figure 1: Figure rating scale. Reproduced with permission from Stunkard *et al.* "Use of the Danish Adoption Register for the study of obesity and thinness", Raven Press, 1983.

numbers and percentages, and comparisons were made between medical and nonmedical students via Chi-squared test. A binary logistic regression model was used to identify predictor variables for the consumption of dietary supplements, and odds ratio (OR) values were used to assess associations. Model fit was measured by the Hosmer–Lemeshow test. The statistical significance level was set as $p<0.05$.

Results

The mean age of all participants was 21.55±2.32 years. Although most medical and non-medical students fell into the youngest age tertile, a significant difference was observed between the two groups ($p<0.001$). Chronic diseases or medication use were reported by a small proportion of the subjects, with anemia and depression being the most frequently mentioned conditions. By BMI justification, the majority of the students in both categories had normal weight. However, 60.66% of all the students were at increased risk and the highest risk for chronic diseases based on their WHtR, leading to a significant difference between medical and non-medical students ($p<0.001$) (Table 1).

Figure 2 demonstrated the prevalence of supplement use among the students, revealing that 74.6% of the total participants occasionally or always used supplements. Medical students were more likely to use supplements than non-medical students (79.1% vs. 69.9%, $p=0.03$). The most frequently used supplements were vitamin D and iron. Additionally, 47.4% of the total students used multivitamin minerals, and 53.8% used B-group vitamins. The only significant difference was observed for vitamin E intake between the two groups ($p<0.05$).

In Table 2, the DSE data indicated that the majority of students from both groups categorized themselves as having a moderately healthy diet ($p>0.05$). However, the evaluations of NK and WMK among the students revealed significant differences between medical and non-medical students. Medical students demonstrated a greater level of knowledge of both nutritional and weight management information ($p<0.05$).

There was a significant difference between the two groups in terms of BID (Table 2). Body image dissatisfaction was higher among medical students than among non-medical students.

Table 1: Characteristics of study participants, and the association of dietary supplements use with demographic and anthropometric data (n=400).

Variable	Total	Medical students (n=202)	Non-medical students (n=198)	*p* value
Age				<0.001
18-22 years old	290 (72.5)	126 (62.1)	164 (83.2)	
23-27 years old	79 (19.8)	57 (28.1)	22 (11.2)	
28-32 years old	13 (3.3)	12 (5.9)	1 (0.5)	
Marital status				
Single/Divorced	363 (94.3)	184 (93.9)	179 (94.7)	0.72
Married	22 (5.7)	12 (6.1)	10 (5.3)	
Occupation				
Student	90 (23.6)	40 (20.6)	50 (26.6)	0.17
Having job	292 (76.4)	154 (79.4)	138 (73.4)	
Chronic disease				
Yes	28 (7.2)	15 (7.6)	3 (6.8)	0.76
No	360 (92.8)	182 (92.4)	178 (93.2)	
Medicine use				
Yes	44(11.3)	25(12.6)	19(9.9)	0.39
No	346(88.7)	173(87.4)	173(90.1)	
BMI status				0.97
Underweight	51 (12.9)	26 (13.1)	25 (12.8)	
Normal weight	254 (64.3)	126 (63.3)	128 (65.3)	
Overweight	68 (17.2)	36 (18.1)	32 (16.3)	
Obese	22 (5.6)	11 (5.5)	11 (5.6)	
WHtR status				<0.001
Healthy	133 (33.4)	98 (52.7)	35 (23.0)	
Increased risk	173 (51.2)	78 (41.9)	95 (62.5)	
Highest risk	32 (9.46)	10 (5.4)	22 (14.5)	

The data were presented as number (%) of respondents, Chi-squared test was recruited to determine the differences of supplement use between medical and non-medical students. The significance levels were considered $p<0.05$. BMI: Body mass index; WHtR: Waist to height ratio.

