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Prevalence of Anemia Among University Students; Tarhuna, Libya

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ABSTRACT

Background: Anemia is a prevalent condition affecting red blood cells and hemoglobin, leading to oxygen deficiency in the body's tissues. This study aimed to investigate anemia prevalence among university students, its associated factors, and the impact on their health and academic performance. **Methods:** A cross-sectional survey was conducted on 100 university students from different collees of Azzaytuna University the age between 18-24 years; blood samples were collected to measure hemoglobin, red blood corpuscular count, and hematocrit levels. A questionnaire was designed to collect data about the volunteers, including dietary habits, medical history, and anemia symptoms. **Results:** The study revealed that 29% of studied students were anemic (27% Mild anemia, while 2% severe). Correlations between hemoglobin, red blood corpusculs count, and hematocrit highlighted the need for comprehensive health assessments. Weight distribution indicated potential nutritional deficiencies. Self-reported data showed 25% of students had anemia, with fatigue (62%), dizziness (44%), and accelerated heartbeat (41%) as common symptoms. Only 9% of students received treatment, and 31% had medical examinations. The results align with previous studies, indicating higher anemia prevalence among female students. The study emphasizes the impact of anemia on student health and the need for targeted interventions. Regional variations in anemia prevalence highlight the influence of demographic and cultural factors. **Conclusion:** anemia is a significant concern among university students, particularly females. Comprehensive health assessments, nutritional education, and early detection programs are essential to address this issue. Further research is needed to develop effective interventions and improve student health services

1. INTRODUCTION

Anemia is a condition characterized by a reduction in the number or functionality of red blood cells (RBCs) or the hemoglobin they contain. Hemoglobin, an iron-rich protein, is essential for transporting oxygen from the lungs to the body's tissues. When hemoglobin levels are insufficient, tissues receive inadequate oxygen, leading to symptoms such as fatigue, weakness, pale skin, shortness of breath, and rapid heartbeat. The severity and presentation of these symptoms vary depending on the underlying cause and the degree of anemia (Hoffbrand & Moss, 2022; Kassebaum, 2016).

Diagnosis typically involves a complete blood count (CBC) to assess hemoglobin levels and RBC parameters like mean corpuscular volume (MCV), mean corpuscular hemoglobin (MCH), and red blood cell distribution width (RDW). Additional tests, including iron studies, vitamin B12 and folate levels, and reticulocyte counts, may be conducted to identify the root cause (Camaschella, 2015). Anemia arises from diverse factors, including blood loss, nutrient deficiencies (e.g., iron, folate, vitamin B12), and underlying medical conditions affecting RBC production or lifespan. The three primary types are iron-deficiency anemia, vitamin deficiency anemia, and anemia of chronic disease (Camaschella, 2015). Classification of anemia subtypes, based on RBC size and hemoglobin content, provides critical insights into causation and guides treatment (Hoffbrand & Moss, 2022). Globally, anemia affects approximately 1.62 billion people, with the highest prevalence in developing countries. It is particularly common among pregnant women, young children, and the elderly (McLean et al., 2009; Kassebaum, 2016). Anemia significantly impacts health and quality of life, making its understanding crucial for effective management and prevention. Among university students, anemia can impair academic performance and overall well-being. Studying its prevalence and risk factors in this population enables targeted interventions, such as nutritional education, mental health support, and early detection programs, thereby enhancing student health services (World Health Organization, 2020). Iron deficiency is the leading global cause of anemia, though deficiencies in folate, vitamin B12, and magnesium also contribute (World Health Organization, 2020). Anemia occurs when RBCs fail to meet the body's physiological oxygen demands, which vary by age, gender, altitude, smoking status, and other factors. Hemoglobin measurement is essential for diagnosis, even when iron deficiency is not the cause (World Health Organization, 2020). Prevalence of anemia serves as a key health indicator, and when combined with iron status measurements, hemoglobin concentration informs the severity of iron deficiency (World Health Organization, 2017). Anemia is frequently encountered in primary care, pediatrics, and pregnancy (National Heart, Lung, and Blood Institute, 2024). Iron deficiency (ID) and iron deficiency anemia (IDA) are distinct conditions. IDA is the most widespread cause of anemia globally, particularly in developing nations, and poses a significant health challenge (Centers for Disease Control and Prevention, 2022). It affects up to 40% of home-dwelling elderly individuals, 5% of children and adolescents, 10% of premenopausal women, and 1% of men (National Institute on Aging, 2024). This research holds particular importance due to the rising rates of anemia among young people, especially within student populations. Anemia negatively impacts academic performance and daily life for students, which threatens their academic and health achievements. By studying the prevalence of anemia among university students and analyzing the associated factors, this research can provide valuable recommendations to enhance nutritional and health awareness among students, improving their academic and personal quality of life. Additionally, this research could serve as a starting point for future studies focusing on effective health interventions to combat anemia among young adults.

