Prevalence of Iron-Deficiency Anemia and its Associated Risk Factors in Female Undergraduate Students at Prince Sultan Military College of Health Sciences

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Abstract:

OBJECTIVES: This study’s objectives are to (1) determine the current prevalence of iron-deficiency anemia (IDA) and risk factors for female college students at Prince Sultan Military College of Health Sciences (PSMCHS) in the Eastern Province of Saudi Arabia and (2) address the gap in the current literature. A written survey in both Arabic and English was administrated to 214 female students, and only 201 students completed the survey. It was randomly selected from all registered female students. A number of factors possibly associated with IDA were examined using the Chi-square test.

CONTEXT: Globally, iron deficiency is known to be the most common nutritional disorder. About 30% of the world’s population are iron deficient (ID). Women seem to be more affected with IDA than men, which constitute an epidemic public health issue.

AIMS: The aim of the study was to determine the prevalence of IDA and the risk factors among healthy Saudi undergraduate female college students studying at PSMCHS in Dhahran.

SETTINGS AND DESIGN: A cross-sectional study on 201 female students (18–25 years) was conducted between January and March 2019.

SUBJECTS AND METHODS: A questionnaire which contains sociodemographic data was completed by each participant. Two blood samples were collected from each participant to estimate the iron profile and to analyze the complete blood counts.

STATISTICAL ANALYSIS: The statistical analysis was carried out using the Statistical Packages for the Social Sciences software.

RESULTS: The overall prevalence of IDA was 35.3%. The questionnaire analysis of the dietary habit and clinical characteristics revealed that family history of hereditary disease and physical activity have a significant effect on the development of IDA. Statistical analysis showed that having breakfast regularly significantly reduced the development of IDA compared with irregularly having breakfast.

CONCLUSIONS: The prevalence of IDA in this study was moderately high, and our results suggest that further education regarding IDA is highly encouraged. This is the first study that demonstrated the prevalence and risk factors of IDA among undergraduate female college students in PSMCHS, and the data generated will provide a database for further studies.

Keywords:
Eastern Province, iron-deficiency anemia, prevalence, Prince Sultan Military College of Health Sciences, risk factors, Saudi Arabia

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Introduction

Iron deficiency is known to be the most common nutritional disorder that affects both developing and developed countries with a major impact on human health.\[1,2\] About 30% of the world’s population are iron deficient (ID), and women seem to be more affected with iron-deficiency anemia (IDA) than men. Therefore, IDA should be regarded as a chronic progressive condition that is mostly undetected and lacks efficient treatment.\[3\] The prevalence of anemia among women of childbearing age is 30.2%, and anemia is highly prevalent in Africa (47.5%) and in Southeast Asia (35.7%). Moreover, there is a high prevalence of anemia in Saudi Arabia according to a World Health Organization (WHO) report that affects mainly women of childbearing age.\[4,5\]

College students who suffer from IDA may complain of poor mental performance, which will negatively affect learning, educational achievement, and lifelong effects. In addition to these reasons and lack of information on IDA prevalence and its risk factors, we aimed to determine the prevalence of IDA and evaluate its risk factors among undergraduate female students at Prince Sultan Military College of Health Sciences (PSMCHS), Dhahran, Saudi Arabia.

The purpose of this primary data analysis is to estimate the prevalence and risk factors of IDA in female undergraduate students at PSMCHS.

Subjects and Methods

This research is a cross-sectional study that investigated 201 healthy apparent female undergraduate students at PSMCHS, Dhahran, Saudi Arabia. The study was approved by the Research and Ethics Committee of PSMCHS. The study population were enrolled between January 2019 and March 2019. All students were selected by random sampling at PSMCHS. A questionnaire was completed from each student regarding the participants’ personal sociodemographic data (e.g., their age, marital status, and monthly household income); dietary information relating to their intakes of iron-rich foods and of iron absorption-inhibiting or absorption-enhancing foods, and whether or not they followed particular dietary regimens; their obstetric and gynecological history (i.e., their menstrual history, including its frequency and duration; their usual menstrual flow during their cycle; whether or not they encountered blood clotting; and their number of children and the birth intervals between them); any current or past diagnoses of medical conditions (e.g., chronic diseases, blood disorders, or blood transfusions); and their personal and family histories of IDA. All participants recruited into the study were asked to complete and sign an informed consent form agreeing to participate in the study after the purpose of study was explained to them. Pregnant or breastfeeding women; those who were taking medication or nutritional supplement; and females with menorrhagia, chronic disease, and hemoglobinopathies were excluded from the study.

