Original Article

Estimation of Mean Hemoglobin, Prevalence of Anemia, and its Risk Factors Among Undergraduate Students of Rawalpindi Medical University

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Abstract

Background: Iron deficiency anemia significantly increases pregnancy-related death risk and adversely affects prenatal development in women aged 15-24 years
Objectives: This study aims at determining the risk factors of anemia, to assess the mean hemoglobin level of the students and the prevalence of anemia among students at Rawalpindi Medical University
Materials and Methods: This is an observational cross-sectional study conducted among 110 undergraduate students aged 18 to 25 years at Rawalpindi Medical University by using a convenient sampling technique. Hemoglobin levels assessed using an automated CP analyzer were included. Data was collected by verified self-grading anemia questionnaire on Google Forms and analyzed using IBM SPSS software version 26.
Results: Among 110 students, the number of non-anemic individuals was 1.75 times higher than those with anemia. Among anemic students, 92.5% were female, while 7.5% were male. These findings indicate a higher prevalence of anemia among females. Our study demonstrates that the estimated mean hemoglobin value in the studied population is 11.7mg/dl. Hemoglobin levels were significantly lower in females with heavy menstrual flow than those with normal flow. Among those who took iron a few times in their diet, 77.5% were anemic.
Conclusion: The research found a higher prevalence of anemia among female medical students (92.5%) compared to their male counterparts (7.5%) due to heavy menstruation and insufficient iron intake. Our findings indicate a pressing need for awareness programs on anemia and its preventive measures.
Keywords: Global Health; Iron Deficiencies; Public Health; Healthcare Access

Introduction

Anemia is a medical condition characterized by deficiency in circulating red blood cells, and hemoglobin levels below 12.0 g/dL in women and 13.0 g/dL in men. It leads to insufficient oxygen transport, causing fatigue and weakness. The causes of anemia include iron deficiency, vitamin B12 deficiency, aplastic, and hemolytic anemia, and symptoms. It can be diagnosed by blood tests, and its treatment varies from dietary changes.[1] It is a global health issue that particularly affects young children, menstruating women, and pregnant women. Prevalent studies show that the female population is more affected by anemia, with epidemiological data revealing that women between the ages of 35 and 49 are at heightened risk. This remains a moderate public health problem according to WHO classification.[2] In some cases, severe anemia can lead to heart failure, so requires timely medical intervention.[3]

Anemia is a significant health concern affecting millions of children, particularly in developing countries. The prevalence of anemia among Orang Asli children in Malaysia is concerning, ranging from 21.6% to a very high 80%. Iron deficiency is the most common cause accounting for 34% of cases of anemia.[4] Also, iron deficiency may not always lead to anemia. However, if left untreated, iron deficiency can progress to anemia. A study in Spain finds that 13.3% of adolescents have iron deficiency, but only 1.2% have iron deficiency anemia. This suggests iron deficiency is common but doesn't always progress to anemia.[5]

The risk factors for anemia among women in low-income countries are diverse, contextual, and complex. In sub-Saharan Africa, the primary predictors of anemia in women of reproductive age include iron deficiency, malaria, low economic status, illiteracy, multiple pregnancies, and intestinal parasitic infections6. Anemia during pregnancy is considered a risk factor for poor pregnancy outcomes, leading to life-threatening complications for both the mother and the fetus.[7] Socioeconomic status plays a significant role in the contribution of anemia, as students from lower-income backgrounds often present with reduced BMI and hemoglobin levels.[8] Obesity is also a contributing factor to the development of anemia, affecting the body's ability to produce healthy red blood cell.[9] The clinical importance of anemia extends beyond its hematologic manifestations, as it impacts multiple organs including kidneys, brain, immune system, cardiovascular system, and reproductive system.[10] In young adults, anemia is known to reduce workability and impair psychomotor functions.[10]

Pakistan has the second-highest prevalence (53%) of anemia among children under 5 and the fourth-highest prevalence (41.3%) of anemia among women of reproductive age so this study helps to understand the complex etiology of anemia and various risk factors associated with it. This study estimates the average hemoglobin levels among students at Rawalpindi Medical University and finds out association between lifestyle factors and prevalence of anemia. This study also contributes to public awareness of the common causes of anemia and advocates for lifestyle and dietary modifications to prevent this pathological condition. It also holds significant relevance for public health initiatives, as it seeks to address the challenges of anemia and its associated health complications.