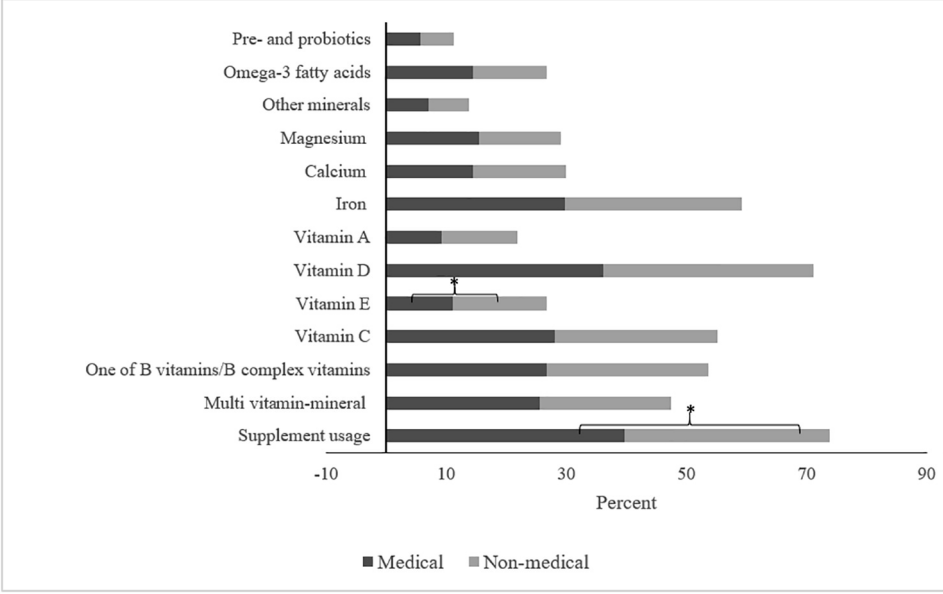

Figure 2: Prevalence of supplement use between medical and non-medical students (n=400). Chi-squared test was recruited to determine the differences of supplement use between medical and non-medical students. The significance levels were considered *p<0.05.

Table 2: Characteristics of study participants, and the association of dietary supplements use with nutritional knowledge and attitude of respondents (n=400).

Variable	Total	Medical students (n=202)	Non-medical students (n=198)	p value
DSE				0.20
Unhealthy	65 (16.5)	39 (19.4)	26 (13.5)	
Moderately Healthy	314 (79.7)	153 (76.1)	161 (83.4)	
Completely healthy	15 (3.8)	9 (4.5)	6 (3.1)	
NK level				<0.01
Low	8 (2.0)	1 (0.5)	7 (3.6)	
Medium	49 (12.3)	17 (8.5)	32 (16.2)	
High	341 (85.7)	183 (91.0)	158 (80.2)	
WMK				<0.001
Low	41 (10.4)	12 (6.0)	29 (14.9)	
Medium	212 (53.5)	93 (46.2)	119 (61.0)	
High	143 (36.1)	96 (47.8)	47 (24.1)	
BI discrepancy				
Satisfied	138 (34.8)	57 (28.5)	81 (41.3)	0.03
Desired to be fat	47 (11.9)	26 (13.0)	21 (10.7)	
Desired to be thin	211 (53.3)	117(58.5)	94 (48.0)	

The data were presented as number (%) of respondents for other categorical variables. Chi-squared test was recruited to determine the differences of categorical variables between medical and non-medical students. The significance levels were considered p<0.05. DSE: Diet self-evaluation; NK: Nutritional knowledge; WMK: Weight management knowledge; BI: Body image.

The levels of satisfaction were greater in non-medical group rather than medical group (41.3% vs. 28.5%). An adjusted binary logistic regression analysis was conducted to assess the influence of age, demographic variables, dietary supplement education (DSE), the NK score, weight management knowledge (WMK), anthropometric data, and BI discrepancy on supplement use among students (Table 3). The Hosmer and Lemeshow test for model 1 and model 2 were $\chi^2(8)=12.63$, $p=0.12$ and $\chi^2(8)=7.35$, $p=0.50$, respectively which indicated a good fit for both. The analysis revealed that both ages (p<0.001, OR=1.39, 95%CI [1.19–1.62]) and the NK score (p<0.01, OR=1.11, 95%CI [1.04–1.18]) were positively associated with the likelihood of supplement use. Ranking themselves to have unhealthy and moderately diet were the independent predictor for supplement used (p<0.01).

Table 3: The Binary logistic regression of dietary supplement use by socio-demographic, anthropometric and nutritional attitude determinants in university students (n=400).

Variable	Model 1		Model 2	
	p value	OR (95% CI) for B	*p* value	OR (95% CI) for B
Age	<0.001	1.36 (1.16-1.60)	<0.001	1.39 (1.19-1.62)
Married (yes)	0.27	0.51 (0.16-1.68)		
Occupation (yes)	0.08	0.58 (0.31-1.07)		
Chronic disease (yes)	0.81	0.82 (0.15-4.48)		
Medicine use (yes)	0.12	3.04 (0.74-12.49)		
BMI	0.17	1.06 (0.98-1.17)		
WHtR	0.55	0.33 (0.01-12.45)		
NK score	0.03	1.08 (0.01-1.17)	<0. 01	1.11 (1.04-1.18)
WMK	0.63	1.03 (0.90-1-1.18)		
BI discrepancy				
Satisfied	0.42			
Desired to be fat	0.19	1.60 (0.79-3.24)		
Desired to be thin	0.47	1.43 (0.53-3.85)		
DSE				
Unhealthy diet	<0.01		<0.01	
Moderately healthy diet	<0.01	3.06 (1.57-5.98)	<0.01	2.77 (1.48-5.17)
Completely healthy diet	0.143	3.44 (0.66-18.01)	0.15	3.66 (0.73-18.40)

BMI: Body mass index; WHtR: Waist to height ratio; DSE: Diet self-evaluation; NK: Nutritional knowledge; WMK: Weight management knowledge; BI: Body image OR: odds ratio; CI: confidence interval; Model 1: enter, Model 2: forward-conditional. The significance levels were considered $p<0.05$.