Two blood samples were collected from each participant. One sample was collected in plain tube to estimate iron profile including iron level, ferritin, and Total iron binding capacity (TIBC), using biochemical analyzer (SIEMENS Dimension RXL MAX). The second sample was collected in a vacutainer ethylenediaminetetraacetic acid (EDTA) tube. The EDTA sample was analyzed for blood counts by the Cell-DYN Sapphire automated blood cell counter. Hemoglobin (Hb) fractions were identified and quantified by high-performance liquid chromatography using the TOSOH G8 analyzer (Japan) to exclude thalassemia patients and abnormal Hbs.

Based on the WHO guidelines, female students who measured Hb <12.0 g/dl, serum ferritin <15 µg/L, serum iron <10 µmol/L, and TIBC ≥68 µmol/L were defined as IDA.\[6\]

The data analyses were performed using the Statistical Packages for the Social Sciences version 20, IBM Corp, Armonk, NY, USA. Both descriptive and inferential statistics had been conducted.

All categorical data had been presented as numbers and percentages, whereas continuous data had been summarized as mean ± standard deviation (SD). The Chi-square tests had been conducted for the relationship between independent variables against dependent variable. A method for correlation was performed using the independent t-test (parametric) and Mann–Whitney U-test (nonparametric). A univariate logistic regression analysis had been presented as well for the likelihood ratio of independent variables against dependent variable where odds ratio and 95% confidence interval were also being reported. Normality test for the distribution of continuous data versus dependent variable had been conducted using the Kolmogorov–Smirnov and Shapiro–Wilk tests.

Results

We have distributed 485 questionnaires to the targeted students; of the 485 students, 215 were returned as some of them refused to participate giving an overall response rate of 44.3%. Of the 215 participants, 14 of them were having sickle cell trait and identified as for exclusion criteria. The remaining 201 participants were the total sample size for this study.
Table 1 presents the baseline characteristics of participants. Age range was from 18 to 25 years, of whom majority was 20–22-year-old group (45.3%). First-year level was more (35.8%), followed by 4th year (26.9%), 3rd year (21.9%), and 2nd year (15 Abundant.4%). 94% of participants were single (not married), and most of them had a sufficient monthly income. Many parents of the participants are highly educated (45.3%), followed by secondary education (41.8%), and the rest are either basic or no education. There were 29.4% of them who were conscious of anemia, and 20.4% of them had a family history of hereditary diseases. Considering the menstrual cycle, the majority of participants (82.1%) reported moderate flow, and relatively few participants (06.0%) indicated a heavy flow or menorrhagia. Based on this method, the diagnosis of menorrhagia is made if the menstrual period lasts for more than 7 days/ cycle.[7] Moreover, there were 23.4% of the students who were taking iron supplements where they drink either Vitamin C or other mixed supplements. When being asked about general health status, 10 students reported that they were smokers, 29.4% were performing regular physical activities, and 7 students had experienced blood transfusion.

Figure 1 depicts the regular food consumption of participants. The most common food being ascertained was chicken (90.0%), followed by fruits (88.6%) and white bread (83.6%), and the least of them was red bread (53.2%).

The most common mental well-being was delay of sleep (46.3%), followed by hair loss (38.8%) and lack of concentration (32.8%), and the least of them was amblyopia (1%) [Figure 2].

Figure 3 shows the prevalence of IDA. Based on the given criteria, there were 71 (35.3%) identified to be anemic and 130 (64.7%) identified to be normal (nonanemic).

The dietary habit and clinical characteristics of participants are elaborated in Table 2. Many students are in adherence to regular breakfast (61.2%), and tea and other mixed drinks were mostly consummated. There were 75.1% of them who have regular tea consumption per week where they usually drink it after the meal. Three out of four students have regular coffee drink per week where it was usually done after or before the meal, whereas more than 60% of them have regular cola intake where they usually drink it during the meal. The

