

RESEARCH ARTICLE

IMPACT OF DIETARY HABITS ON HEMATOLOGICAL HEALTH IN ALLIED HEALTHCARE STUDENTS IN TRIPURA

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ABSTRACT: Background: Diet influences hematological health, especially among young adults susceptible to anemia and nutritional imbalances. Allied healthcare students are particularly at risk due to academic stress and irregular eating habits. Objectives: This study examined the relationship between dietary habits and hematological health, focusing on anemia, hematological parameters, and BMI among undergraduate allied healthcare students in Tripura. Methods: A cross-sectional study was conducted among 138 students (72 males, 66 females), aged 18–21 years, from January to April 2025. Hematological parameters were measured using standard laboratory techniques, and dietary practices were assessed via a structured questionnaire. Data analysis involved descriptive statistics and chi-square tests, with significance set at $p < 0.05$. Results: Anemia prevalence was significantly higher in females (40.9%) than in males (19.4%). BMI distribution showed 11.6% underweight, 53.6% normal, 16.7% overweight and 18.1% obese, with obesity more common in males. Among anemic students, 61.0% had mild anemia and 39.0% had moderate anemia. Dietary patterns revealed that 82.6% consumed mixed diets, but only 32.8% regularly ate fruits and green leafy vegetables, while 44.2% frequently consumed junk food. Meal skipping was reported by 34.1%, and only 8.0% used nutritional supplements. Significant associations were found between diet patterns, BMI, and anemia status. Conclusion: Poor dietary practices, along with gender and BMI differences, are linked to hematological variations and higher anemia rates among allied healthcare students in Tripura. Encouraging balanced diets and reducing unhealthy eating may enhance blood health and lower anemia risk.

Keywords: Diet, anemia, BMI, hematological health, allied healthcare students

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INTRODUCTION:

Diet plays a crucial role in maintaining overall health, with its influence extending to blood parameters that reflect the body's physiological and nutritional status. Adequate intake of macronutrients and micronutrients is essential for supporting hematopoiesis, immune function, and oxygen transport ^[1]. Conversely, poor dietary habits—such as low consumption of iron-rich foods, insufficient vitamin B12 and folate intake, and high dependence on processed foods contribute to hematological disorders including anemia, leukopenia, and impaired platelet function ^[2,3].

Young adults, particularly students, are at increased risk of nutritional imbalances due to academic stress, irregular routines, and lifestyle factors that negatively affect eating behaviors^[4,5]. Allied healthcare students, despite their medical knowledge and awareness, are not exempt from these challenges. Academic pressures, hostel living conditions, and financial constraints may lead to poor dietary choices and insufficient nutrient intake ^[6]. These concerns are especially pertinent in India, where anemia and micronutrient deficiencies remain widespread among youth populations ^[7].

Blood health, evaluated through parameters such as hemoglobin concentration, hematocrit, red blood cell indices, white blood cell counts, and platelet levels, offers critical insight into nutritional status and the body's capacity to respond to stress^[8]. Iron deficiency anemia is among the most common hematological issues in students, largely attributed to inadequate iron intake and limited dietary diversity^[9]. Similarly, vitamin B12 and folate deficiencies can disrupt erythropoiesis, resulting in megaloblastic anemia, while low protein intake may further impair hemoglobin production^[2].

Tripura, a state in Northeast India, provides a unique setting for studying dietary influences on blood health. While the region is rich in local produce and cultural food practices, studies suggest that micronutrient deficiencies and dietary imbalances remain prevalent among its youth^[10,11]. Investigating the dietary patterns and their association with hematological health in allied healthcare students is therefore imperative not only because they are a nutritionally vulnerable group but also because their health impacts future healthcare delivery.

Despite existing knowledge of anemia and nutritional deficiencies in India, there is limited research exploring the direct link between diet and blood health among allied healthcare students, particularly in regions like Tripura. This study aims to address this gap by assessing the impact of dietary habits on hematological parameters in undergraduate students. The findings are expected to guide the development of nutrition-based interventions and health promotion strategies tailored to the unique needs of this population.

