



## Original Article

# The prevalence of iron deficiency anemia in a Saudi University female students



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## ABSTRACT

The study aims to determine the prevalence of anemia in apparently healthy university female students. This study was conducted in 2007–2008 at Taibah University and a total of 268 female students participated in this research. In order to assess iron deficiency and iron deficiency anemia, the venous blood samples were collected from consecutive female students at the medical center of Taibah University excluding those already on iron supplementation for iron-deficiency anemia. One hundred and seventy-one (64%) students were found to be anemic. The overall prevalence of mild (10–11 g/dL), moderate (7–10 g/dL), and severe (Hb <7 g/dL) anemia was 45%, 49%, and 6%, respectively. Out of the anemic students, 81% showed microcytic (MCV <80 fL) and 1.6% had macrocytic (MCV >96 fL) variety. The results of this study warrant further evidence-based surveys on a larger scale to validate these findings and eventually set a stage to develop well-organized educational and nutritional programs to safeguard and improve the nation's health. The high prevalence of iron deficiency anemia in the present study might be related to life style of female students as well as to their dietary habits. It is recommended that female students never skip breakfast as it is essential for their cognitive functions and physical activities.

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## 1. Introduction

Nutritional anemia occurs due to insufficient intake of nutrients by cells. Among the most important nutrients whose deficiency can lead to nutritional anemia are iron, folic acid, vitamin B12, vitamin B6, vitamin C and protein. Iron deficiency anemia is one of the most frequent health problems in the world [1]. The World Health Organization recently reported that 1.62 billion of the world population is anemic. The rate among students is 25.4% and in preschool age children anemia reaches its highest percentage of 47.4 [2]. Iron deficiency anemia accounts for 75% of all types of anemia in the third world, affecting 30% of population [3]. In females of childbearing age, the most

frequent cause of iron-deficiency anemia is loss of iron in blood due to significant menstruation or pregnancy. Iron-deficiency anemia can also be caused by a poor diet or by certain intestinal diseases that affect how the body absorbs iron. The condition is normally treated with iron supplements.

Literature about anemia in adolescents and youth is scarce, as compared to that focusing on women and children. In Saudi Arabia the overall country prevalence of iron deficiency anemia was 30–56% [4]. A cross-sectional study conducted in Riyadh City among schoolgirls showed that the prevalence was 40.5% among female adolescents (16–18) years old [5].

The current study is an attempt to present a glimpse of prevalence of iron deficiency anemia in the Saudi female students of Taibah University Almadinah Almunawwarah Saudi Arabia. The clinical associations of iron deficiency anemia are discussed with a view to highlight the need for

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the establishment of a national level program to overcome the nutritional deficiencies of the Saudi nation.

**2. Materials and methods**

During this cross-sectional observational study done through year 2007–2008, the hemoglobin levels of the apparently healthy female students of medicine, science, and education colleges of Taibah University Almadinah Almunawwarah Saudi Arabia were analyzed. A written informed consent was taken from all the participants entailing the purpose of the investigation and ensuring the confidentiality of the results. The venous blood samples were collected from consecutive female students at the medical center of Taibah University excluding those already on iron supplementation for iron-deficiency anemia. The results were produced from venous blood samples collected in 3 ml EDTA vacuum tubes (Becton Dickenson, USA) and were tested by the laboratory technologist using the semi-automated Medonic CA 620 hematology analyzer (Adolphsberg Svagen, Sweden). The cut-off value for the determination of anemia was defined as blood Hb concentration <12 g/dL [6]. The analysis was done on day-to-day basis and the results were saved in excel sheets for further analysis.

A secondary analysis of those found to be anemic was carried out including hematocrit (Hct), mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and mean corpuscular hemoglobin concentration (MCHC). The severity of anemia was classified into three stages: mild (10–11 g/dL), moderate (7–10 g/dL), or severe (Hb <7 g/dL). On the basis of RBC indices, an anemia with MCV <80 fL was classified as microcytic, an MCV >96fL as macrocytic and an MCH <27 pg for hypochromic anemia. The data was stored and analyzed on Microsoft Excel 2007.

**3. Results**

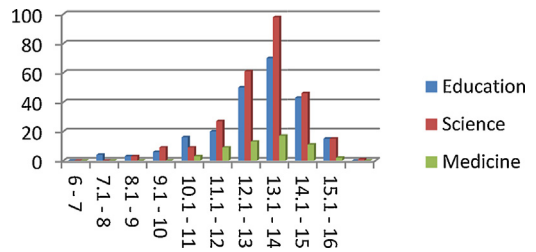
A total of 268 female students were incorporated in this research; age range 20–31 years with a mean of 24.5 years. One hundred and seventy-one (64%) students were found to be anemic (Table 1 and Fig. 1). The mean Hb concentration for the study sample was 9.8 ± 7 g/dL with a range from 5.7 to 17.4 g/dL. Forty-one percent students from the education college, 40% from the science college and 39% from the medical college were reported to have hemoglobin less than 12 g/dL (Figs. 2–7). The overall prevalence of mild (10–11 g/dL), moderate (7–10 g/dL), and severe (Hb <7 g/dL) anemia was 45%, 49%, and 6%, respectively.