2. METHOD

- Questionnaire: A structured questionnaire was designed to collect data on demographic information, dietary habits, medical history, and symptoms of anemia.

-Blood tests: Complete blood count (CBC) .To measure RBC and hemoglobin levels and hematocrit.

Data collection procedure:

- Recruitments of participants: Students were informed about the study through Facebook posts, and classroom announcements.

- Questionnaire administration: Participants completed the questionnaire under the supervision of the research team. Clarifications were provided when necessary to ensure accurate responses.

- Blood samples collection: Before the procedure began, the purpose of the blood collection was explained to each participant. Small amount of blood (approximately 2ml) was drawn in EDTA tube (potassium).

The samples were then transported to the laboratory within 2hours of collection for analysis using A Sysmex model KX-21N. based on the recommendations of the WHO which recommended that the rate of blood hemoglobin in pregnant women is considered anemic if it is less than 11.0 g/d [

Data analysis:

Statistical analysis was performed using SPSS (version2023) software to evaluate the questionnaire responses and analyze blood test data for assessing the prevalence of anemia among university students.

3. ETHIC APPROVAL

Ethical approval for this study, was granted by the Department of Medical Laboratories at the College of Medical Technology Azzaytuna University, following a thorough review of the research protocol in accordance with established ethicalguidelines. Additionally, informed verbal consent was obtained from all participating student donors, who were briefed on the study's objectives, procedures, and potential risks, with assurance of their right to withdraw at any stage without consequence. All consent procedures were documented to ensure compliance with ethical standards and research integrity

4. RESULT

The study comprised 100 blood samples randomly collected from university students at various stages of their academic careers, representing a diverse range of ages and both genders (20% male and 80% female) as illustrated in Figure 1.

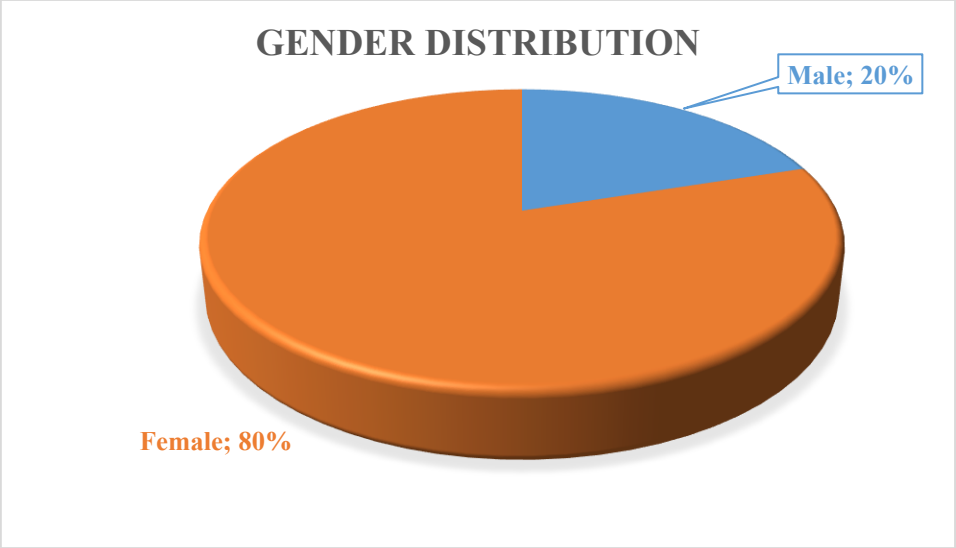

Figure 1 displays the study sample's gender distribution.

The high percentage of female participants could influence the study's results, especially if anemia prevalence or causes differ between genders.

Since the study population is AZZaytuna University students (undergraduate level), the ages of most participants (76%) ranged between 19 and 21 years, as show in Figure 2.