Materials and Methods

An observational cross-sectional study was performed between January 2024 to June 2024 including a sample of 110 undergraduate students at Rawalpindi Medical University aged between 18 and 25 years. The sample size using Yamane's formula with N (population size) =110 and e (margin of error) =0.05 is 87. All students who were suffering from any blood disorders, younger or older than the specified age, or who recently had blood transfusions were excluded. A convenient sampling technique was used. Laboratory tests presenting Hb levels which were estimated by using an HTI MicroCC-20 Plus Automated Hematology Analyzer, CBC Machine were included. After taking informed consent the students were assessed for gender, height, weight, socioeconomic status, hostelite/day scholar status, and BMI. Data was collected by a validated self-grading anemia questionnaire on Google Forms. The analysis of the data was carried out using SPSS version 26. The correlation between anemia and nutritional parameters was determined by using Chi-square test and it was considered statistically significant if p value was less than 0.05.

Results

In total, 110 medical students were recruited, female (80%; n=88) and male (20%; n=22), with a median age of 20 years (range 18 to 25). Hemoglobin levels among the students range from a minimum value of 6mg/dl and a maximum value of 16mg/dl. Notably the mean hemoglobin concentration stands at 11.87mg/dl.

Among these 110 students, 25.5% (n=28) were underweight i.e. BMI <18.5; 16.4% (n=18) were overweight i.e. BMI >25, and 58.2% (n=64) were normal i.e. BMI between 18.5 to 24.9. The frequency of non-anemic students was higher than anemic students (anemic = 40; non-anemic =70). The percentage of anemia among female population was 42% and that of male was 14%, depicted in Table- I and Table-II. This suggests that anemia is more prevalent in females than males. The association between study variables and Hb level was determined using chi-square test which has been displayed in Table-III. The Hb level was significantly different between different genders, with 92.5% of anemic students being females (n=37) and 7.5% being males (n=3) (P=0.013). Among the 88 females, 86.4% had normal menstrual flow (n=76) while 13.6% had heavy menstrual flow (n=12). 75.7% of anemic females had normal menstrual flow (n=28) while only 24.3% of them had a heavy menstrual flow (n=9). 30.9% were hostelites (n=34) while 69.1% were non hostelites. Hb level was significantly lower in females with heavy flow than those with normal flow (P=0.013). Out of a total of 110 students, 20.9 % (n=23) reported consuming iron-rich foods daily; 70.9% (n=78) stated they include iron-rich foods in their diet a few times a week; while 7.3% of them (n=8) rarely consumed iron-rich foods. Among the daily consumers of iron-rich food, 10% (n =4) were anemic while among those who took iron a few times in their diet, 77.5% (n=31) were anemic. Out of 40 anemic students, 27.5 % were underweight (n=11); 12.5% were overweight (n=5) and 60% were normal weight (n=24). Hence, there was no significant difference in BMI (P=0.7) in anemic vs. non-anemic participants. Moreover, socioeconomic status (P=0.867) and hostelite /non hostelite status (P=0.119) did not have a significant relation with anemia.