The distribution of anemia among the investigated population is also illustrated in Figs. 3, 5 and 7 which show that

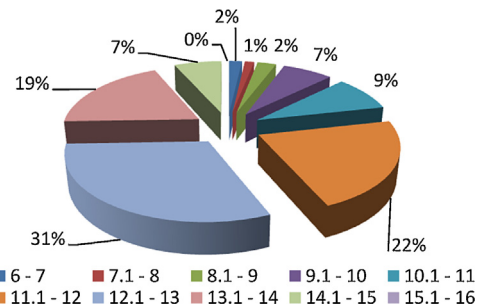
**Table 1**

Shows the pre-treatment and post-treatment hemoglobin levels in the study group.

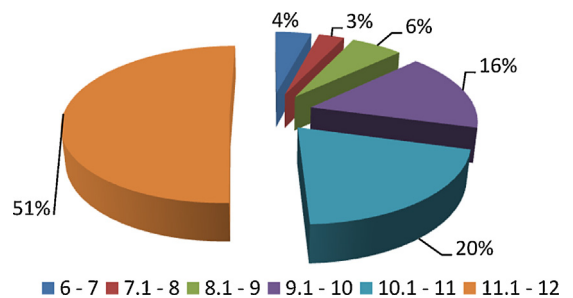
| Hemoglobin levels (mg%)  | No. of students | Percentage of anemia |
|--------------------------|-----------------|----------------------|
| Less than or equal to 12 | 171             | 64%                  |
| More than 12             | 97              | 36%                  |
| Total                    | 268             | 100%                 |



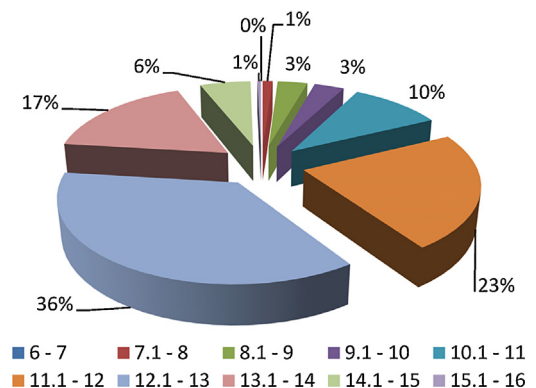
**Fig. 1.** The overall distribution of hemoglobin for students of three colleges.



**Fig. 2.** Distribution of hemoglobin in the college of education.



**Fig. 3.** Distribution of anemia in college of education.



**Fig. 4.** Distribution of hemoglobin in college of science.

the medical college students had the lowest prevalence of anemia. Out of the anemic students, 81% showed microcytic (MCV <80 fL) and 1.6% had macrocytic (MCV >96 fL) variety.

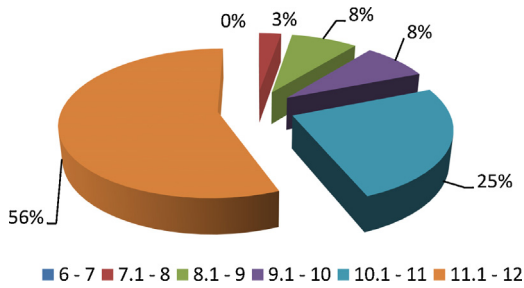


Fig. 5. Distribution of anemia in the college of science.

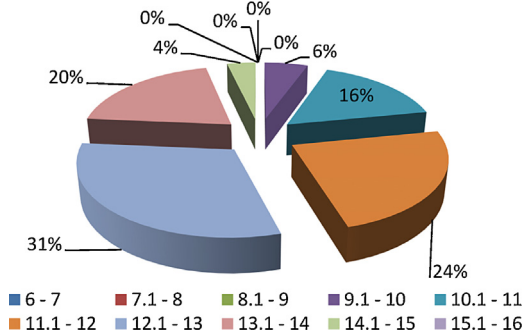


Fig. 6. Distribution of hemoglobin in the college of medicine.