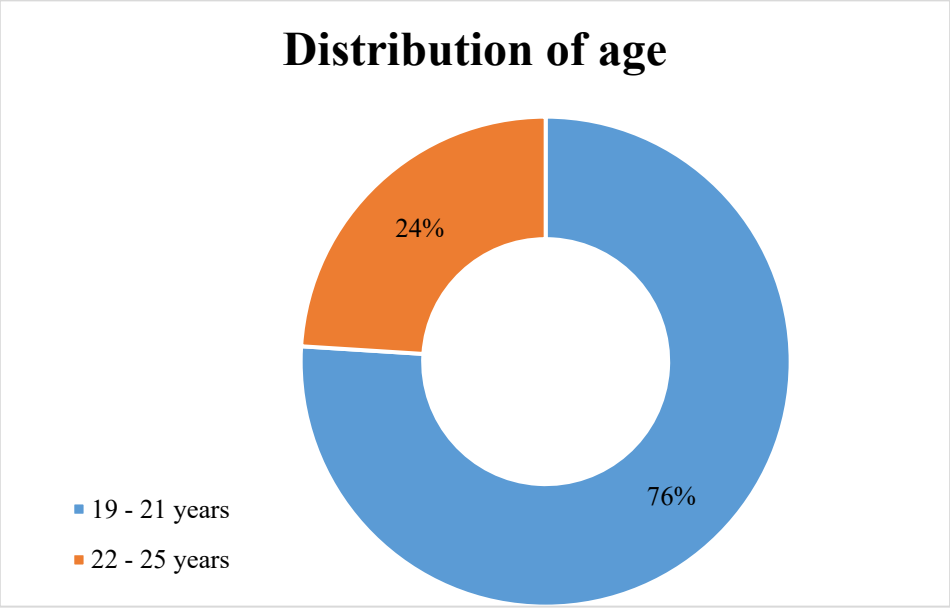

Fig.2: shows distribution of study sample according to age groups

The study's focus on younger adults provides valuable insights into the health conditions of this specific population segment. However, it may limit the generalize ability of the findings to older age groups. Regarding to students' weights, the individuals participating in this study were divided into three age groups as follows: 40 - 60 kg (60% of the study sample), 61 - 80 kg (36% of volunteers), and eventually, >80 kg (4% of the study sample), as shows in Figure 3.

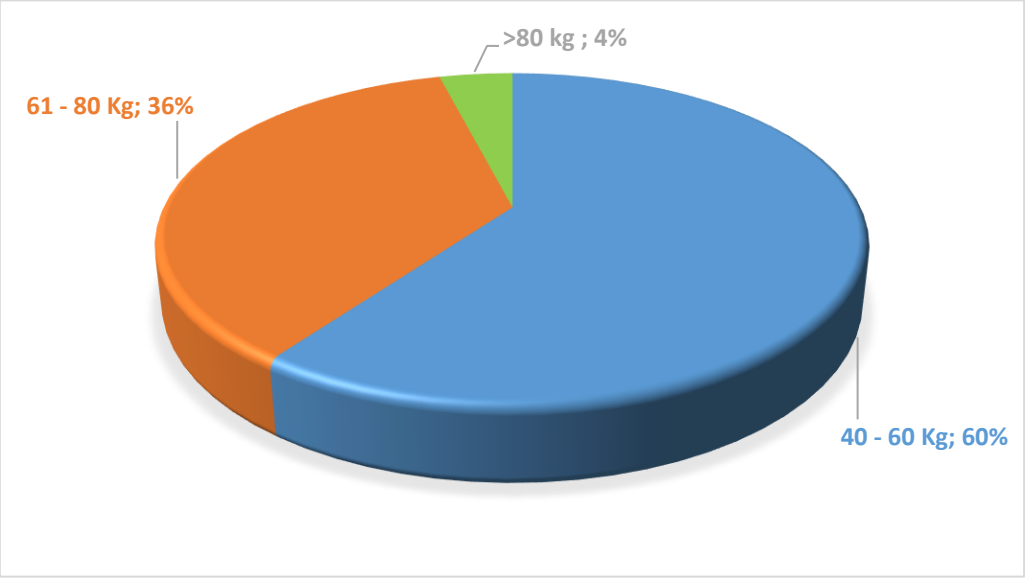

Fig 3. show Weigh Distribution

which may be concerning for potential malnutrition or inadequate dietary intake. This finding suggests that a significant portion of the population may be at risk for anemia due to nutritional deficiencies.

which may reflect dietary habits or lifestyle factors.

The weight distribution highlights the potential impact of nutritional status on anemia prevalence and emphasizes the need for dietary education and health promotion.

