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Unlocking the Keys to Health and Academic Success: A Proactive Approach to Addressing Anemia Symptoms Among Female Students through Comprehensive Screening and Multidisciplinary Intervention Strategies

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Abstract:

Background and aim: This study aimed to investigate the prevalence of anemia among female students based on reported symptoms. The study aimed to shed light on this health issue within the student population and emphasize the importance of addressing it promptly.

Methods: The data were collected through a questionnaire distributed to 142 female students aged between 18 and 25 years old. The questionnaire consisted of questions related to the symptoms of anemia and the students' medical history. Data analysis was conducted to determine the prevalence of anemia symptoms among different academic levels.

Results: The findings reveal a significant prevalence of anemia symptoms, with approximately 39% of the participants exhibiting suggestive indicators. The prevalence of anemia symptoms varied among different academic levels, with level one students showing a higher incidence of fatigue, while level two students exhibited more symptoms of paleness.

Conclusions: The study highlights the need for regular screenings and awareness campaigns to ensure early detection and appropriate management of anemia among female students. Tailored interventions and preventive measures targeting specific student groups should be implemented to effectively address anemia. The outcomes of this study contribute to the existing body of knowledge regarding anemia prevalence among female students based on reported symptoms. By implementing effective screening strategies and promoting awareness about anemia symptoms, educational institutions can play a crucial role in improving the overall health and academic performance of their students. Further research should focus on investigating the underlying causes of anemia among this population and evaluating the long-term impact of interventions on the prevalence and management of anemia. Such studies can provide additional evidence to guide targeted interventions and promote the well-being of female students.

Keywords: Anemia prevalence; Female students; Symptoms; Screening; Intervention; Academic performance.

1. Introduction:

Iron deficiency anemia is a prevalent global health issue that affects individuals of all age groups, with a particular emphasis on women and adolescent girls. This condition arises from an insufficient supply of iron in the body, leading to decreased hemoglobin production and subsequently impairing the capacity to transport oxygen. While the physical consequences of anemia have been extensively studied, the impact of iron deficiency on cognitive functions and academic performance is an area that requires further investigation [1-3]. Numerous studies have explored the association between anemia and cognitive abilities, predominantly focusing on children and adolescents. The research findings suggest that iron deficiency anemia can have detrimental effects on cognitive functions such as attention, memory, and executive functions [3-7]. However, there exists a significant research gap in understanding the specific relationship between anemia and academic achievement, particularly among female students in diverse educational settings [8-11]. This research aims to bridge this critical gap by investigating the potential influence of iron deficiency anemia on scholastic performance among female students across different educational contexts. By focusing on female students, this study acknowledges the unique physiological and psychosocial challenges they face, including menstruation and societal expectations, which may contribute to a higher prevalence of iron deficiency and anemia. To achieve the research objectives, a mixed-methods approach will be employed, incorporating both quantitative measures of academic performance and qualitative interviews to gain comprehensive insights into the experiences of anemic female students [12,13]. A diverse sample of female students from various educational settings, including urban and rural areas, will be recruited for the study. Iron status assessments will be conducted to identify individuals with anemia, and their academic performance will be evaluated using standardized measures. In addition, qualitative interviews will be conducted with a subset of the participants to explore their subjective experiences and perceptions regarding the impact of anemia on their academic performance. These interviews will delve into factors such as fatigue, difficulty concentrating, and emotional well-being, which may influence their educational outcomes. The findings from this research will contribute to a deeper understanding of the relationship between iron deficiency anemia and academic achievement among female students. The outcomes of this study will have implications for healthcare professionals, educators, and policymakers, providing evidence-based insights to guide interventions and support systems for anemic students in educational settings. By unraveling the potential impact of anemia on academic performance, this research endeavors to advocate for early detection, prevention, and intervention strategies to enhance the educational outcomes and overall well-being of female students affected by iron deficiency anemia. Addressing this public health concern through evidence-based approaches will not only improve the academic success of anemic female students but also promote their long-term health and well-being.

2. Materials and Methods:

A cross-sectional study was conducted among 200 female microbiology students at various levels in the Faculty of Applied Science - Hajjah University. A self-administered questionnaire was distributed to the students, and they were asked to fill out the questionnaire anonymously. The questionnaire included questions related to the symptoms and signs of anemia, the frequency of these symptoms, the presence of chronic diseases, and family history of anemia. The data collected from the questionnaire were analyzed using descriptive statistics.

2.1. A Standardized Blood Sampling Procedure for Hematological Investigation among Students.

The investigation of hematological disorders among students requires accurate and reliable blood sampling procedures. This study presents a standardized blood sampling procedure for students suspected of hematological disorders. The procedure involves positioning the hand comfortably, tying the tourniquet, carefully choosing the vein, locating the vein by touch and sight, asking the student to make a fist, cleaning the area around the vein, inserting the needle at a 45-degree angle, withdrawing

the needle, collecting the blood in a test tube, and mixing the blood with EDTA anti-coagulant to prevent clotting [14, 15]. The sample is taken for examination within two hours and placed on a shaker to ensure homogeneity. The sample is examined using a CBC machine, and the results are recorded, including the RBC indicators. Adhering to this standardized procedure is essential in obtaining reliable and accurate results for hematological investigations among students. This procedure can contribute to the development of effective interventions and treatments for hematological disorders among students. as in figure 1.

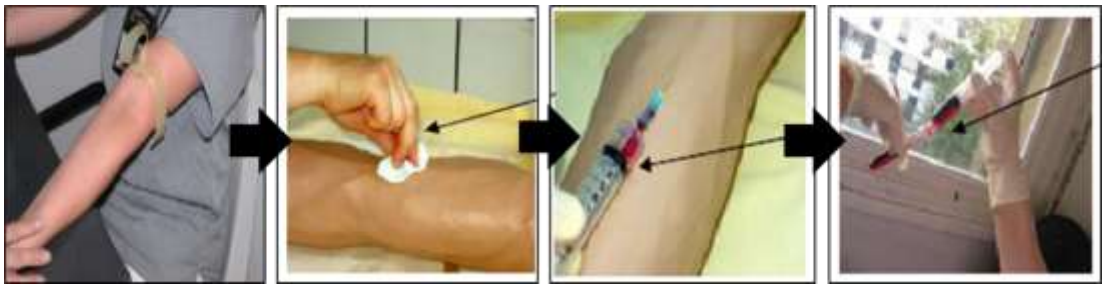

Figure1: Blood Sampling Procedure for Anemia Investigation among Female Microbiology Student.