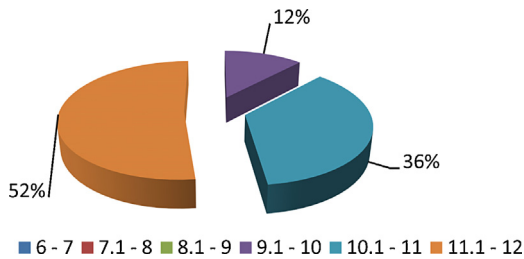


Fig. 7. Distribution of anemia in the college of medicine.

#### 4. Discussion

Although anemia in the women and children has been studied extensively in most parts of the world, there is a dearth of information on its prevalence in the university female students in the Saudi Arabia. In the present study, the mean Hb 9.8 g/dL was pretty low as compared to the report from Emirati college students with a measured mean Hb of 12.3 g/dL [7]. In that study, the overall estimated sample prevalence of anemia (Hb <12 g/dL) was 26.7% which contrasts to the present study's prevalence of anemia (64%). Another report published mean Hb concentration of the entire sample of 12.7 g/dL [8] which is not consistent with the current study's findings. The published range of prevalence of iron deficiency anemia from the developing countries account from 16.5% to 62.6% [9,10].

Lethargy, lack of energy, apathy, fatigue and numbness, loss of strength and unwillingness to physical activities like sports, are some of the signs that teachers and parents can be notice among the students. Sufficient iron is essential for healthy growth, and provides a favorable context for learning in educational period. Its deficiency in all stages of life

can reduce the power of perception and learning power [3]. Due to effects on learning ability, anemia reduces the learning power which causes academic dropout among students [11]. In children, iron deficiency anemia causes cognitive disorder before any other signs [12]. Mild iron deficiency can cause many disorders including movement disorders, the evolution of speech, language disorders and also learning focusing problems on children and students.

Iron deficiency apart from learning disabilities; also cause series of behavioral disorders [13]. A recent study investigated the effect of iron therapy on anemic patients by prescribing 2 Ferro sulfate tablets for 8 weeks. At the end of 8th week the indicators were assessed again which showed that all hematological and biochemical indices, which were less than the normal amounts before the ferrous sulfate supplementation, remarkably increased. There was a significant correlation between hemoglobin concentration and pictorial memory ( $r=0.31, P<0.05$ ), optical memory and hematocrit ( $r=0.32, P<0.05$ ) and MCH with verbal memory ( $r=0.33, P<0.05$ ). According to the results, increase of iron level led to increase of concentration and improvement of memory in the anemic patients [14]. Other cognitive deficiency symptoms observed with iron-deficiency anemia include deficits in attention, perceptual motor speed, memory and verbal fluency, and lead to impaired psychomotor development and cognitive performance [15].

Lundberg's "unhealthy life career hypothesis", states that poor childhood living conditions would be a principal factor starting a chain of unhealthy living conditions, leading to a low level of education, restricted opportunities on the labor market, and thus, to poor living conditions in adulthood with increased illness risks [16]. This hypothesis seems more valid in Saudi Arabia where socio-economic standards, suboptimal literacy rate, low and below average public awareness campaigns can be held responsible for the deteriorating health of the nation on the whole. This study has shown that iron is an important cause of anemia in Saudi female university students but it cannot predict what contributions to anemia are made by other nutrients, such as vitamin A, copper, and vitamin B12. Ascorbic acid is known as a powerful enhancer of iron absorption from non-meat foods when consumed within a meal [17]. Important iron absorption inhibitors are polyphenols (galloyl groups), present in tea, coffee and cocoa. Many studies have reported such an inhibitory effect [18].

The strikingly high prevalence of iron deficiency anemia in the present study might be related to life style of female students as well as to their dietary habits. Breakfast is often skipped by 28% of our students at various grades and never taken by 17% of secondary school female students [19]. Breakfast skipping is common in other parts of the world; it is highly prevalent in the United States and Europe (10–30%) [20]. It is well-known that breakfast is often neglected and omitted more by teenagers and young adults than by any other age group. Studies have demonstrated that, compared to other meals, breakfasts provide significantly fewer nutrients, but do supply energy; this is essential for better cognitive functions and physical activities [21,22]. Farghaly et al. [19] have hypothesized one likely explanation as to why females at that age are more

apt to miss breakfast is the pursuit of thinness and frequent dieting attempts. Looking into the cultural habits of the Saudi population, university students are not inclined to take breakfast at home and this habit obliges them to take unhealthy food in the campus thus leading to specific nutritional deficiencies.

## 5. Conclusion

Health programs targeting public awareness to improve the health and nutritional status of the university students should be implemented to focus on the improvement of nutritional habits and quality and quantity of the diet. Moreover, school health and nutrition programs directed toward school students and their parents are crucial to help them recognize the healthy nutritional habits and the body's requirements from the different nutrients.

## Conflict of interest

The author declares no conflict of interest.

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