The data shown in Figure 4 showed that 71% of students had normal levels of hemoglobin, 27% suffered from mild anemia, and only 2% suffered from severe anemia, which is concerning but relatively small percentage.

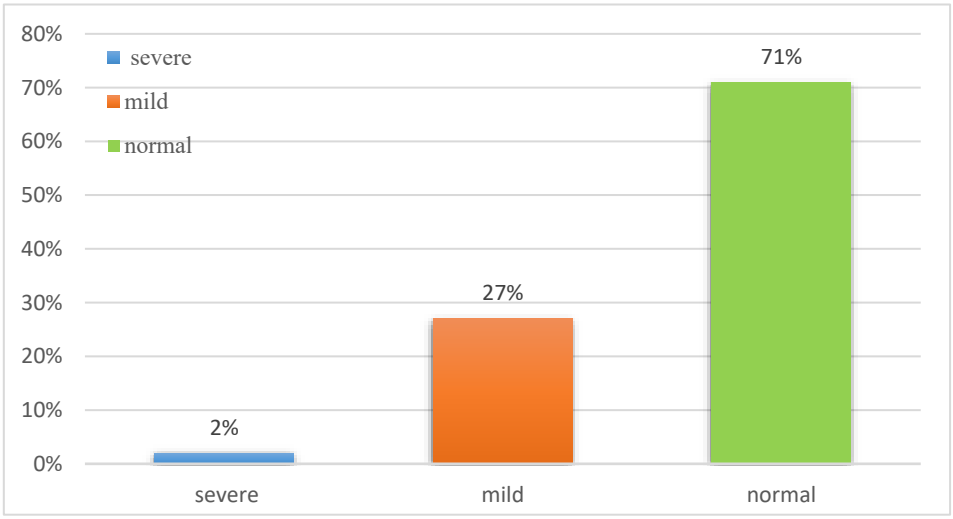

Fig 4. illustrates Hemoglobin levels

The distribution of hemoglobin levels raises concerns about the overall health and nutritional status of the student population, as anemia can impact energy levels and overall well-being.

The results of the current study also showed that the hemoglobin level in females was higher than in males, 2/80 (2.5%) of females suffered from severe anemia, 26/80 (32.5%) suffered from mild anemia, while 52/80 (65%) were in the normal range, on the other hand there was no severe anemic cases in the male samples, only one case had a mild anemia (5%), and 19/20 (95%) were within the normal range for hemoglobin, as shows in Figure 5.

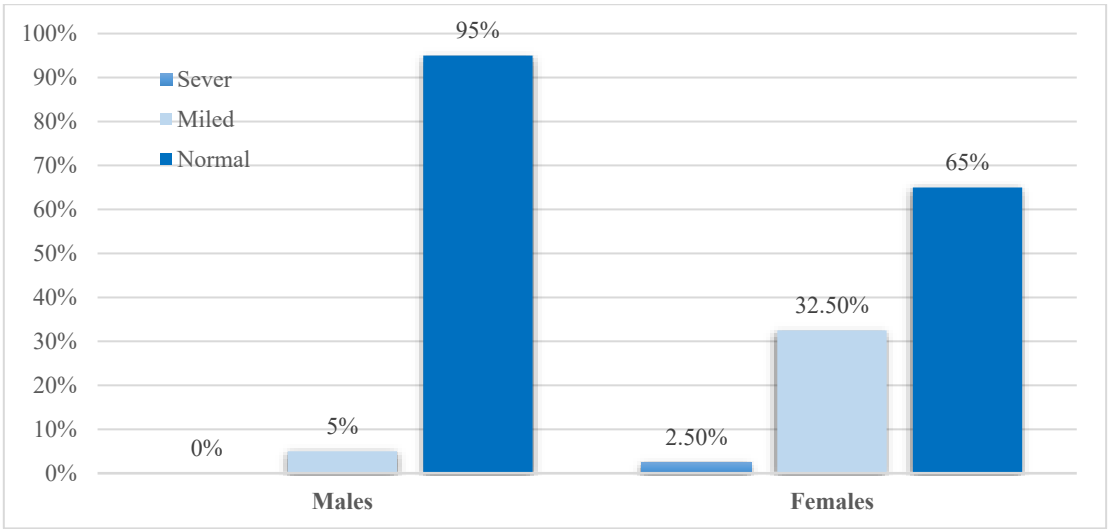

Fig.5.Hemoglobin levels in males and females

In addition, Figure 6 shows that 13% of students had low RBCs count, 55% had normal RBCs and 32% had high RBCs count.

