



Anemia and Its Associated Factors among Final-Year Medical Students at Sana'a University, Yemen

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ABSTRACT

Objective: To determine the prevalence of anemia and its associated risk factors among final-year medical students at Sana'a University, Yemen.

Methods: This cross-sectional study was conducted among 269 final year students randomly selected from the medical faculties of Sana'a University in the period from January to April 2018. Data were collected using a structured questionnaire, while venous blood samples were collected by venipuncture into EDTA tubes. Hemoglobin (Hb) concentration was estimated using an automated hematology analyzer in the Laboratory Department of the University of Science and Technology in Sana'a city. Data were analyzed using appropriate statistical tests, and statistical significance was considered at P -values <0.05 .

Results: The mean Hb concentration of final-year medical students at Sana'a University was 15.1 ± 1.9 g/dL. The mean Hb concentration for male students was 16.3 ± 1.5 g/dL, while the mean Hb concentration for female students was 13.1 ± 1.5 g/dL. Anemia was prevalent among 12 (4.5%) out of 269 medical students and was significantly associated with the gender and smoking status of the students, where females (OR = 5.9, 95% CI: 1.8–27.4; $P = 0.011$) and smokers (OR = 6.3, 95% CI: 1.2–3.7; $P = 0.002$) were about six times more likely to be anemic compared to their counterparts. In contrast, there was no statistically significant association between anemia and age, family size, family income, presence of chronic disease(s), khat chewing, exercise, or history of blood transfusion.

Conclusions: The prevalence of anemia among final-year medical students at Sana'a University is low compared to other studies elsewhere. The female gender and smoking are the risk factors significantly associated with anemia among medical students. Further large-scale studies among medical and non-medical students from different levels of study at public and private universities of the country are recommended.

Keywords: Anemia, Hemoglobin, Medical students, Prevalence, Risk factors, Sana'a

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1. Introduction

Anemia is a public health problem in developed and developing countries, affecting human health as well as social and economic development.^(1,2) It negatively affects growth and energy levels, impairs the immune system and increases morbidity, particularly in pregnant women and children.^(1, 3) Young children from low-income families are at a higher risk of developing anemia due to iron deficiency that occurs because of the increased demand for iron during the phase of rapid growth.⁽⁴⁾

Anemia affects about 24.8% of the world's population, with the highest prevalence among pre-schoolchildren and the lowest prevalence among men.⁽²⁾ In the Eastern Mediterranean Region, about 150 million people are estimated to suffer from some types of anemia.^(5, 6) Young people in the second decade of life are in a period of intense growth and are exposed to major physical and psychological changes. Therefore, they are more prone to anemia due to increased demand for iron associated with the rapid growth as well as changing growth patterns, lifestyles, nutritional habits and behaviors along with their college work.⁽⁶⁾

This study was conducted among the medical students because this group is vulnerable to anemia as a result of the long schedule of college study, stress, clinical publishing, activities, additional curricula, poor eating and skipping breakfast. In addition, the current situation of war in Yemen and the difficult economic conditions may contribute to the development of anemia. Therefore, the present study aimed to determine anemia prevalence and its associated risk factors among the medical students at Sana'a University, Yemen.

2. Methods

2.1. Study design, setting and sampling strategy

This cross-sectional study was conducted among Sana'a University medical students of nursing, medical laboratories, dentistry and pharmacy in their final academic year in the period from January to April 2018. A sample size of 269 was calculated using Epi Info™, Version 7 (CDC, Atlanta, USA) based on the following parameters: a population size of 269, an expected prevalence of anemia of 50.0%, a confidence level of 95% and an accepted marginal error of 5.0%. Medical students were recruited by simple random sampling during lectures.

2.2. Data and sample collection

Demographic and other relevant data were collected using a pre-designed questionnaire. Then, about 3 ml of venous blood were collected by venipuncture into an EDTA tube under aseptic conditions. Blood samples were labeled and transported immediately to the laboratory of the University of Science and Technology Hospital (USTH).

2.3. Hemoglobin measurement

Hemoglobin (Hb) concentration was measured using SysmX KX-21n Automated Hematology Analyzer (Sysmex Corporation, Kobe, Japan) at the Laboratory of USTH. Anemia was established if the Hb concentration was less than the cut-off points recommended by the World Health Organization (WHO); namely, 13.0 g/dL for adult males and 12.0 g/dL for adult non-pregnant females.⁽⁷⁾

2.4. Statistical analysis

Data were analyzed using IBM SPSS Statistics for Windows, version 24.0 (IBM Corp., Armonk, NY, USA). The chi-square or Fisher's exact test was used for testing the significant differences between categorical variables. Statistical significance was considered at P -value <0.05 .