METHODOLOGY:

Study Design and Participants: This cross-sectional study was conducted between January and April 2025 among 138 undergraduate allied healthcare students (72 males and 66 females) aged 18-21 years in Tripura. Students who provided informed consent and met the inclusion criteria were enrolled in the study, while those with pre-existing hematological disorders, chronic illnesses, recent infections, long-term medication use, recent blood transfusion or supplementation, special diets, or a history of alcohol or tobacco use in the past year were excluded.

Anthropometric and Vital Measurements: Height was measured using a Harpenden-type anthropometer to the nearest 0.1 cm. Body weight was recorded with a calibrated digital weighing scale to the nearest 0.1 kg. Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared (kg/m^2) and categorized according to the World Health Organization ^[12] guidelines.

Hematological Assessment: Blood samples were collected following standard procedures and analyzed for hematological parameters, including hemoglobin concentration, hematocrit, red blood cell indices, white blood cell count, and platelet levels. All tests were performed using the *Horiba Yumizen H550 automated hematology analyzer*, with reagents such as *ABX Diluent*, *ABX Cleaner*, *Whitediff*, and *ABX Minoclair*, manufactured by Horiba, as recommended for routine analysis. These reagents ensured precision and reliability of measurements while following the manufacturer's protocols.

Dietary Assessment: A structured questionnaire was used to collect information on participants' dietary habits, including types of foods consumed, frequency of intake, use of supplements, and meal patterns. The questionnaire was adapted from validated dietary surveys used in previous research among student populations and was piloted with a small group of students (n=15) to ensure clarity, cultural relevance, and feasibility in the local context.

Statistical Analysis: Data were analyzed using descriptive statistics to summarize hematological and dietary patterns. Associations between variables such as diet, body mass index (BMI), and anemia status were evaluated using chi-square tests. A p-value of less than 0.05 was considered statistically significant. All analyses were performed using standard statistical software SPSS version 22.0.

RESULT:

Table 1 summarizes the distribution of hematological parameters among male and female allied healthcare students in Tripura. Significant gender differences were observed in several parameters including hemoglobin, red blood cell count, hematocrit, RDW-SD, and platelet count. Females showed a higher prevalence of low hemoglobin, low hematocrit, and increased red cell distribution width, suggesting a greater burden of anemia in comparison to males. No significant

differences were found in MCV, MCH, MCHC, RDW-CV, or white blood cell counts between genders.

Table 1. Distribution of hematological parameters by gender (n = 138)

Parameter	Male (n=72)			Female (n=66)			p value
	Low	Normal	High	Low	Normal	High	
Hemoglobin	12	58	2	24	39	3	< 0.05
RBC count	3	66	3	5	59	2	< 0.05
Hematocrit (Hct)	8	62	2	18	48	0	< 0.05
MCV	10	58	4	14	48	4	> 0.05
MCH	11	57	4	20	43	3	> 0.05
MCHC	7	61	4	13	51	2	> 0.05
RDW – SD	6	56	10	4	44	18	< 0.05
RDW – CV	0	60	12	0	48	18	> 0.05
WBC count	2	67	3	1	61	4	> 0.05
Platelet count (PLT)	1	64	7	0	56	10	< 0.05

Counts are the number of students; row totals equal group sizes (males = 72, females = 66). P-values from chi-square tests comparing Low/Normal/High distributions between genders. *p < 0.05 is considered significant.

Table 2 presents the gender-wise distribution of BMI categories and anemia status. The majority of students were within the normal BMI range, but obesity was more prevalent among males, while underweight status and anemia were more common among females. Anemia affected nearly one-third of the population, with a higher incidence in females. Among those affected, mild anemia was predominant across both genders.