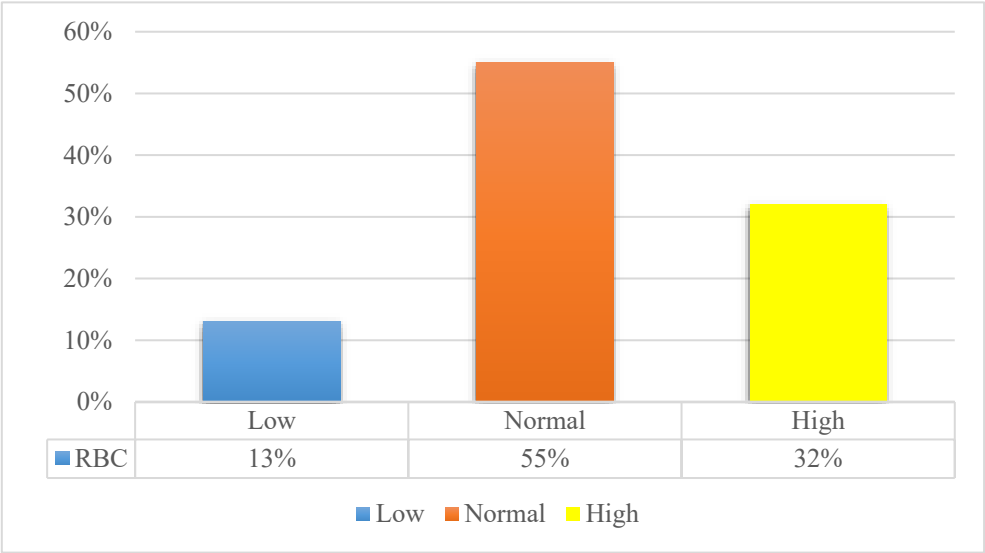

Fig.6 show Red Blood Cell count

which may suggest a risk for anemia. This finding is concerning as it indicates a segment of the population potentially experiencing significant health issues.

suggesting better overall health. , indicating good production and overall health.

The distribution of red blood cell counts provides insights into the prevalence of anemia within the sample and highlights the importance of maintaining healthy red blood cell levels. The current study findings showed that, 84% of students had hematocrit levels at normal rang, 14% had high levels while only 2% had low hematocrit levels, as represent in Figure 7.

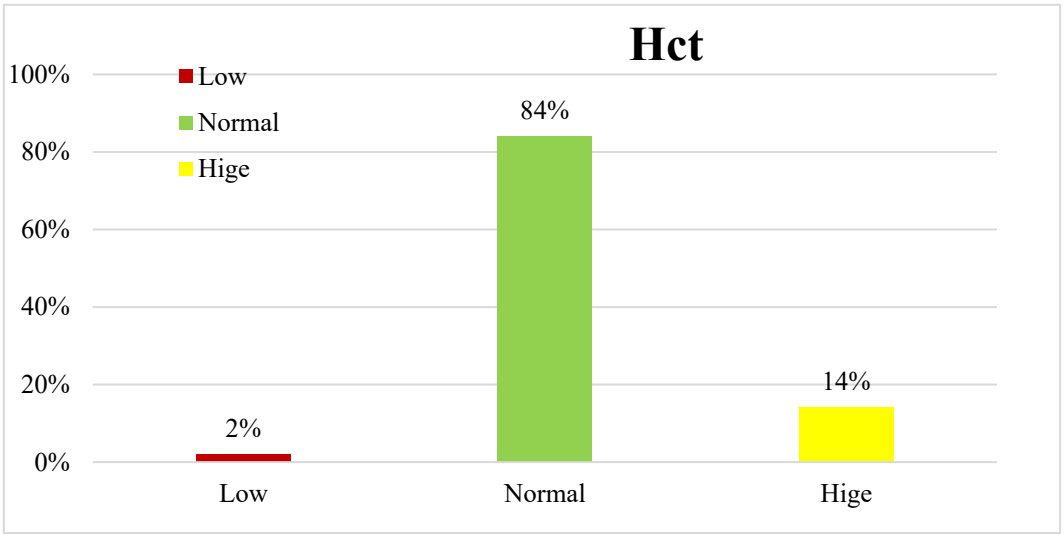

Fig 7. shows results of Hematocrit measurements in study sample.

suggesting a small but critical group at risk for severe anemia. This finding emphasizes the need for further investigation and targeted interventions for this vulnerable group.