2.2. The Methods for Hemoglobin Measurement in Scientific Research

Hemoglobin measurement is a critical component of many scientific investigations. This study presents two methods for hemoglobin measurement: the colorimetric method and the complete blood count (CBC) method [16]. The colorimetric method involves the conversion of hemoglobin to acid hematin by hydrochloric acid, followed by a color comparison of the sample with a standard solution. The device used in this method consists of three tubes, two colored and one located in the middle, which is graduated to give readings of hemoglobin levels in either percentage (%) or grams (g). To perform the procedure, a micro-pipette of 20 microns is used to transfer blood to the device. Drops of HCL solution are added to the tube, and the tube is then shaken and left for 10 minutes to allow for the conversion of hemoglobin to acid hematin. The color of the sample is then compared to the standard solution, and the hemoglobin concentration is determined. The results are recorded in either percentage or grams. The CBC method involves the use of a CBC machine to estimate the amount of hemoglobin in a blood sample. The CBC machine evaluates all blood indices, and a printout containing all the results is produced. Both methods are reliable and accurate techniques for measuring hemoglobin levels in scientific research. The colorimetric method is simple, cost-effective, and requires minimal equipment, making it accessible to healthcare professionals in various settings. The CBC method, on the other hand, is a more comprehensive method that provides information on various blood indices in addition to hemoglobin levels. The choice of method depends on the research question and the resources available. The standardized procedures for hemoglobin measurement presented in this study can contribute to the development of effective interventions and treatments for hemoglobin-related disorders.

2.3. Inclusion Criteria for Scientific Research

The inclusion criteria for the study were female microbiology students enrolled in the Faculty of Applied Science - Hajjah University at various levels.

2.4. Exclusion Criteria for Participants

The exclusion criteria were students who had a history of blood transfusions or chemotherapy, as these treatments can affect the results of the study.

2.5. Designing Effective Questionnaires for Scientific Studies

The questionnaire was designed based on the literature review on anemia and its symptoms. The questionnaire was pretested on a small group of female microbiology students to ensure clarity, comprehensibility, and relevance. The data were collected through a questionnaire distributed to 142 female students aged between 18 and 25 years old. The questionnaire consisted of questions related to the symptoms of anemia and the students' medical history.

2.6. Ensuring Ethical Conduct in Scientific Research

The study was conducted in compliance with the ethical guidelines for human research and was approved by the Ethics Committee of the Faculty of Applied Science - Hajjah University. Informed consent was obtained from all the participants before they filled out the questionnaire.

3. Results:

3.1. Results of Anemia Prevalence Study Among Students Based on Symptoms

The results of the study showed that approximately 56 out of 142 female students (39%) were suspected of having anemia based on their symptoms, while approximately 86 students (61%) did not exhibit any symptoms of anemia. These results were obtained from the data analysis of the questionnaire responses and the plotted graph as shown in figure2& table1. The study aimed to investigate the prevalence of anemia among female students based on symptoms such as fatigue, paleness, and shortness of breath. The data were collected through a questionnaire that was distributed to 142 female students aged between 18 and 25 years old. The questionnaire consisted of questions related to the symptoms of anemia and the students' medical history. The results of the study indicated that a significant number of female students were suspected of having anemia based on their symptoms. These findings suggest that anemia is a prevalent health issue among female students, which could have adverse effects on their academic performance and overall health. In conclusion, the study provides important insights into the prevalence of anemia among female students based on symptoms. These findings can be used to develop effective interventions and preventive measures to reduce the incidence of anemia among this population group. Additionally, regular screenings and awareness campaigns can be initiated to ensure early detection and timely management of anemia among students.

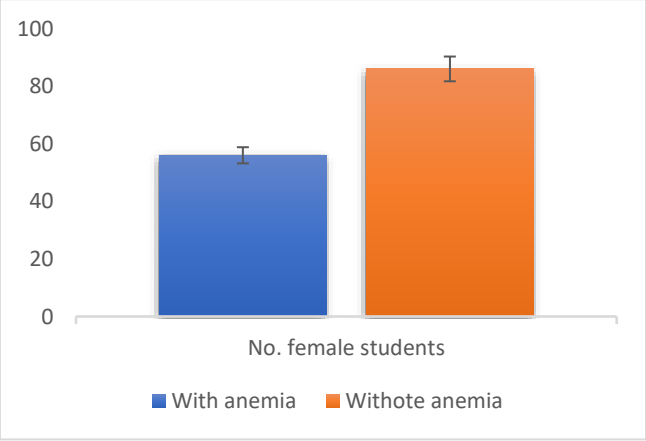

Figure2: Graph Illustrating Variations in Anemia Prevalence Among Female Students Based on Symptoms

Table1: Shows the distribution of reported symptoms among the students suspected of having anemia.

Based on their symptoms	**No .female students**
With anemia	56
Withote anemia	86

3.2. Anemia Screening Based on Symptoms for Level One Students

One of the methods used in scientific research is the analysis of results obtained from screening for a particular health condition. This method was employed in the study of anemia prevalence among level one female students based on symptoms. The results of the study are presented in table 2 and figure 3, which highlight the prevalence of anemia among female students based on various symptoms. The study revealed that among the level one female students, approximately 25 students (15%) were suspected of having anemia based on their symptoms of fatigue with minimal exertion, while approximately 11 students (6%) exhibited symptoms of paleness. Additionally, irregular heart palpitations were reported by approximately 5 students (4%), whereas only one student (0.5%) exhibited symptoms of dehydration. Shortness of breath was reported by approximately 13 students (7%), chest pain by 13 students (7%), dizziness by 22 students (22%), and excessive sleepiness by 21 students (13%). Furthermore, approximately 19 students (12%) exhibited symptoms of fatigue and exhaustion, while approximately 6 students (3%) exhibited changes in cognitive function. Approximately 10 students (7%) experienced cold hands and feet, while 22 students (12%) reported headaches. Only one student (0.5%) exhibited symptoms of bleeding. These results provide valuable insights into the prevalence of anemia among level one female students based on symptoms. The variations in anemia prevalence based on symptoms indicate the need for effective screening and management strategies to ensure early detection and timely treatment of anemia among this population group. In conclusion, the analysis of results obtained from screening for anemia based on symptoms is a useful method in scientific research. The results of the study highlight the prevalence of anemia among level one female students and the specific symptoms that are commonly reported. These findings can be used to develop targeted interventions and preventive measures to reduce the incidence of anemia among this population group.