3. Results

3.1. Characteristics of the study population

Table (1) shows that of 269 medical students included in this study, 52.4% were males and 63.6 were aged 20 years or younger. The mean Hb concentration of final-year medical students at Sana'a University was 15.1 ± 1.9 g/dL. The mean Hb concentration for male students was 16.3 ± 1.5 g/dL, while the mean Hb concentration for female students was 13.1 ± 1.5 g/dL. The majority of students were living in families of 8 members or fewer (66.5%) and had a medium family income (85.9%).

Table 1. Characteristics of final-year medical students at Sana'a University, Yemen included in the study (2018)*

Characteristics	n (%)
Gender	
Male	141 (52.4)
Female	128 (47.6)
Age (years)	
Mean \pm SD:	22.5 \pm 1.5
≤ 22	171 (63.6)
> 22	98 (36.4)
Hb (g/dL)	
Mean \pm SD:	15.1 \pm 1.9
Male mean Hb \pm SD:	16.3 \pm 1.5
Female mean Hb \pm SD:	13.1 \pm 1.2
Family size (members)	
≤ 8	179 (66.5)
> 8	90 (33.5)
Family income (Yemeni rials)	
Low (< 50000)	20 (7.4)
Medium (50000–100000)	231 (85.9)
High (> 100000)	1 (6.7)

*The total number of students was 269; SD, standard deviation; Hb, hemoglobin.

3.2. Prevalence of anemia among medical students

Fig. (1) shows that anemia was prevalent among 12 (4.5%) out of 269 students medical students.

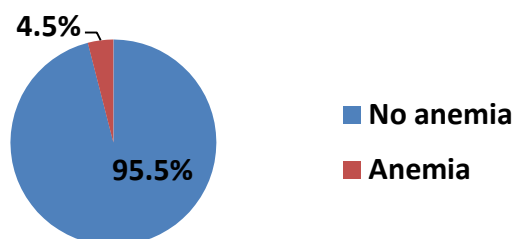


Fig 1. Prevalence of anemia among final-year medical students at Sana'a University, Yemen in 2018

3.3. Factors associated with anemia among medical students

Table (2) shows that anemia among medical students at Sana'a University was significantly associated with the gender and smoking status of the students, where females (OR = 5.9, 95% CI: 1.8–27.4; $P = 0.011$) and smokers (OR = 6.3, 95% CI: 1.2–3.7; $P = 0.002$) were about six times more likely to be anemic compared to their counterparts. In contrast, there was no statistically significant association between anemia and age, family size, family income, presence of chronic disease(s), khat chewing, exercise, or history of blood transfusion.

Table 2. Factors associated with anemia among final-year medical students at Sana'a University, Yemen (2018)

Variable	N	Presence of anemia		P-value
		n (%)	OR (95% CI)	
Gender				
Male	141	2 (1.4)	Reference	
Female	128	10 (7.8)	5.9 (1.8–27.4)	0.011
Age (years)				
≤ 22	171	10 (12.9)	3.0 (0.6–13.9)	0.221
> 22	98	2 (14.6)	Reference	
Family size (members)				
≤ 8	179	9 (5)	Reference	
> 8	90	3 (3.3)	0.7 (0.2–2.5)	0.560
Family income				
Low	20	1 (5.0)	Reference	
Medium-to-high	249	11 (4.4)	0.9 (0.1–7.2)	1.000
Presence of chronic disease(s)				
Yes	22	3 (13.6)	4.2 (1.0–16.7)	0.064
No	247	9 (3.6)	Reference	
Smoking				
Yes	23	4 (17.4)	6.3 (1.2–3.7)	0.002
No	246	8 (3.3)	Reference	
Khat chewing				
Yes	178	22 (12.4)	0.6 (0.2–2.0)	0.407
No	224	35 (15.6)	Reference	
Exercise				
Yes	90	1 (1.1)	Reference	
No	179	11 (6.1)	5.8 (0.7–45.9)	0.058
History of blood transfusion				
Yes	36	0 (0.0)	---	
No	223	12 (5.4)	Reference	0.164

OR, odds ratio; CI, confidence interval.