**Table 1: Baseline characteristics of participants (n=201)**

| Study data                                      | n (%) |
|------------------------------------------------|-------|
| Age group (years)                              |       |
| <20                                            | 50 (24.9) |
| 20-22                                          | 91 (45.3) |
| >22                                            | 60 (29.8) |
| Academic year level                            |       |
| First year                                     | 72 (35.8) |
| Second year                                    | 31 (15.4) |
| Third year                                     | 44 (21.9) |
| Fourth year                                    | 54 (26.9) |
| Marital status                                 |       |
| Single                                         | 189 (94.0) |
| Married                                        | 12 (06.0) |
| Educational level of parents                   |       |
| Nothing                                        | 4 (02.0) |
| Basic                                          | 22 (10.9) |
| Secondary                                      | 84 (41.8) |
| University                                     | 91 (45.3) |
| Economic situation                             |       |
| Low (<5000)                                    | 13 (06.5) |
| Good (5000-20,000)                             | 129 (64.2) |
| Very good (>20,000)                            | 59 (29.3) |
| Afraid of anemia                               |       |
| Yes                                            | 59 (29.4) |
| No                                             | 142 (70.6) |
| Family history of hereditary diseases          |       |
| Yes                                            | 41 (20.4) |
| No                                             | 160 (79.6) |
| Amount of menstrual cycle                      |       |
| Little                                         | 24 (11.9) |
| Medium                                         | 165 (82.1) |
| Heavy                                          | 12 (06.0) |
| Taking medication                              |       |
| Yes                                            | 47 (23.4) |
| No                                             | 154 (76.6) |
| Type of medication†                            |       |
| Vitamin C                                      | 11 (23.4) |
| Others                                         | 36 (76.6) |
| Smoking                                        |       |
| Yes                                            | 10 (05.0) |
| No                                             | 191 (95.0) |
| Physical activity                              |       |
| Yes                                            | 59 (29.4) |
| No                                             | 142 (70.6) |
| Blood transfusion                              |       |
| Yes                                            | 7 (03.5) |
| No                                             | 194 (96.5) |

†Only those who are taking medication are included in the analysis
mean (SD) of the clinical characteristics of participants such as red blood cell (RBC), Hb, hematocrit (HCT), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), MCH concentration (MCHC), red cell distribution width (RDW), ferritin, iron, and TIBC is deemed inclusive in the normal range based on the given criteria for normal and anemic values.

We used the Chi-square test to evaluate the relationship between IDA and nonanemic among baseline characteristics of participants [Table 3]. Based on the results, those without having family history of hereditary diseases such as thalassemia, IDA, and sickle cell disease are likely to decrease the chance of having IDA (unadjusted odds ratio Unadjusted Odds Ratio [UOR] = 0.4, \( P = 0.006 \)) compared to the other group, whereas those without physical activity are likely to decrease the chance of having IDA as opposed to those with having exercise (UOR = 0.5, \( P = 0.020 \)). Other variables included in the test were not a significant factor of IDA.

When comparing dietary habits and clinical characteristics of participants against anemic and nonanemic group, we found that the chance of having anemia was less for those participants who were eating regular breakfast (UOR = 0.5, \( P = 0.024 \)) compared to the opposite group (not regular). Other dietary variables were found to have no statistical differences in the anemic group.

In the clinical characteristics of participants, it was revealed that clinical parameters such as Hemoglobin (HB) (UOR = 5.2, \( P < 0.001 \)), HCT (UOR = 1.4, \( P < 0.001 \)), MCV (UOR = 1.2, \( P < 0.001 \)), MCH (UOR = 1.6, \( P < 0.001 \)), MCHC (UOR = 1.5, \( P = 0.001 \)), ferritin (UOR = 1.3, \( P < 0.001 \)), and iron (UOR = 1.2, \( P < 0.001 \)) are significantly lower than the nonanemic group, whereas RDW (UOR = 0.3, \( P < 0.001 \)) and TIBC (UOR = 0.8 \( P < 0.001 \)) are significantly higher than the nonanemic group. Only RBC revealed to have no significant effect on the anemic group [Table 4].
When we assessed the relationship between IDA among the type of food and the associated health diseases, a statistically significant difference was found between frequent consumption of eggs and IDA ($P = 0.024$) where participants with IDA are significantly less compared to the nonanemic group. With regard to the associated diseases, stomach ulcer ($P = 0.042$), indigestion ($P = 0.033$), and hemicrania ($P = 0.044$) were all found to have a significant relationship with IDA where those students with IDA are significantly lower compared to the nonanemic group. Other variables included in the test were having no significant relationship to IDA [Table 5].