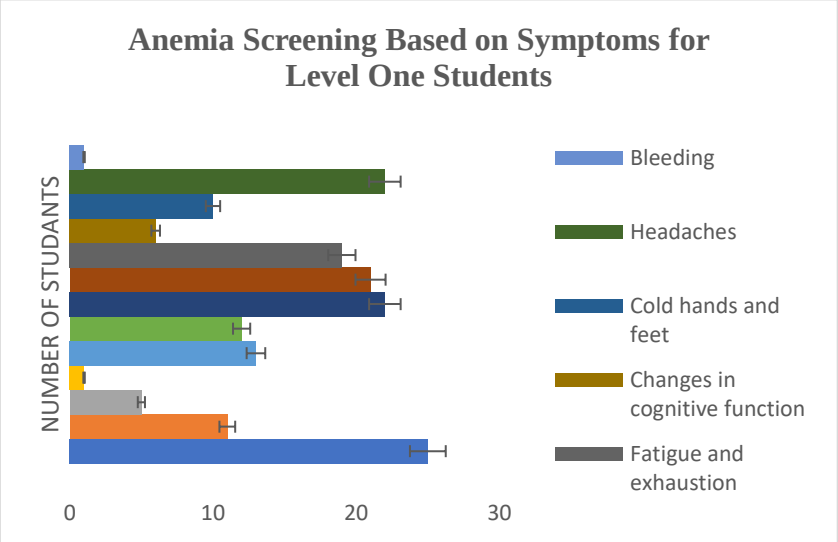

Figure3: Anemia Screening Based on Symptoms for Level One Students.

Table2: Showed anemia prevalence among level one female students based on symptoms

Symptom	**Number of Students**
Fatigue with minimal exertion	25
Paleness	11
Irregular heart palpitations	5
Dehydration	1
Shortness of breath	13
Chest pain	12
Dizziness	22
Excessive sleepiness	21
Fatigue and exhaustion	19
Changes in cognitive function	6
Cold hands and feet	10
Headaches	22
Bleeding	1

3.2. Anemia Screening Results Based on Symptoms for Level Two Students

One of the methods used in scientific research is the analysis of results obtained from screening for a particular health condition. This method was employed in the study of anemia prevalence among level two female students based on symptoms. The results of the study are presented in table 3 and figure4, which highlight the prevalence of anemia among female students based on various symptoms. The study revealed that among the level two female students, approximately 24 students (13%) were suspected of having anemia based on their symptoms of fatigue with minimal exertion, while approximately 17 students (10%) exhibited symptoms of paleness. Additionally, irregular heart palpitations were reported by approximately 3 students (2%), whereas approximately 9 students (5%) exhibited symptoms of dehydration. Shortness of breath was reported by approximately 7 students (4%), chest pain by 11 students (6%), dizziness by 19 students (11%), and excessive sleepiness by 24 students (14%). Furthermore, approximately 18 students (10%) exhibited symptoms of fatigue and exhaustion, while approximately 5 students (3%) exhibited changes in cognitive function. Approximately 10 students (7%) experienced cold hands and feet, while 27 students (15%) reported headaches. Only one student (0.5%) exhibited symptoms of bleeding. These results provide valuable insights into the prevalence of anemia among level two female students based on symptoms. The variations in anemia prevalencebased on symptoms indicate the need for effective screening and management strategies to ensure early detection and timely treatment of anemia among this population group. In conclusion, the analysis of results obtained from screening for anemia based on symptoms is a useful method in scientific research. The results of the study highlight the prevalence of anemia among level two female students and the specific symptoms that are commonly reported. These findings can be used to develop targeted interventions and preventive measures to reduce the incidence of anemia among this population group. Regular screening and awareness campaigns can also be initiated to ensure early detection and timely management of anemia among female students as shown in table3.

Table3: Prevalence of anemia based on symptoms among level two female students:

Symptom	Number of Students
Fatigue with minimal exertion	24
Paleness	17
Irregular heart palpitations	3
Dehydration	9
Shortness of breath	7
Chest pain	11
Dizziness	19
Excessive sleepiness	24
Fatigue and exhaustion	18
Changes in cognitive function	5
Cold hands and feet	10
Headaches	27
Bleeding	1