The distribution of hematocrit levels provides valuable information for assessing the severity of anemia and guiding appropriate health interventions.

Correlations:

Significant positive correlations were found between hemoglobin (Hb), red blood cell count (Rbc), and hematocrit (Hct). This emphasizes the interdependence of these measures in assessing anemia.

Table 1 Mean Correlations between all variables and anemia.

		Hb	Rbc	Hct	weight
Hb	R	1	.401	.509	.320
	P-Value	-	.000	.000	.001
	N	100	100	100	100
Rbc	R	.401	1	.490	.208
	P-Value	.000	-	.000	.038
	N	100	100	100	100
Hct	R	.509	.490	1	.295
	P-Value	.000	.000	-	.003
	N	100	100	100	100
weight	R	.320	.208	.295	1
	P-Value	.001	.038	.003	-
	N	100	100	100	100

Correlation is significant at the 0.01 level (P-Value).

Correlation is significant at the 0.05 level (P-Value).

Hemoglobin (Hb) Correlations

The correlation between Hb and Rbc suggests that higher hemoglobin levels are associated with higher red blood cell counts, which is expected given their physiological relationship in oxygen transport. The correlation coefficient is 0.401 ($p < 0.001$), indicating a moderate positive relationship The correlation between Hb and Hct indicates that as hemoglobin levels increase, hematocrit levels also tend to increase, further supporting the assessment of anemia severity. The correlation is stronger at 0.509 ($p < 0.001$), reflecting a significant positive association

With weight The correlation is 0.320 ($p = 0.001$), suggesting a weaker but still significant positive relationship. This indicates that students with higher hemoglobin levels may also have higher body weight, which could be influenced by factors such as nutrition and overall health.

Red Blood Cell Count (Rbc) Correlations:

- With Hb: The correlation of 0.401 ($p < 0.001$) reaffirms the relationship noted earlier, emphasizing the importance of both measures in understanding anemia.

- With Hct: The correlation is 0.490 ($p < 0.001$), indicating a strong positive relationship. This suggests that higher red blood cell counts are associated with higher hematocrit levels, reinforcing the physiological connections between these parameters.

-With Weight: The correlation of 0.208 ($p = 0.038$) is significant but indicates a weaker relationship compared to Hb and Hct. This could suggest that while there is some association between weight and red blood cell count, it may be influenced by various other factors.

Hematocrit (Hct) Correlations:

-With Hb: The strong correlation of 0.509 ($p < 0.001$) highlights the close relationship between hemoglobin and hematocrit, essential for assessing anemia's severity.

-With Rbc: The correlation of 0.490 ($p < 0.001$) similarly underscores the interdependence of these measures.

-With Weight: The correlation of 0.295 ($p = 0.003$) indicates a moderate positive relationship, suggesting that as hematocrit levels increase, body weight may also increase, possibly reflecting better nutritional status.

Gender Correlations:

-With Hb: The correlation coefficient is -0.317 ($p = 0.001$), indicating a significant negative relationship. This suggests that being female may be associated with lower hemoglobin levels, which could reflect broader trends seen in anemia prevalence among genders.

-With Rbc: The correlation is -0.474 ($p < 0.001$), demonstrating a strong negative relationship. This indicates that females tend to have lower red blood cell counts compared to males, reinforcing the findings regarding gender disparities in anemia.

-With Hct: The correlation coefficient is -0.501 ($p < 0.001$), indicating a strong negative relationship. This further supports the conclusion that females may exhibit lower hematocrit levels than males, which is consistent with existing literature on gender differences in blood parameters.

-With Weight: The correlation is -0.446 ($p < 0.001$), suggesting that females may have lower body weight compared to males, which could be linked to dietary habits and health behaviors. The significant negative correlations between gender and all three blood parameters (Hb, Rbc, Hct) highlight the need for targeted health interventions for female students to address anemia and its health impacts.

Age Correlations:

-With Hb: The correlation coefficient is -0.047 ($p = 0.644$), indicating no significant relationship between age and hemoglobin levels. This suggests that age does not have a meaningful impact on Hb in this sample.

-With Rbc: The correlation is 0.016 ($p = 0.874$), also showing no significant relationship. This further supports the idea that age does not significantly affect red blood cell counts among students.

-With Hct: The correlation coefficient is -0.044 ($p = 0.665$), indicating no significant association with hematocrit levels.

-With Weight: The correlation of 0.182 ($p = 0.070$) indicates a trend towards a positive relationship, but it does not reach significance at the 0.05 level. This suggests that there may be some association between age and weight, but it requires further investigation.