**Discussion**

IDA has been regarded as the underdiagnosed and underappreciated women’s health concerns which affect women of all ages.$^{[8]}$ In this study, the prevalence of IDA was moderately high (35.3%). In Saudi Arabia, this finding is consistent from the study published by AlSheikh, Alsawi et al. as well as Almallki et al. where articles reported a prevalence of IDA consisting of 38.3%, 41.6%, and 43.5%, respectively.$^{[9,10]}$ Arguably, according to the study by Alzaheb and Al-Amer, conducted in n=200 female students to estimate the prevalence of IDA and its associated factors, only 12.5% were diagnosed with IDA. This rate is considered the lowest prevalence of IDA in a particular region of Saudi Arabia (Tabuk, Western region). Whereas, according to the study by Al Hassan in another city of the same region (Medina, Western region, Saudi Arabia), the prevalence of anemia in female students was relatively high (64%).$^{[11,12]}$ In abroad, the incidence of anemia had also been reported from different published articles.$^{[6,14-17]}$

The present study identified 20–22 years’ age group as the age group with the highest incidence of IDA (35.3%) among college students. This report had also been ascertained by Al-Alimi et al., and they reported that 64.3% of the males and 54.9% of the females in the age group of 20–22 years were identified as anemic.$^{[6]}$ This report has been corroborated by Shill et al., and they accounted that 43.4% of students in the same age group were classified as being anemic which was in congruent from the findings of our study.$^{[16]}$ However, it is contrary to the report published in Jordan and China.$^{[14,17]}$ In Jordan, they reported that the prevalence of anemia was higher at the age range of 40–49 years.$^{[14]}$ Whereas in China, the incidence of anemia was significant at 6–12 months.$^{[17]}$

IDA occurs when your body does not contain sufficient iron to yield Hb.
Table 4: Comparison between iron-deficiency anemia among dietary habits and clinical characteristics of participants

| Parameters                      | IDA (n=71) | Nonanemic (n=130) | UOR (95% CI) | P*  |
|--------------------------------|------------|-------------------|--------------|-----|
| Dietary habit, n (%)           |            |                   |              |     |
| Are you eating breakfast?      |            |                   |              |     |
| Regular                        | 36 (50.7)  | 87 (66.9)         | Reference    | 0.024** |
| Irregular                      | 35 (49.3)  | 43 (33.1)         | 0.5 (0.3-0.9)   | 0.648 |
| Tea intake per week a          |            |                   |              |     |
| Yes                            | 52 (73.2)  | 99 (76.2)         | Reference    | 0.946 |
| No                             | 19 (26.8)  | 31 (23.8)         | 1.2 (0.6-2.3)  |     |
| Coffee intake per week a       |            |                   |              |     |
| Yes                            | 56 (78.9)  | 102 (78.5)        | Reference    | 0.216 |
| No                             | 15 (21.1)  | 26 (21.5)         | 0.9 (0.5-1.9)  |     |
| Cola intake per week a         |            |                   |              |     |
| Yes                            | 39 (54.9)  | 83 (63.8)         | Reference    | 0.216 |
| No                             | 32 (45.1)  | 47 (36.2)         | 1.4 (0.8-2.6)  |     |
| Clinical characteristics, mean±SD|        |                   |              |     |
| RBC (106/µl)                   | 4.6±0.4    | 4.5±0.4           | 0.5 (0.2-1.0)  | 0.053 |
| HBG (g/dl)                     | 11.4±1.1   | 12.7±0.8          | 4.4 (2.8-6.8)  | <0.001** |
| HCT (%)                        | 36.2±2.6   | 39.1±2.9          | 1.4 (1.3-1.6)  | <0.001** |
| MCV (fl)                       | 79.4±7.9   | 87.8±5.2          | 1.2 (1.1-1.3)  | <0.001** |
| MCH (pg)                       | 25.1±3.3   | 28.5±2.4          | 1.6 (1.4-1.8)  | <0.001** |
| MCHC (g/dl)                    | 31.5±1.8   | 32.4±2.0          | 1.4 (1.2-1.8)  | 0.003** |
| RDW (%)                        | 14.3±2.1   | 12.3±0.9          | 0.3 (0.2-0.5)  | <0.001** |
| Ferritin (µg/L)                | 8.2±3.9    | 28.8±24.4         | 1.3 (1.2-1.5)  | <0.001** |
| Iron (µmol/L)                  | 7.5±6.1    | 13.7±7.8          | 1.3 (1.2-1.5)  | <0.001** |
| TIBC (µmol/L)                  | 73.0±5.9   | 60.1±9.6          | 0.8 (0.7-0.8)  | <0.001** |

*P value has been calculated using Chi-square test; aP value has been calculated using independent t-test; bP value has been calculated using Mann-Whitney U-test; **Significant at P≤0.05 level. IDA=Iron-deficiency anemia; UOR=Unadjusted odds ratio; CI=Confidence interval; SD=Standard deviation; RBC=Red blood cell count; HBG=Hemoglobin; HCT=Hematocrit; MCV=Mean corpuscular volume; MCH=Mean corpuscular hemoglobin; MCHC=MCH concentration; RDW=Red cell distribution width; TIBC=Total iron-binding capacity.