Table 2. Gender-wise distribution of BMI, anemia, and its grading among allied healthcare students (N = 138)

Parameter	Total (N=138)	Male (n=72)	Female (n=66)	p-value
BMI				

Parameter	Total (N=138)	Male (n=72)	Female (n=66)	p-value
Underweight	16 (11.6%)	7 (9.7%)	9 (13.6%)	0.05
Normal	74 (53.6%)	38 (52.8%)	36 (54.5%)	
Overweight	23 (16.7%)	9 (12.5%)	14 (21.2%)	
Obese	25 (18.1%)	18 (25.0%)	7 (10.6%)	
Anemia				
Present	41 (29.7%)	14 (19.4%)	27 (40.9%)	0.02*
Absent	97 (70.3%)	58 (80.6%)	39 (59.1%)	
Grading of Anemia (n=41)				
Mild	25 (61.0%)	9 (64.3%)	16 (59.3%)	0.02*
Moderate	16 (39.0%)	5 (35.7%)	11 (40.7%)	

Values are presented as a number (%). * $p < 0.05$ = statistically significant.

Table 3 illustrates the relationship between BMI and anemia status and grading. Anemia was present across all BMI categories without a statistically significant association. This suggests that factors other than BMI, such as dietary patterns and nutrient intake, may be contributing to the observed hematological alterations.

Table 3. Association of anemia and its grading with BMI categories among students (n = 138)

Anaemia (n=138)	Underweight (n=18)	Normal (n=72)	Overweight (n=28)	Obese (n=20)	p value
Anaemia					
Present (n=41)	6 (33.3%)	22 (30.6%)	7 (25.4%)	6 (30.0%)	0.142
Absent (n=97)	12 (66.7%)	50 (69.4%)	21 (75.0%)	14 (70.0%)	
Grading of anaemia (n=42)					
Mild (n=25)	4 (66.7%)	13 (59.1%)	5 (71.4%)	3 (50.0%)	0.219
Moderate (n=16)	2 (33.3%)	9 (40.9%)	2 (28.6%)	3 (50.0%)	

Table 4 highlights the dietary habits of the study participants. While a majority reported consuming

a mixed diet, unhealthy eating behaviors like frequent junk food consumption and meal skipping were also common. Less than half of the students consumed fruits and green leafy vegetables regularly, and only a small percentage used iron or multivitamin supplements. These dietary behaviors may be contributing factors to anemia and other blood health issues.

Table 4: Dietary patterns of allied healthcare students (n = 138)

Question on Dietary Habit	Number (n)	Percentage (%)
Do you follow a vegetarian diet?	24	17.4%
Do you follow a mixed diet?	114	82.6%
Do you regularly consume fruits and green leafy vegetables?	59	42.8%
Do you regularly consume junk/fast food?	61	44.2%
Do you take iron or multivitamin supplements?	11	8.0%
Do you skip meals (≥ 3 times/week)?	47	34.1%
Do you have irregular breakfast intake?	39	28.3%
Do you drink adequate water daily (≥ 2 L/day)?	80	58.0%
Do you consume high amounts of tea/coffee (≥ 2 cups/day)?	55	39.9%

DISCUSSION:

This study investigated the relationship between dietary habits and hematological health among undergraduate allied healthcare students in Tripura. A total of 138 participants (72 males and 66 females) were assessed, revealing gender-specific differences in blood parameters and dietary behaviors that are consistent with existing literature.

The analysis of hematological parameters (**Table 1**) showed significant sex-based differences in hemoglobin, red blood cell count, hematocrit, RDW-SD, and platelet count. Female students exhibited a higher prevalence of low hemoglobin and hematocrit, with 36.4% having low hemoglobin compared to 16.7% of males. This mirrors findings from national studies such as the National Family Health Survey (NFHS-5), which reported a higher anemia prevalence among women of reproductive age in India (53.1%)^[13]. Similarly, studies from other countries have linked menstrual blood loss, poor iron intake, and stress-related factors to

anaemia among university students^[14]. Elevated RDW-SD levels among females further suggest underlying nutritional deficiencies, potentially due to inadequate iron, folate, or vitamin B12 intake. The higher platelet counts observed in females may reflect compensatory responses to haematological stress, consistent with prior research in adolescent populations^[15].

Interestingly, parameters such as MCV, MCH, MCHC, RDW-CV, and WBC count remained stable across genders. This suggests that while certain hematological indices are affected by diet and lifestyle, others may be less sensitive to short-term nutritional changes or stressors.