Discussion

Nutritional ingredients were demonstrated to have a pivotal role in health status (21-23). It seems that various dietary supplements in this relation can play a crucial role too (24-27). In general view, our findings suggested that WHtR may be a more sensitive measure for identifying health risks than BMI, with approximately 60% of respondents having WHtR above the cutoff point. As it was presented in the results, almost 77% of students had a BMI less than 25 kg/m^2. The WHtR was previously recognized as a significant anthropometric indicator of central adiposity (28). In an Iranian population, WHtR similarly showed the highest adjusted odds ratios among anthropometric indices for all risk factors and cardiovascular diseases (29). In line with our findings, another study on young female adults in Iran also found an average WHtR of 0.529±0.08, indicating a health burden from central adiposity in this population (30).

We focused on the differences in DS use between students in medical and non-medical fields, categorizing our questions by the type of supplement. Subsequently, we analyzed the data to determine odds ratios for variables that might predict DS use. Overall, medical students were more likely to use dietary supplements than non-medical students. These results were consistent with findings from Japanese college students in the medical and pharmaceutical fields (7). In our research, the high frequency of taking vitamin D and iron supplements can be attributed to widespread vitamin D insufficiency in the Iranian population (31), and a relatively high prevalence of iron deficiency among Iranian women (32). Similarly, iron was the most frequently used supplement among Iranian female university students (22.8%) in a previous study (5). Mahdavi-Roshan *et al.* (2021) also indicated that calcium/vitamin D, ferrous sulfate, and vitamin D were commonly used among Iranian adults aged 35 and older (3).

Concerning dietary and nutritional knowledge and attitudes, significant differences were observed between the two groups. More than 90% of medical students (vs. 80% of non-medicals) had high scores in NK, and nearly half of them (vs. one quarter of non-medicals) achieved high scores in WMK, that was possibly influenced by the relevant university courses or personal interests in the medical field. All students, particularly medical ones, reported dissatisfaction about their BI. It is clear that this issue is widespread among youth globally (33, 34), and is also a concern among young adults in Iran, where most individuals selected the thinnest figure as their ideal body image (35). Rafati *et al.* also reported a high prevalence of body dissatisfaction among medical students, influenced by social media platforms such as Instagram, which promoted thinness and the internalization of beauty ideals (36).

Regarding certain predictors for DS use, our study

revealed that older age, higher NK scores, and dietary self-evaluating were independent predictors for DS use. The association between older age and DS use aligned with the findings of previous studies (3, 37). Other studies have shown a relationship between higher academic education and greater literacy with DS use (38, 39). We believe that higher NK scores reflect greater health literacy, which can predict increased supplement intake. The literature review revealed that believing in having a healthy diet had not been previously investigated with this term. However, positive predictors of supplement use were highly adhered to the Mediterranean dietary pattern (p<0.001) and nutrient adequacy score (p<0.01) in a previous work (40). Their findings were in contrast with ours since our respondents with an unhealthy or relatively healthy diet tended to use supplements more frequently.

Like other studies, there were limitations in our work that needed to be addressed. First, since the participants were from a single university in Iran's capital city, the findings may not accurately reflect the broader population of university students. Second, there were no gender differences, so as we described earlier the influence of the presence of gender distinctions was deliberately avoided. Additionally, the cross-sectional design of the study restricted our ability to determine causal relationships.

Conclusion

Current work provided some new insights into the prevalence and predictors of dietary supplement (DS) use among female university students in Iran. It highlighted the importance of recruiting multi-anthropometric measuring in assessing health risks of the young female population. This study demonstrated that medical students were more likely to use DSs, with vitamin D and iron being the most commonly used supplements in this population. This study showed the impact of nutritional knowledge and self-assessment of diet quality on supplement consumption too. This research has also revealed some trends and behaviors associated with supplement use. So our findings may empower women globally with the knowledge to make informed health choices, ultimately contributing to better overall well-being.

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Authors' Contribution

MSMQ: Designing research plan, managing the implementation of the research; SMT: Data collection; SMT and MSMQ: Data analysis, MSMQ and MSH: Executive coordination and writing article. All authors reviewed and confirmed the manuscript.

Conflict of Interest

The authors declare no conflicts of interest.

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