Weight Correlations:

- The correlation with Hb is 0.320 ($p = 0.001$), with Rbc at 0.208 ($p = 0.038$) and Hct at 0.295 ($p = 0.003$). These relationships, while significant, are weaker than those between the blood parameters, indicating that body weight may be influenced by factors beyond just hemoglobin and red blood cell levels, such as lifestyle, diet, and physical activity.

Table 2 Mean Correlations of gender and age

		Age	Gender
Hb	R	-.047	-.317
	P-Value	.644	.001
	N	100	100
Rbc	R	.016	-.474
	P-Value	.874	.000
	N	100	100
Hct	R	-.044	-.501
	P-Value	.665	.000
	N	100	100
THE WEIGHT	R	.182	-.446
	P-Value	.070	.000
	N	100	100

Correlation is significant at the 0.01 level (P-Value).
Correlation is significant at the 0.05 level (P-Value).

Anemia Prevalence with symptoms:

29% of students reported having anemia, indicating a significant concern within the student population. This finding suggests that one in the study students may be affected by anemia. 71% of students reported not having anemia, indicating a larger segment of the population is likely healthier in terms of blood parameters. The self-reported prevalence of anemia highlights the need for further investigation into the potential causes, such as nutritional deficiencies, dietary habits, or health behaviors. 62% of students reported experiencing permanent fatigue and weakness, which is a concerning finding. This high percentage raises concerns about the overall health and well-being of the student body, as fatigue and weakness are often associated with anemia or other underlying health issues.

The contrast between the two groups (62% experiencing fatigue vs. 38% not experiencing it) indicates a clear division in student health, with a majority experiencing significant fatigue.Nearly half (44%) of the students reported experiencing constant dizziness, which is a significant finding. Dizziness is often associated with anemia and other health issues, and its prevalence among the student population highlights a potential concern. The data suggest that a substantial portion of the students may be affected by this symptom, which could impact their daily activities and academic performance.

41% of students reported experiencing an accelerated heartbeat, which is a concerning symptom. An accelerated heartbeat can be associated with various health issues, including anemia, anxiety, and cardiovascular problems. The prevalence of this symptom among the student population indicates a significant health concern that warrants further investigation. 75% of students reported having difficulty focusing and paying attention while studying. This high percentage raises concerns about the impact of potential health issues, including anemia, on academic performance. The finding suggests that a significant portion of the student population may be struggling with concentration, which could affect their academic success. 66% of students reported experiencing either nail wrinkles or hair loss. These symptoms can often indicate deficiencies in essential nutrients, such as iron, which is critical for maintaining healthy hair and nails. The high prevalence of these physical manifestations suggests that a significant number of students may be facing health challenges that require attention. Slightly more than half (51%) of the students reported consuming iron-rich foods. This finding suggests that a portion of the student body is aware of the importance of dietary iron in preventing anemia.

However, the fact that nearly half (49%) of the students do not consume iron-rich foods raises concerns about potential nutritional deficiencies. 51% of students reported feeling cold, which is a noteworthy finding. Increased sensitivity to cold can be a symptom associated with anemia and other health issues. 38% of students reported experiencing loss of appetite and weight loss. These symptoms can be associated with nutritional deficiencies, including those related to anemia. The finding suggests that a substantial minority of students may be struggling with health issues that require attention, as these symptoms can significantly impact academic performance and overall well-being. Only 31% of students reported having undergone a medical examination to detect anemia in the past year. This relatively low percentage suggests a lack of awareness or initiative among students to seek preventive health care. The data highlight a concerning gap in health monitoring, which may contribute to undiagnosed cases of anemia within the student population. Only 9% of students reported currently taking medications or supplements to treat anemia.This low percentage is alarming, as it suggests that very few students are actively managing their condition, despite the reported prevalence of anemia symptoms. The finding highlights a clear gap in treatment adherence and suggests that many students may be unaware of their condition or how to address it effectively.

5- DISCUSSION

The study aimed to assess the prevalence of anemia among university students. The results of this study indicate that the overall prevalence of anemia was 29%. Of this percentage, 2% of the cases were classified as severe anemia, while 27% were moderate anemia.

The higher prevalence of anemia among female students (35%) compared to males (5%) is a notable finding and is consistent with global trends. This disparity can be attributed to various factors, including menstrual blood loss and increased iron requirements among women, especially those of reproductive age. These gender-specific factors contribute to the higher susceptibility of females to anemia, as supported by the literature

Additionally, the sample size for the study was relatively small (100 students). This limitation was primarily due to a lack of response from many students, which restricted the breadth of the study analysis.