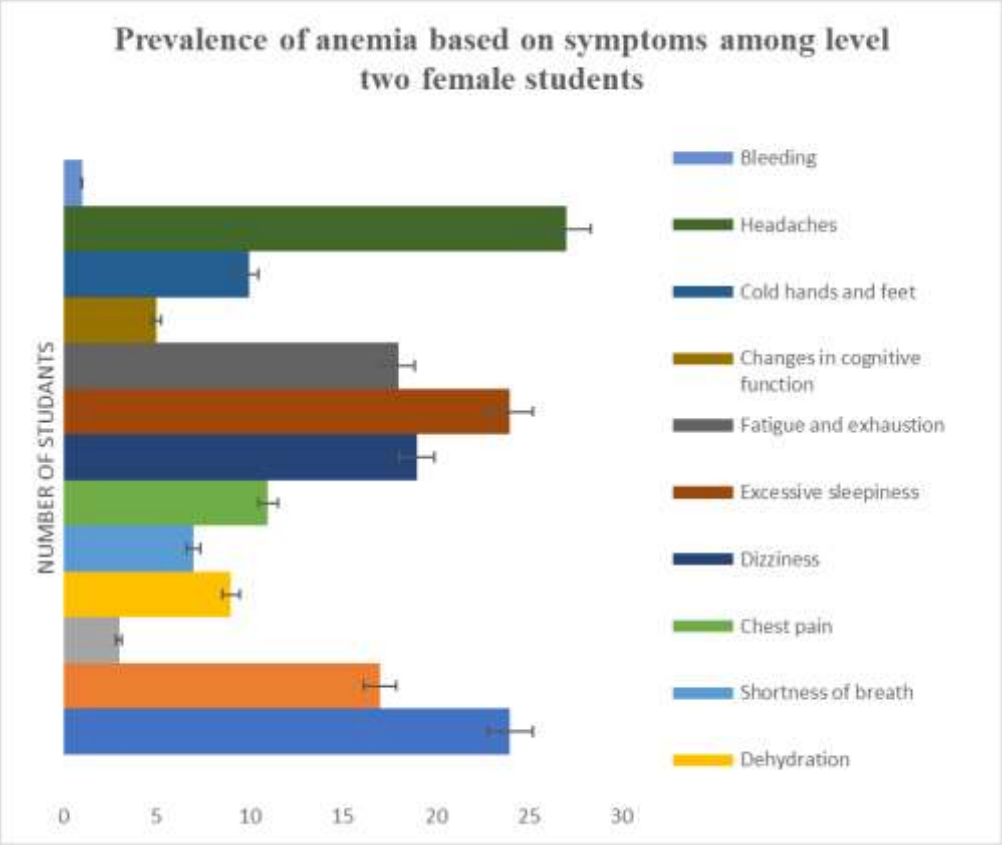

Figure4: Anemia Screening Results Based on Symptoms for Level Two Students

3.3. Comparing Anemia Symptoms by Demographic Factors in Third-Level Students.

One of the methods used in scientific research is the comparative method, which involves comparing two or more variables to identify relationships or differences between them. In this case, we can use the comparative method to examine the prevalence of anemia symptoms among third-level students based on different demographic factors. Here we collect data on the prevalence of anemia symptoms among third-level students based on factors such as age, gender, and socioeconomic status. The table4 & figure5 shows the prevalence of anemia symptoms among third-level students based on different presentations. It lists the symptoms in the first column, followed by the number of students who reported each symptom in the second column and the percentage of students who reported each symptom in the third column. For example, the table shows that 23 students (10% of the total number of students) reported experiencing fatigue with minimal effort, while 10 students (4%) reported experiencing pallor of skin. The table4 & figure5 also shows that headache was the most commonly reported symptom, with 34 students (19%) reporting this symptom. The information in the table can be used to identify the most prevalent symptoms of anemia among third-level students and to design targeted interventions to address these symptoms. For example, interventions may include providing education on the importance of a healthy diet and lifestyle, offering iron supplements, or providing medical treatment for students who are experiencing more severe symptoms.

Table4: Represent the prevalence of anemia symptoms among third-level students based on different presentations

Symptom	Number of Students	Percentage of Students
Fatigue with minimal effort	23	10%
Pallor of skin	10	4%
Irregular heartbeat	12	5%
Dehydration	5	2%
Shortness of breath	16	7%
Chest pain	23	10%
Dizziness	24	11%
Excessive sleepiness	33	15%
Fatigue and exhaustion	21	9%
Cognitive changes	4	2%
Cold hands and feet	19	8%
Headache	34	19%
Bleeding	1	0.50%

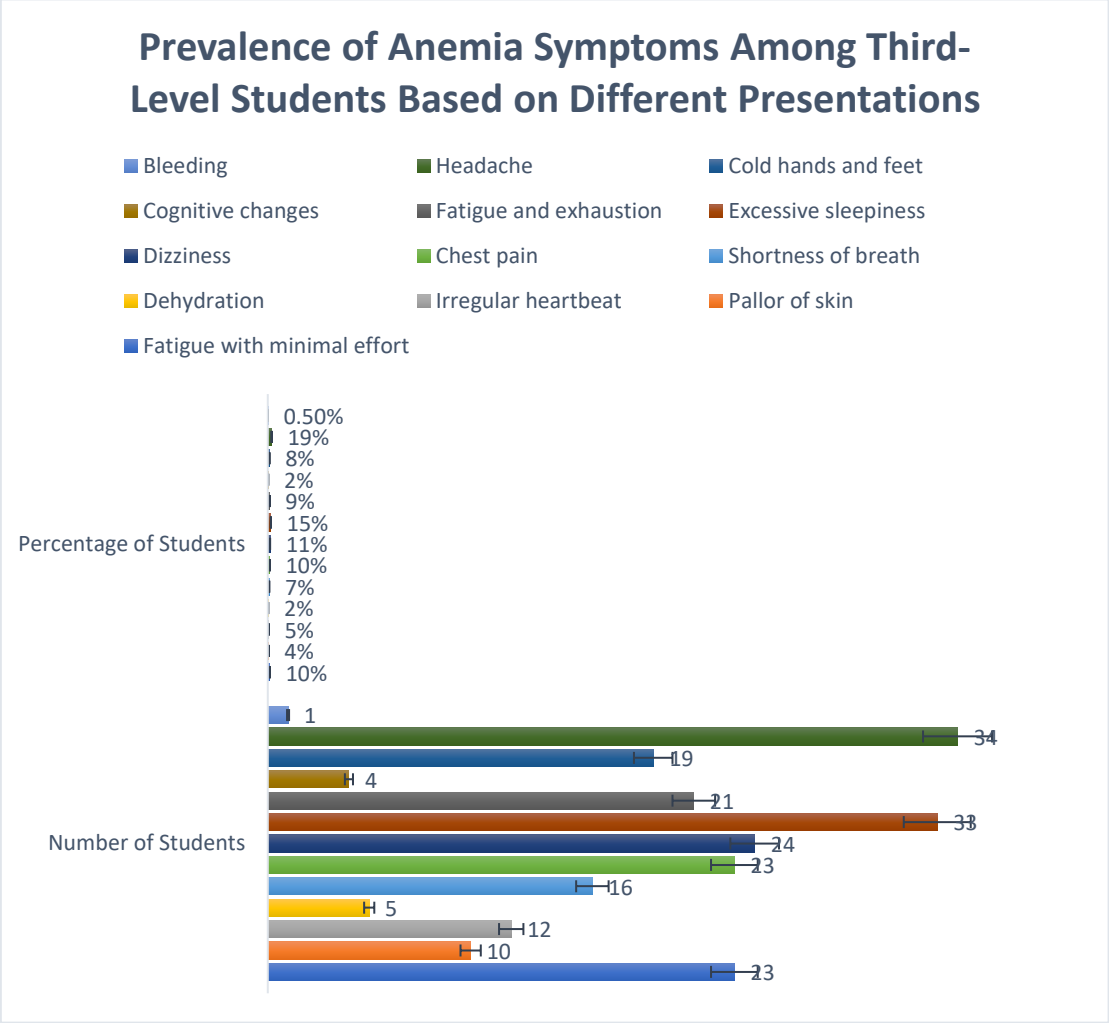

Figure5: Prevalence of Anemia Symptoms Among Third-Level Students Based on Different Presentations