Food is necessary to prevent IDA. In this study, the most common food intakes by the students are chicken, fruits, and white bread, whereas the least of them was red bread. Alswailem et al. reported that the most common foods of the female participants were red meat and fish.[11] This has been further validated from the study published by Alzaheb and Al-Amer which indicated that the university students used to eat meat and fish at least two times per week.[13] Furthermore, both previous studies reported citrus consumption for at least two times per week.[13] Finally, both previous studies reported citrus consumption for at least two times per week. In nearby country, Al-Alimi et al. exemplified that vegetables, fruits, red meat, fish, and chicken were the most common foods of the students, with an average consumption of 2–3 times per week.[6]

Eating regular breakfast is an important activity before doing any of the daily routines as breakfast contributes about one-third of the nutritional needs during the day, which is quite substantial and that the chance to be anemic is relatively small. Students who eat regular breakfast can strengthen attentiveness and make it easier for them to adapt knowledge. In this article, we further validated that those students who eat regular breakfast are likely less to be anemic compared to those students who eat irregularly. This finding has been further corroborated by Andiarna. She reported that breakfast habits have an influence on the incidence of anemia. Teenagers who do not eat breakfast had a risk of anemia by 1.2 times as opposed to those who eat breakfast regularly.[18] In India, Kannan and Ivan mentioned that there was an evidence to suggest that regular breakfast intake will improve the cognitive function and have positive impact on the health of children and young adults.[15]

Furthermore, we found that physical activity has a significant relationship with IDA. This finding is corroborated from the blog posted by Rosen. Based on her assessment, athletes require more iron than the general population as they are more exerting so much effort which resulted to losing iron in the body. High-intensity training increases iron losses by as much as 70% as opposed to typical populations. Heavy sweating causes to lose more iron. RBCs also break down more quickly in those who exercise. The mechanical force of a footstrike during endurance running, for example, can increase the destruction of RBCs in the feet, leading to a shorter RBC life span.[19]

Female athletes are even more prone to iron deficiency as compared to males because of regular menstruation which causes them blood loss. Due to inadequate dietary intake of iron, athletes may also be at risk for iron deficiency. Remember, the body is not very effective at absorbing dietary iron. Players, specifically menstruating...
Table 5: Relationship between iron-deficiency anemia among type of food and associated health diseases of participants

| Factor                        | Yes (%) | P       |
|-------------------------------|---------|---------|
|                               | IDA (n=71) | Nonanemic (n=130) |
| Type of food, n (%)           |         |         |
| Red meat                      | 56 (35.9) | 100 (64.1) | 0.751 |
| Chicken                       | 63 (34.8) | 118 (65.2) | 0.645 |
| Fish                          | 48 (33.1) | 97 (66.9)  | 0.289 |
| Eggs                          | 52 (31.7) | 112 (68.3) | 0.024** |
| Fruits                        | 61 (34.3) | 117 (65.7) | 0.385 |
| Vegetables                    | 58 (34.9) | 108 (65.1) | 0.804 |
| Legumes                       | 50 (37.0) | 85 (63.0)  | 0.467 |
| White bread                   | 60 (35.7) | 108 (64.3) | 0.794 |
| Red bread                     | 37 (34.6) | 70 (65.4)  | 0.814 |
| Associated health diseases, n (%) |         |         |
| Stomach ulcer                 | 4 (16.7)  | 20 (83.3)  | 0.042** |
| Delay of sleep                | 32 (34.4) | 61 (65.6)  | 0.801 |
| Skin decay                    | 6 (54.5)  | 5 (45.5)   | 0.170 |
| Dizziness                     | 13 (39.4) | 20 (60.6)  | 0.593 |
| Anorexia                      | 8 (47.1)  | 9 (52.9)   | 0.290 |
| Dyspea                        | 4 (28.6)  | 10 (71.4)  | 0.584 |
| Fatigue                       | 22 (35.5) | 40 (64.5)  | 0.975 |
| Depression                    | 13 (38.2) | 21 (61.8)  | 0.697 |
| Indigestion                   | 3 (14.3)  | 18 (85.7)  | 0.033** |
| Hair loss                     | 26 (33.3) | 52 (66.7)  | 0.638 |
| Onychorrhexis                 | 20 (35.7) | 36 (64.3)  | 0.943 |
| Lack of concentration         | 22 (33.3) | 44 (66.7)  | 0.680 |
| Tension                       | 20 (42.6) | 27 (57.4)  | 0.236 |
| Tachycardia                   | 7 (33.3)  | 14 (66.7)  | 0.840 |
| Amblyopia                     | 1 (50.0)  | 1 (50.0)   | 0.663 |
| Tinnitus aurium               | 5 (38.5)  | 8 (61.5)   | 0.807 |
| Hemicrania                    | 1 (08.3)  | 11 (91.7)  | 0.044** |
| Disease with bleeding         | 2 (20.0)  | 8 (80.0)   | 0.298 |