A large and more diverse sample would have provided a more comprehensive understanding of anemia prevalence among university students. The study also explored various factors contributing to anemia, such as dietary habits and lifestyle choices.

Many students reported suboptimal dietary patterns, including insufficient intake of iron rich foods. The academic environment often leads to stress and irregular schedules, which can negatively impact dietary choices and contribute to nutrient deficiencies, including iron. The study was conducted on a sample of 100 university students, assessing the prevalence of anemia among them.

The results showed an overall anemia prevalence of 29%, with a higher rate among females (35%) compared to males (5%).

A previous study by Hassan et al. (2016) in Egypt found an anemia prevalence of 17.3% among university students.

The prevalence was significantly higher among females (24.3%) compared to males (7.3%). This study indicates gender differences in anemia prevalence, which is consistent with y study.

Al-Karaki and Al-Faraj (2016) conducted a study in Jordan, finding an anemia prevalence of 11.5%.The prevalence was higher among females (15.5%) compared to males (5%).These results align with the study study, indicating a higher prevalence of anemia among females

Al-Hamaq, Al-Kaabi, and Al-Kaabi (2018) conducted a study in the UAE, reporting an anemia prevalence of 12.7%. prevalence was higher among females (16.3%) compared to males (5.3%). These findings are consistent with the study, showing gender differences in anemia prevalence.

Al-Farsi et al. (2017) conducted a study in Oman, finding an anemia prevalence of 13.6%. - The prevalence was slightly higher among females (15.4%) compared to males (11%). results also align with the study, indicating a higher prevalence among females.

Elbashir et al. (2016) conducted a study in Sudan, reporting an anemia prevalence of 36.5%. prevalence was significantly higher among females (48.5%) compared to males (21%). This study highlights a substantial difference in anemia prevalence between females and males in Sudan.

Li et al. (2019) conducted a study in China, finding an anemia prevalence of 9.7%. prevalence was higher among females (13.4%) compared to males (4.5%). These results are consistent with the study study, indicating a higher prevalence among females. Chatchomkol et al. (2019) conducted a study in Thailand, reporting an anemia prevalence of 20.5%. The prevalence was significantly higher among females (28.5%) compared to males (8%). This study highlights a substantial gender difference in anemia prevalence in Thailand.

Wolnicka-Szewczyk et al. (2019) conducted a study in Poland, reporting an anemia prevalence of 6.7%. The prevalence was higher among females (9.3%) compared to males (2.7%). These results are consistent with the study study, showing a higher prevalence among females.

Hamade et al. (2018) conducted a study in the United States, reporting an anemia prevalence of 9.4%. The prevalence was higher among females (12.4%) compared to males (4.6%). These findings align with the study study, indicating a higher prevalence among females. (20.5%) compared to males (11.8%).

These results are consistent with this study, showing a higher prevalence among females in Oceania and Australia

Patterson et al. (2018) conducted a study in Australia, reporting an anemia prevalence of 7%. prevalence was higher among females (10%) compared to males (3%). These findings align with this study, indicating a higher prevalence among females

The detailed comparison reveals a general consistency between the study and the previous studies, especially regarding the higher prevalence of anemia among female university students compared to males.

Anemia prevalence rates vary across countries and regions, indicating the influence of regional and demographic factors on the disease's spread. Despite differences in samples and sizes, the studies provide a comprehensive overview of anemia prevalence among university students worldwide, helping to understand the health challenges faced by these students better.

6- CONCLUSIONS

prevalence of Anemia: The study found that the overall prevalence of anemia among university students was 29%. This figure indicates an urgent need to enhance health awareness programs.

Gender Differences: The results show a higher prevalence of anemia among female’s students compared to male students. This trend may be due to factors such as menstrual blood loss and dietary habits.

Impact of Dietary factors: The study revealed that many students struggle with unhealthy eating habits, lacking sufficient intake of iron-rich foods.

Sample Size: The sample size was limited (100students), which affected the depth of the results. It is important to expand the sample range in future research to obtain a clearer view of anemia prevalence among university students.

Comparison with previous Studies: There is a notable variation in anemia prevalence rates in previous studies from Arab countries, ranging from 11.5% to 36.5%. However, all studies agree that females consistently experience higher rates of anemia than males.

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