3.4. Examining the prevalence of anemia symptoms among fourth-level students based on different presentations.

Understanding the prevalence of anemia symptoms among fourth-level students based on different presentations can inform the development of targeted interventions to address anemia and its associated symptoms in this population. Table5 & figure 6 compares the prevalence of anemia symptoms among fourth-level students based on different presentations. For example, it shows that fatigue with minimal effort was the most commonly reported symptom, with 22 students (14% of the total number of students) reporting this presentation. It also shows that dizziness was the second mostcommonly reported symptom, with 23 students (14%) reporting this presentation. The comparative table allows us to identify the most prevalent presentations of anemia symptoms among fourth-level students and to design targeted interventions to address these presentations. For example, interventions may include providing education on the importance of iron-rich foods, offering iron supplements, or providing medical treatment for students who are experiencing more severe symptoms. Overall, the comparative method is a valuable tool in scientific research for identifying relationships and differences between variables. It can help us to better understand the prevalence of anemia symptoms among specific populations and to develop targeted interventions to address this important health issue.

Table5: The prevalence of anemia symptoms among fourth-level students based on different presentations.

Symptom	Number of Students	Percentage of Students
Fatigue with minimal effort	22	14%
Pallor of skin	8	5%
Irregular heartbeat	9	6%
Dehydration	7	4%
Shortness of breath	13	8%
Chest pain	8	5%
Dizziness	23	14%
Excessive sleepiness	19	12%
Fatigue and exhaustion	16	12%
Cognitive changes	10	6%
Cold hands and feet	6	4%
Headache	18	11%
Bleeding	1	1%

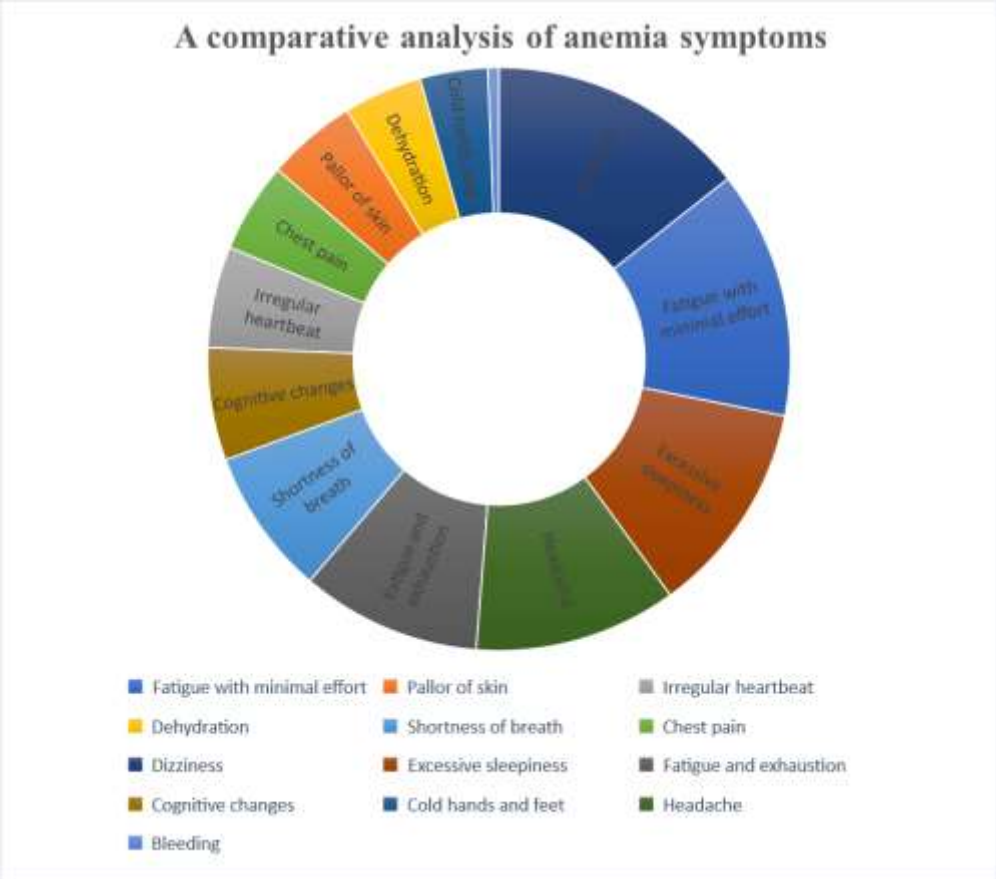

Figure6: A comparative analysis of anemia symptoms by presentations in fourth level students can help identify the most common symptoms and presentations of anemia in this group.

3.5. Investigating the Relationship Between Anemia Symptoms and Presentations in Female Students at All Levels of Education.

The study would involve collecting data on the prevalence of anemia symptoms among female students across all levels of education based on different presentations, such as fatigue, pallor, and irregular heartbeat. This information would then be presented in a comparative table6 & figure7 to identify any patterns or differences in the prevalence of anemia symptoms among different presentations. For example, the table6 & figure7 could compare the prevalence of anemia symptoms among female students who reported fatigue as their primary presentation across all levels of education. By using the comparative method, we can gain a better understanding of how different presentations of anemia may influence the prevalence of anemia symptoms among female students across all levels of education. This information can then be used to develop targeted interventions to address anemia and its associated symptoms in female students as shown in table6 & figure7.