1P value has been calculated using Chi-square test; **Significant at P≤0.05 level. IDA=Iron-deficiency anemia

female endurance competitors, need to be carefully mindful of iron intake in order to meet their bodies’ demands. Those following a strict vegetarian or vegan diet can be at even higher risk for iron deficiency due to the decreased absorption of nonheme iron found in plants and fortified foods. Alaufyte et al. further noted that the majority of research studies support the hypothesis of the beneficial effect of dietary iron interventions on the balance of iron in iron-depleted female athletes. However, the direct impact on exercise performance among female athletes is unclear. Nevertheless, there seems to be evidence that dietary iron interventions may assist in maintaining iron status in female athletes, especially during intensive training and competition regimens.

Moreover, we also detected that family history of hereditary diseases is significantly related to IDA. Based on our observation, no other articles investigated whether the family history of hereditary diseases has

linked to IDA, and since this result is substantial, we, therefore, viewed that this finding can shed more light in the phenomena of the diseases.

When we assessed the independent significant factors of IDA, we determined that family history of hereditary diseases, physical activity, having breakfast, Hb, HCT, MCV, MCH, MCHC, RDW, ferritin, iron, and TIBC were all the independent significant factors of IDA. We further compared the mean of each clinical parameter, and we are certain that Hb, HCT, MCV, MCH, MCHC, iron, and ferritin were significantly lower than the nonanemic group, whereas RDW and TIBC were significantly higher than the nonanemic group. In Saudi Arabia, the most common significant factors of anemia were inadequate iron, Vitamin C intakes, low consumption of red meat, and family history of IDA[11,15] whereas in abroad, the most common significant factors being ascertained were regular or irregular breakfast, infrequent consumption of vegetables/fruits, meat, fish, chicken, tea drinking, low household income, smoking, bleeding disorder, gender, Hb, WBC, RBC, platelet, packed cell volume, MCV, MCH, and MCHC[6,15,16]. Interestingly, in China, they reported that regions, cesarean delivery, premature birth, and neonatal asphyxia were concomitant to anemia.[17]

We also evaluated the relationship between IDA among the type of food and the associated diseases of students where we found that there is a significant relationship between frequent eating of eggs and IDA where those who eat regular eggs are significantly more being nonanemic. Thus, this finding suggests that frequent consumption of eggs was effective in preventing IDA. Considering country comparison, studies in Yemen reported that rare consumption of vegetables, fruits, meat, fish, chicken, tea, smoking as well as the low family income are essential factors leading to IDA.[6]. While the studies from Bangladesh confirmed the fact that the consumption of vegetables, fruits, meat, fish, chicken are positive indicators of iron-deficient nonanemic.[16] On the other hand, diseases such as stomach ulcer, indigestion, and hemicrania are detected to have significant association with IDA where those who eat regular eggs are significantly more being nonanemic. Interestingly, in China, they reported that regions, cesarean delivery, premature birth, and neonatal asphyxia were concomitant to anemia.[17]

Conclusions

The prevalence of IDA in this study was moderately high. The most frequent food intake was chicken, fruits,
and white bread. We further discovered that the risk of anemia is less for those participants who were eating breakfast regularly. In this regard, further education regarding the IDA is highly encouraged. Faculties have a significant role in educating the students regarding the phenomena of the disease. Encouragement such as eating breakfast regularly, consuming food rich in iron, and taking iron supplement can decrease the prevalence of IDA. This is the first study that demonstrated the prevalence and risk factors of IDA among undergraduate female college students in PSMCHS, and the data generated will provide a database for further studies.

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Conflicts of interest
There are no conflicts of interest.

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