Table-I Sociodemographic details of students

Characteristics	Item	Frequency	Percentage %
Gender	Female	88	80
	Male	22	20
Boarder/Non- boarder	Boarder	34	31
	Non-boarder	76	69
BMI	Underweight	28	25.5
	Normal weight	64	58.2
	Overweight	18	16.4
Socioeconomic status	< 20,000	6	5.5
	20,000-50,000	8	7.3
	50,000-1,00,000	32	29.1
	> 1,00,000	64	58.2

Table-II Level of Haemoglobin in males and females

Gender	Anemic/ non-anemic	N (%)	Mean Hb	SD
Total		110	11.87	1.878
	Anemic	40(36.4%)	10.05	1.518
	Non- anemic	70(63.6%)	12.91	1.122
Female	Anemic	37(42%)	9.95	1.527
	Non- anemic	51(58%)	12.64	1.008
Male	Anemic	3(13.6%)	11.33	0.577
	Non- anemic	19(86.4%)	13.63	1.116

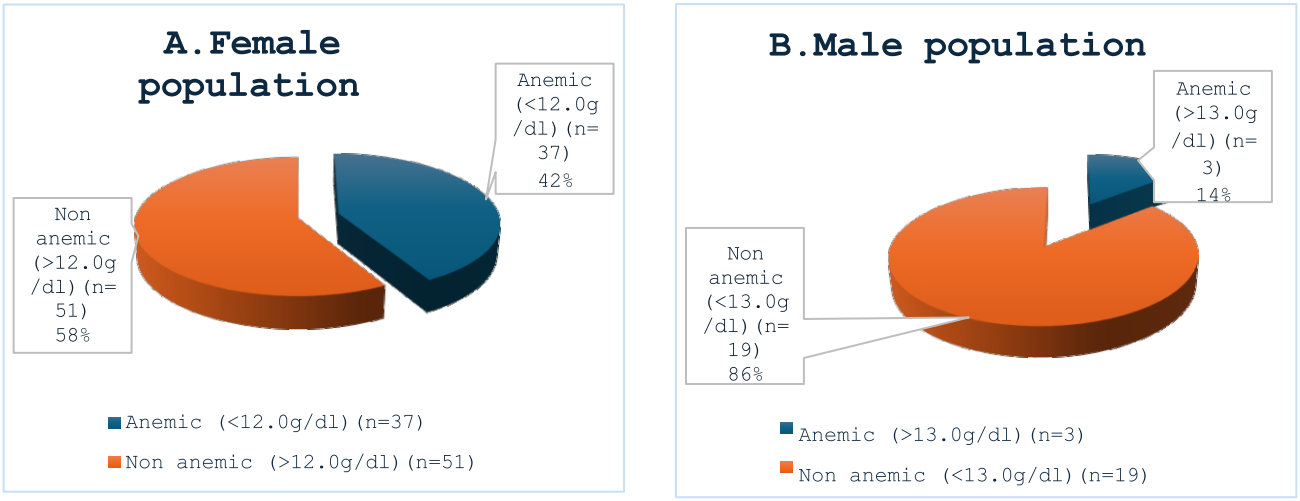

Figure 1 Percentage of anemia in female and male population

Table-III Characteristics associated with anemia in the study participants

Parameters		Anemic n (%)	Non-anemic n (%)	p- value
Gender	Female	37(42%)	51(58%)	0.013*
	Male	3(13.6%)	19(86.4%)	
BMI	Underweight	11 (27.5%)	17(24.3%)	0.700
	Normal	24(60%)	40(57.1%)	
	Overweight	5(12.5%)	13(18.6%)	
Boarding Status	Boarder	16(40%)	18(25.7%)	0.119
	Non-boarder	24(60%)	52(74.3%)	
Menstruation	Normal	28(75.7%)	48(94.1%)	0.013*
	Heavy	9(24.3%)	3(5.9%)	
Diet	Rarely	4(10%)	4(5.7%)	0.096
	Few times a week	31(77.5%)	47(67.1%)	
	Daily	4(10%)	19(27.1%)	
	Never	1(2.5%)	0(0%)	
Socioeconomic status	<20,000	2(5%)	4(5.7%)	0.867
	20,000-50,000	4(10%)	4(5.7%)	
	50,000-1,00,000	11(57.5%)	21(30%)	
	>1,00,000	23(40%)	41(58.6%)	

Posture while using the devices was also significantly related to the presence of headache (p=0.017) and pain in the wrist/arms (p=0.038). The percentage of headache (71.4%) and

Discussion

Anemia is one of the major nutritional public health problems across the world affecting developed, under developed and developing countries including Pakistan. It results in impairment of cognitive performance, behaviour, poor concentration with reduction in work capacity. Currently, the Government of Pakistan is providing iron with supplementation of folic acid to pregnant women through the National Lady Health Worker Program. Studies done in Pakistan in the past have shown that anaemia is more wrist/arm pain (57%) was greater with the use of electronic devices while lying as compared to sitting position (38% and 23.8% respectively).