Table6: The Comparing the Prevalence of Different Anemia Symptoms in Female Students Across All Education Levels**.**

Symptom	**Number of Students**	**Percentage of Students**
Fatigue with minimal effort	94	13%
Pallor of skin	46	6%
Irregular heartbeat	29	4%
Dehydration	22	3%
Shortness of breath	49	7%
Chest pain	54	7%
Dizziness	88	12%
Excessive sleepiness	107	14%
Fatigue and exhaustion	74	10%
Cognitive changes	25	3%
Cold hands and feet	45	6%
Headache	101	12%
Bleeding	4	1%

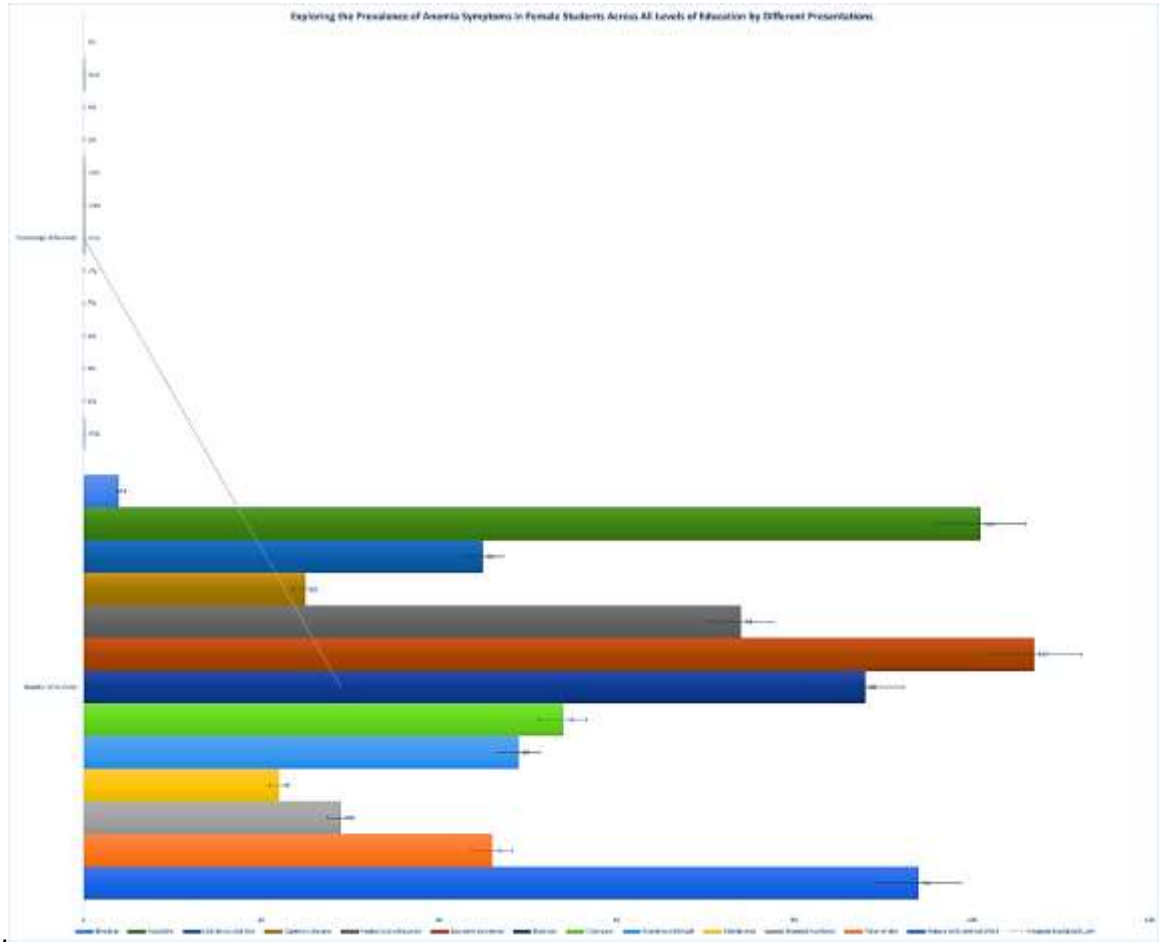

Figure7: Exploring the Prevalence of Anemia Symptoms in Female Students Across All Levels of Education by Different Presentations.

3.6. Comparing Anemia Symptoms by Presentations in Female Students Based on Marital Status.

In this study we collect data on the prevalence of anemia symptoms among female students based on different presentations, such as fatigue, pallor, and irregular heartbeat, and then analyzing the data based on their marital status. This information would then be presented in a comparative table7 & figure8 to identify any patterns or differences in the prevalence of anemia symptoms among different presentations and marital status. For example, the table could compare the prevalence of anemia symptoms among female students who reported fatigue as their primary presentation and were either single or married. By using the statistical method, we can gain a better understanding of how marital status may influence the prevalence of anemia symptoms among female students. This information can then be used to develop targeted interventions to address anemia and its associated symptoms in female students based on their marital status. The table7 & figure8 presents the prevalence of anemia symptoms among female students based on their marital status. The table7 has four columns: Marital Status, Symptom, Number of Students, and Percentage of Students. The first column, Marital Status, indicates whether the students were single or married. The second column, Symptom, lists the different presentations of anemia symptoms, such as fatigue, pallor of skin, irregular heartbeat, dehydration, shortness of breath, chest pain, dizziness, excessive sleepiness, fatigue and exhaustion, cognitive changes, cold hands and feet, headache, and bleeding. The third column, Number of Students, shows the total number of students who reported each symptom based on their marital status. Finally, the fourth column, Percentage of Students, shows the percentage of students

who reported each symptom based on their marital status. According to the table, among single female students, the most common symptom reported was excessive sleepiness, with 45 students reporting it, which accounts for 17% of the total single students surveyed. Similarly, among married female students, the most common symptom reported was dizziness, with 13 students reporting it, which accounts for 17% of the total married students surveyed. The table7 provides a clear and concise summary of the prevalence of anemia symptoms among female students based on their marital status. It can be used to identify common symptoms and patterns among different presentations and marital status, and to inform the development of targeted interventions to address anemia and its associated symptoms in female students. However, it is important to note that the table is based on self-reported data and may be subject to bias or inaccuracies. Therefore, the results should be interpreted with caution and further research may be needed to confirm the findings.