The BMI distribution (**Table 2**) revealed a dual nutritional challenge, with obesity being more common among males and underweight status more prevalent among females. This pattern reflects broader trends observed globally, where urbanization, sedentary lifestyles, and irregular eating habits have contributed to both under nutrition and over nutrition among young adults^[16]. The anaemia prevalence of 40.9% in females and 19.4% in males is alarming, though it aligns with findings from studies conducted in other regions of India, where anemia among students ranges from 30% to 50%^[13,17]. The predominance of mild anemia is consistent with reports that iron deficiency is often subclinical but progressively impacts health over time.

The absence of a statistically significant association between BMI categories and anemia (**Table 3**) supports the view that anemia is a multifactorial condition. While poor nutritional intake plays a role, other factors such as menstrual health, inflammation, absorption issues, and lifestyle choices may exert greater influence than body composition alone. Similar conclusions have been drawn by researchers studying the nutritional profiles of students in diverse settings^[18].

Dietary patterns (**Table 4**) further reinforce this conclusion. Although most students followed a mixed diet, unhealthy eating behaviours such as frequent consumption of junk food (44.2%) and meal skipping (34.1%) were common. Regular intake of fruits and green leafy vegetables critical sources of iron and vitamins was limited to less than half of the participants. The low use of iron and multivitamin supplements (8%) is particularly concerning given the high anemia prevalence.

Excessive consumption of tea or coffee, reported by nearly 40% of students, may also inhibit iron absorption and worsen nutritional deficits^[17]. Similar dietary trends have been documented in university students worldwide, where academic stress, irregular schedules, and poor meal planning lead to suboptimal nutrient intake^[19].

Limitations

This study has several limitations. First, dietary habits were assessed through self-reported questionnaires, which are subject to recall bias and social desirability effects. Second, the cross-sectional design limits the ability to infer causality between diet and hematological outcomes. Third, factors such as menstrual history, absorption disorders, or infections were not comprehensively evaluated, which may influence anemia prevalence. Finally, the sample was restricted to allied healthcare students in a single region, which may limit the generalizability of the findings.

Despite these limitations, the study highlights the urgent need for targeted nutritional interventions and gender-sensitive health education programs among students. Efforts to promote balanced diets, increase awareness about iron and micronutrient intake, and encourage healthier lifestyle choices can contribute to improved hematological health and overall well-being.

CONCLUSION:

This study highlights a significant association between dietary habits and hematological health among undergraduate allied healthcare students in Tripura. The results reveal that female students are particularly vulnerable to anemia, with a higher prevalence of low hemoglobin and hematocrit levels. Both male and female students exhibited unhealthy eating behaviours, such as frequent consumption of junk food, irregular meal patterns, and insufficient intake of fruits and green leafy vegetables—key sources of iron, folate, and other micronutrients essential for maintaining optimal blood health. Although BMI did not show a statistically significant association with anemia, poor diet quality and irregular eating habits were found to be critical factors influencing hematological outcomes.

Given these findings, there is a clear need for targeted interventions at the college and policy levels. We recommend the following action points:

1. **Nutrition Awareness Programs:** Colleges should implement regular educational sessions on balanced diets, emphasizing the importance of iron-rich foods, fruits, vegetables, and micronutrient supplements to prevent anemia.
2. **Early Screening Initiatives:** Routine hematological screening for anemia and related blood disorders should be introduced, especially for female students and those with poor dietary patterns, to enable timely diagnosis and intervention.
3. **Counseling and Support Systems:** Academic institutions should provide access to dietitians and health counselors who can guide students in making informed food choices and managing stress-related eating behaviours.
4. **Policy-Level Actions:** Health departments and educational authorities should collaborate to integrate nutritional guidelines, subsidized healthy meal options, and wellness programs into student health services.

By addressing dietary inadequacies and promoting healthier lifestyle habits, such initiatives can significantly reduce the burden of anemia and related blood health issues among students. Moreover, fostering a culture of proactive health management will support the well-being, academic performance, and long-term professional success of future healthcare providers in Tripura.

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