4. Discussion

To the best of our knowledge, this is the first study on anemia and its associated factors among the medical students of Sana'a University. Anemia is a major health problem worldwide, affecting 1.62 billion people.⁽²⁾ It usually affects young men and women in developing countries.⁽⁸⁾

Despite the war, the economic blockade, poverty and psychological pressures on students in Yemen, the overall prevalence of anemia in this study was 4.5%, and all of them are only anemic according to the cut-off points recommended by WHO.⁽⁷⁾ In contrast to the finding of the present study, a high prevalence ranging between 29.3% and 70.8% was reported for anemia among medical students from India.⁽⁹⁻¹³⁾ Such variability in anemia prevalence can be attributed to multiple factors, including lifestyle, housing situation, nutrition awareness and socioeconomic status. In the present study, the low prevalence of anemia could be partially explained by the high altitude of Sana'a city, which is located 3,700 km above sea level, leading to hypoxia and a compensatory increase in Hb concentration.

The prevalence of anemia was higher among female medical students in the present, where it was six-fold more likely to occur among females compared to males. The increased prevalence among females could be attributed to blood loss during menstruation. This finding is consistent with that reported among medical students from different Indian universities.^(10, 11, 13)

The prevalence of anemia among females in the present study (7.8%) is much lower than that reported among medical student females from United Arab Emirates (26.7%), Sri Lanka (25.5%) and Punjab, India (94.0%).⁽¹⁴⁻¹⁷⁾ In contrast to the findings of the present study, anemia prevalence was higher among Indian male compared to female first-year medical students from Karnataka, being 42% versus 21%, respectively.⁽¹²⁾ This discrepancy in anemia prevalence according to gender could be

attributed to differences in social, cultural, economic and geographical conditions.

The mean Hb concentration of medical students in Sana'a city (15.1 g/dL) is higher than that (12.3 g/dL) of medical students from south India.⁽⁹⁾ On the other hand, the mean Hb of female students in the present study (13.1 g/dL) was slightly higher than that for female students from Dubai, UAE (12.8 g/dL), Sharjah, UAE (12.5 g/dL) and Sohar, Oman (12.0 g/dL), but much higher than that (10.0 g/dL) for Indian nursing students.^(13, 18-20)

In the present study, the female gender was significantly associated with anemia among final-year medical students at Sana'a University, where females were approximately six-fold more likely to be anemic compared to males. The significantly higher prevalence among females than males in the present study is consistent with that observed among MBBS students in the first year in northern India.⁽²¹⁾

In contrast to the lack of an association between family income and anemia in the present study, Alzaheb et al. (22) found significantly higher anemia prevalence (64.0%) among Saudi female university students with median household income. This higher anemia prevalence may be due to the bad quality of food or the limited awareness of healthy foods because many family members prefer eating outside rather than making food at home.

In the present study, smoking was a risk factor significantly associated with anemia among final-year medical students at Sana'a University, where smokers were approximately six-fold more likely to be anemic compared to non-smokers. This finding is consistent with that reported among university students in Hodeidah, west of Yemen.⁽²³⁾ In contrast to the significant association of khat chewing with anemia among university students from Hodeidah,⁽²³⁾ khat chewing was not significantly associated with anemia among medical students in the present study.



5. Conclusions

The prevalence of anemia among final-year medical students at Sana'a University is low compared to other studies elsewhere. The female gender and smoking are the risk factors significantly associated with anemia among medical students. Further large-scale studies among medical and non-medical students from different levels of study at public and private universities of the country are recommended.

Ethical considerations

This study was ethically approved by the Research Ethics Committee of the Faculty of Medicine and Health Sciences at the University of Science and Technology, Sana'a, Yemen. Written informed consent was obtained from all participants, who were informed that the participation is voluntary and they can refuse it without mentioning a reason. Participants were given feedback notes about the results of their Hb concentration upon completion of the study.

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Authors' contributions

MYN, ASH, FA, AM, AM, FM, HA, RA, NA and WA designed the study; FA, AM, AM, FM, HA, RA, NA and WA contributed to patient interview and data collection; MYN, FA, AM, AM, FM, HA, RA, NA and WA contributed to data analysis and interpretation of results. MYN drafted and revised the manuscript. All authors read and approved the final manuscript.

Competing interests

The authors declare that they have no competing interests associated with this article.

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