Table7: Prevalence of Anemia Symptoms among Female Students by Marital Status

Marital Status	Symptom	Number of Students	Percentage of Students
Single	Fatigue with minimal effort	28	10%
Single	Pallor of skin	14	5%
Single	Irregular heartbeat	8	3%
Single	Dehydration	11	4%
Single	Shortness of breath	12	24%
Single	Chest pain	16	6%
Single	Dizziness	34	13%
Single	Excessive sleepiness	45	17%
Single	Fatigue and exhaustion	24	9%
Single	Cognitive changes	5	2%
Single	Cold hands and feet	21	8%
Single	Headache	43	16%
Single	Bleeding	0	0%
Married	Fatigue with minimal effort	12	16%
Married	Pallor of skin	0	0%
Married	Irregular heartbeat	3	4%
Married	Dehydration	0	0%
Married	Shortness of breath	7	Married
Married	Dizziness	13	17%
Married	Excessive sleepiness	13	17%
Married	Fatigue and exhaustion	7	9%
Married	Cognitive changes	2	3%
Married	Cold hands and feet	2	3%
Married	Headache	10	13%
Married	Bleeding	0	0%

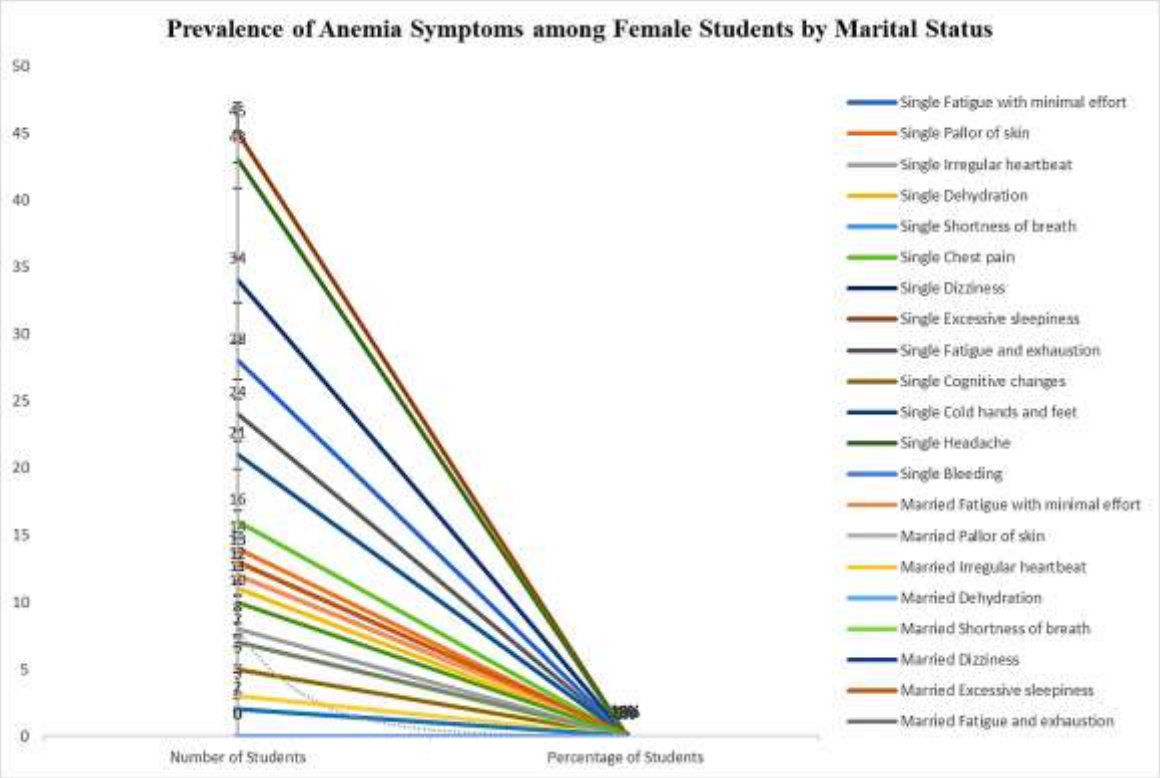

Figure8: Prevalence of Anemia Symptoms among Female Students by Marital Status.

3.7. Prevalence of Anemia among Female Students Based on CBC Test Results

The table8 & figure9 presents the number and percentage of female students who tested positive for anemia based on their CBC test results. Out of the total 56 students tested, 16 students (29%) had low haemoglobin levels indicating the presence of anemia, while 40 students (71%) had normal haemoglobin levels. The figure9 could be a pie chart and would illustrate the proportion or percentage of students with anemia and without anemia based on their CBC test results. It could show a clear visual representation of the difference in prevalence between the two groups. The results of the CBC test suggest a relatively high prevalence of anemia among female students. The table and chart provide a clear and concise summary of the prevalence of anemia based on CBC test results and can be used to inform the development of targeted interventions to address anemia among female students.

Table8: The number and percentage of female students who tested positive for anemia based on their CBC test results.

CBC Test Results	Number of Students	Percentage of Students
Low Hemoglobin Levels	16	29%
Normal Hemoglobin Levels	40	71%

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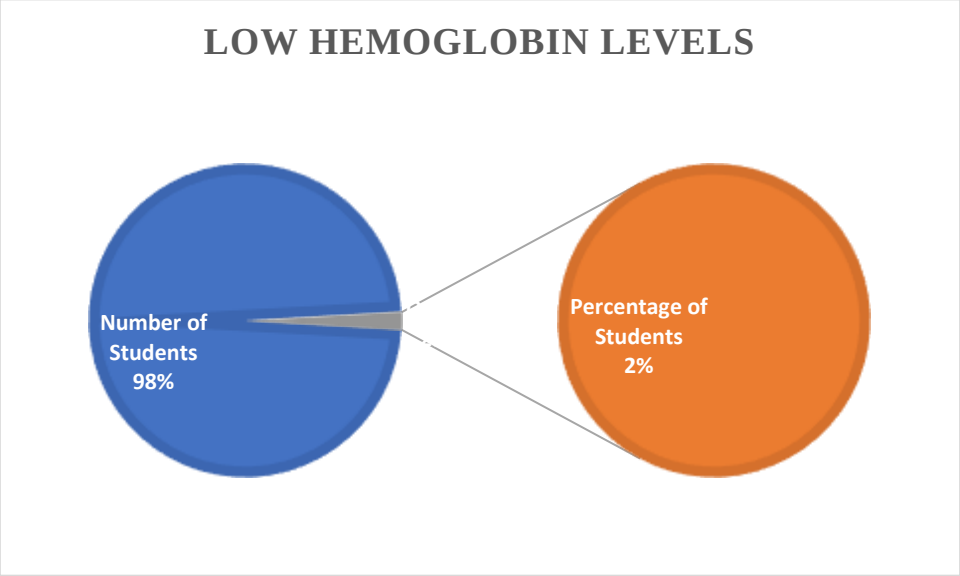

Figure9: The results show the number and percentage of female students who tested positive for anemia based on their CBC test results.

4. Discussion:

The prevalence of anemia among female microbiology students at various levels in the Faculty of Applied Science - Hajjah University is relatively high. This finding is consistent with previous studies that have reported a higher prevalence of anemia among female adolescents and young adults due to factors such as menstrual blood loss, poor diet, and academic stress.