The prevalent among medical students so additional research and public health services are required to prevent it.[13-16] Therefore, the study was conducted to estimate the average haemoglobin levels among students at Rawalpindi Medical University and associated lifestyle risk factors.

In the present study, the mean haemoglobin level was found to be 11.87 and the total prevalence of anaemia was found to be 36.4%. Gender was found to be significantly associated with the presence of anemia (p=0.013). A similar prevalence of anaemia (38.7%) with female predominance (57.8% vs 14.9%) was shown in a study conducted by Sehrish et al at CMH Medical College Lahore.[17] These results are also comparable with another study by Timilsina et al (37.8%) at a medical college in Nepal.[13] The current study also showed a significant association between anaemia & heavy menstruation (p=0.013)) as blood loss is one of the most common causes of anaemia in young females.

A study by Nimra et al at the Physiology Department, University of Sindh Jamshoro also showed a significant association between anaemia (45.94%) and menstrual abnormalities among medical students.[14] Similar findings were reported by HB Channar at a nursing college in Karachi showing a significant association between menstrual flow length and anaemia (p = < 0.001- chi square 14.3).[15]

Analysis of BMI in the present study showed no significant relationship (p=0.7) with anaemia. A positive non-significant correlation was also observed between haemoglobin and body mass index in a study conducted by Uppal S et al among students of CMH Kharian Medical college.[18] However, a latest study conducted by Choudhary N et al. in India showed a statistically significant link between BMI and Hb (p= 0.22).[19]

Our study also showed a significant correlation between iron intake and anaemia as only 10 % of those who consume iron rich diet daily were anaemic while among those who took iron few times in a week 77.5% were anaemic. These findings were similar to study conducted by Kanchana R et al among first year MBBS students in Karnataka India that highlights the need to investigate and correct daily habits of medical students.[20] Our study didn't show any significant relationship between anaemia and hostelite or non hostelite status (p= 0.119) These findings were different from those as reported by Jawed S et al in his study conducted in medical students inFaisalabad that showed higher number of girls living in hostels were anaemic (39.2%) as compared to day scholars (23.1%) (P value= 0.015*).[16] One of the reasons for this difference can be that most students in the current study shifted from their homes to hostels recently after getting admission in first year MBBS and the current study was conducted only among first year students at RMU. Our study also didn't show any relationship between anaemia and socioeconomic status (p=0.119).

This study was limited to a single medical college, resulting in a small sample size and restricting the generalizability of findings to the broader population. Regular health checkups and hemoglobin screening should be implemented in educational institutions for the early detection and prevention of anemia. Additionally, public health programs in schools and colleges should focus on improving the nutritional status of anemic students, including targeted iron supplementation. However, before initiating iron therapy, screening for thalassemia traits should be conducted, and MCV and MCH levels should be assessed to confirm that anemia is due to nutritional deficiency.

Conclusion

This study highlights the significant prevalence of anemia among the studied population, with a higher occurrence in females. While no significant differences in BMI were observed between anemic and non-anemic participants, anemia in women of reproductive age (15–24 years) poses a higher risk of adverse health outcomes hence promoting the dietary intake of iron-rich foods is essential to compensate for menstrual iron losses and prevent deficiencies.

The findings provide valuable insights into the frequency of anemia among male and female students at Rawalpindi Medical University, underscoring the need for university-led awareness programs to educate students on risk factors, prevention, and early management of anemia.

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