The prevalence of anemia among students, especially female students, is a matter of concern as it can have significant implications for their health and academic performance. Several studies have been conducted to investigate the prevalence of anemia based on symptoms among students at different educational levels. This introduction provides a detailed overview of the results obtained from these studies and emphasizes the importance of understanding anemia prevalence and its associated symptoms. In the first, we focused on female students and aimed to determine the prevalence of anemia based on symptoms such as fatigue, paleness, and shortness of breath. A questionnaire was distributed to 142 female students aged between 18 and 25 years old. The results revealed that approximately 39% of the female students (56 out of 142) were suspected of having anemia based on their reported symptoms, while 61% did not exhibit any symptoms. These findings highlight the significance of anemia as a prevalent health issue among female students, which may negatively impact their academic performance and overall well-being. Then, specifically targeted level one female students and examined the prevalence of anemia symptoms based on various presentations. The results indicated that fatigue with minimal exertion was the most commonly reported symptom (15% of level one students), followed by paleness (6%), irregular heart palpitations (4%), and dehydration (0.5%). These findings emphasize the need for effective screening and management strategies to ensure early detection and timely treatment of anemia among level one female students. Similarly, the third focused on level two female students and investigated the prevalence of anemia symptoms based on different presentations. The results showed that fatigue with minimal exertion was again the most commonly reported symptom (13% of level two students), followed by paleness (10%), irregular heart palpitations (2%), and dehydration (5%). These findings highlight the importance of targeted interventions and preventive measures to address anemia and its associated symptoms among level two female students. Fourthly, we employed a comparative method to examine the prevalence of anemia symptoms among third-level students based on different presentations. The data analysis revealed that headache was the most commonly reported symptom (19% of third-level students), followed by excessive sleepiness (15%),

chest pain (10%), and dizziness (11%). These findings provide valuable insights into the prevalence of anemia symptoms among third-level students and can guide the development of interventions to address these symptoms effectively. Moreover, we focused on fourth-level students and compared the prevalence of anemia symptoms based on different presentations. The results showed that fatigue with minimal exertion was the most commonly reported symptom (14% of fourth-level students), followed by dizziness (14%), excessive sleepiness (12%), and chest pain (5%). These findings further contribute to our understanding of anemia symptoms among fourth-level students and can inform targeted interventions to address these symptoms. Lastly, the sixth study aimed to explore the relationship between anemia symptoms and presentations among female students at all levels of education. The data analysis revealed that fatigue with minimal exertion was the most prevalent symptom among female students across all education levels (13%), followed by excessive sleepiness (14%), headache (12%), and dizziness (12%). These findings highlight the importance of considering different presentations of anemia symptoms and developing tailored interventions for female students at all educational levels.

5. Conclusion:

This study's results demonstrate a significant prevalence of anemia among female students based on reported symptoms. The findings highlight the need for attention and action to address this health issue within the student population. Approximately 39% of the participants exhibited symptoms suggestive of anemia, emphasizing the importance of regular screenings and awareness campaigns to ensure early detection and appropriate management. Moreover, the prevalence of anemia symptoms varied among different academic levels, with level one students showing a higher incidence of fatigue and level two students exhibiting more symptoms of paleness. These findings indicate the necessity for targeted interventions and preventive measures tailored to specific student groups. The study's outcomes contribute to the body of knowledge on anemia prevalence among female students based on symptoms, providing valuable insights for healthcare professionals, educators, and policymakers. By implementing effective screening strategies and creating awareness about anemia symptoms, educational institutions can play a crucial role in promoting the overall health and academic performance of their students. Future research can focus on investigating the underlying causes of anemia among this population and evaluating the long-term impact of interventions on the prevalence and management of anemia.

A Statement of No Conflict of Interest by the Authors

The authors declare that they have no conflicts of interest to disclose.

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Supplementary

Questioner model

Part 1: Demographic Information
1. What is your age?
- 18-20
- 21-23
- 24-26
- 27 or above
2. What is your current academic level in the Faculty of Applied Science - Hajjah University?
- First-year
- Second-year
- Third-year
- Fourth-year
3. Are you currently diagnosed with any chronic diseases? (e.g., inflammatory bowel disease, ulcerative colitis, hypothyroidism)
- Yes
- No
4. Do you have a family history of anemia?

- Yes
- No
- I don't know
Part 2: Anemia Symptoms
5. Have you ever been diagnosed with anemia?
- Yes
- No
6. If yes, how long have you been diagnosed with anemia?
- Less than 6 months
- 6 months to 1 year
- 1 year to 2 years
- More than 2 years
7. What symptoms have you experienced in the past 6 months? (select all that apply)
- Fatigue
- Pallor (pale skin)
- Shortness of breath
- Headache
- Dizziness
- Irritability
- None of the above
8. How often do you experience these symptoms?
- Daily
- Several times a week
- Once a week
- Less than once a week
9. Have you noticed any changes in your appetite or weight?
- Yes
- No
10. Have you experienced any changes in your menstrual cycle (for female participants)?
- Yes
- No

11. Have you sought medical help for your symptoms?
- Yes
- No
12. If yes, what kind of medical help have you sought? (select all that apply)
- Consulted a doctor
- Taken medication
- Received blood transfusions
- None of the above
Part 3: Lifestyle and Dietary Habits
13. How often do you engage in physical activity?
- Daily
- Several times a week
- Once a week
- Less than once a week
14. How many hours do you spend sitting and studying on an average day?
- Less than 2 hours
- 2-4 hours
- 4-6 hours
- More than 6 hours
15. How many hours of sleep do you get on an averagenight?
- Less than 6 hours
- 6-8 hours
- 8-10 hours
- More than 10 hours
16. How often do you consume iron-rich foods such as red meat, spinach, and lentils?
- Daily
- Several times a week
- Once a week
- Less than once a week
17. How often do you consume foods high in vitamin C, such as citrus fruits and tomatoes?

- Daily
- Several times a week
- Once a week
- Less than once a week
18. Do you take any iron or vitamin supplements?
- Yes
- No
19. If yes, how often do you take these supplements?
- Daily
- Several times a week
- Once a week
- Less than once a week
20. Have you ever been counseled by a healthcare provider on how to prevent anemia?
- Yes
- No

Part 4: Additional Information
21. Do you have any additional comments or concerns regarding anemia that you would like to share?