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Impact of Age, Dietary Pattern, Meal Timing and Hygiene Practices on Haemoglobin Status among Undergraduate Girls: A Cross-Sectional Study

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ABSTRACT
Nutritional anaemia especially iron deficiency anaemia (IDA) continues to be a major public health problem among adolescent and young adult females in rural and semi-urban India. While dietary intake is often measured, there is seldom a comprehensive analysis of lifestyle factors such as timing of meals, skipping of meals and personal hygiene among rural undergraduate girls. A descriptive cross sectional study was conducted among 150 undergraduate girls in the age group of 18-23 years in Haryana. Data was collected using validated tools for socio-demographic information, 24-hour dietary recall, meal regularity indexes and a 10-point personal hygiene checklist. Overall, the findings show that anaemia is highly prevalent, with the highest burden among girls 19–20 years of age. Those with less than two main meals per day had significantly lower haemoglobin levels than those with three or more meals. Irregular meal timing was strongly associated with anaemia. Better personal hygiene scores were positively correlated with haemoglobin levels, meaning participants with poor sanitation had a lower HB . Irregular eating habits, skipping meals frequently and poor hygiene are the key modifiable risk factors which add to the problem of anaemia among college girls.

Keywords: Anaemia, Chrono Nutrition, Haemoglobin, Meal Timing, Personal Hygiene, Public Health, Undergraduate Girls.

INTRODUCTION

Nutritional anaemia is still a global health problem and women of reproductive age in low- and middle-income countries are disproportionately affected. Data from India's National Family Health Survey (NFHS-5, 2019-21) shows that 54.2% of young women aged 15-24 years are anaemic. The transfer from secondary school to undergraduate university education is a particularly sensitive biological and psychosocial time. The stage faces various challenges for

young adult women like self imposed restrictive eating, alterations in daily routine, increased scholastic stress, irregular sleep patterns and dependence on food from hostel or canteen.
IDA is associated with decreased physical stamina, cognitive performance, academic output, immune competence, and quality of life. Low haemoglobin is mainly due to iron deficiency, but the dynamics of gastrointestinal transit and meal time are important for physiological bioavailability. Skipping meals especially breakfast or erratic eating patterns interfere with the circadian metabolic processes (chrono nutrition) that interfere with gastric acid secretion and micronutrient absorption.
Personal hygiene and environmental sanitation are also important secondary factors in the maintenance of systemic iron homeostasis. Poor hand hygiene, consumption of contaminated water and failure to adhere to routine deworming schedules are responsible for persistent low-grade intestinal inflammation and soil transmitted helminthic (STH) parasitic infestation. Parasitic infections aggravate iron deficiency, even when the numerical dietary intake seems to be adequate, by inducing microscopic gastrointestinal blood loss.

There is a lack of empirical data on the combined interaction of age, meal chrononutrition and personal hygiene among female university students in rural Haryana tho the literature has assessed nutritional intake in isolation. The present study aims to fill this knowledge gap by assessing the combined effect of these multidimensional lifestyle determinants on haemoglobin status in undergraduate girls.

LITERATURE REVIEW

The NFHS-5 (2019–21) reports that over half of Indian women in the 15–24 years age group are suffering from nutritional anaemia, which is a significant public health concern (Ministry of Health and Family Welfare, 2021). Kumar (2023) found that among college-bound girls in Haryana, poor dietary diversity was strongly associated with lower haemoglobin levels, suggesting that in this population, iron status is determined not only by caloric adequacy but also by the quality and variety of intake. This pattern is seen across the region.

The time of taking food has also become important. Sharma and Verma (2021) showed that skipping meals and eating at irregular intervals adversely affected the haematological parameters of young adults, irrespective of total caloric intake. This is in accordance with the physiological theory that regularity of meal timing enhances the circadian rhythm of secretion of gastric acid that is necessary to convert dietary iron to the absorbable form. According to Singh, Kaur, and Kumar (2022), the transition into the second year of undergraduate study is a particularly risky period because of academic stress, sleep disturbances, and irregular eating habits.

A third, related pathway is sanitation & hygiene. The WHO (2020) framework links helminthic infection and chronic gastrointestinal blood loss to poor hand hygiene, water contamination and

inadequate deworming. This results in hepcidin-mediated iron sequestration, which exacerbates the actual iron deficiency with anaemia of chronic inflammation. These studies suggest that dietary diversity, meal chrononutrition and hygiene are independent predictors of anaemia although they have been studied mostly separately and rarely in combination in undergraduates in rural Haryana. This lack of combined age-stratified analysis is a motivation for the present study.

MATERIALS AND METHODS

Study Design and Setting

A descriptive, cross-sectional study was executed on under graduate girls students in the Kaithal district of Haryana, India.

Study Population and Sampling Technique

The study population consisted of undergraduate female students, 18-23 years of age, studying for a degree in Arts, Science and Commerce faculties. A total of 150 participants were selected thru non-probability purposive sampling technique.

Inclusion Criteria: Undergraduate female students who were registered and aged between 18 and 23 years and gave informed voluntary consent.

Data Collection Instruments

A structured questionnaire was prepared and validated for its content by a panel of experts in the fields of Home Science and Public Health. The instrument was composed of four different sections:

1. **Section A (Socio-Demographics & Age):** Age, academic discipline, residential status (hosteller v/s day scholar), household socio-economic variables.
2. **Section B (Dietary Pattern & Meal Timing):** 24-hour dietary recall, daily frequency of meals, frequency of skipping breakfast, and self-reported regularity in timing of meals (Regular if meals were taken within a fixed 1-hour window daily; Irregular if timing varied by >2 hours).
3. **Section C (Personal Hygiene Checklist):** A 10-item index of handwashing practices with soap before meals and after sanitation, source of drinking water, nail hygiene, walking barefoot habits, and deworming history in the last 6 months. Hygiene scores were classified as Poor (0–5 points) and Good (6–10 points).
4. **Section D (Anthropometry &Haemoglobin Estimation):** Standing height (Stadiometer to nearest 0.1 cm) Body weight (Calibrated digital scale to nearest 0.1 kg) The severity of anaemia was defined according to the criteria of WHO for non-pregnant adult females: **Normal:** ≥12.0 g/dl
    - **Mild Anaemia:** 11.0–11.9 g/dl
    - **Moderate Anaemia:** 8.0–10.9 g/dl
    - **Severe Anaemia:**<8.0 g/dl

Statistical Analysis

Data were coded, tabulated and analysed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY). Continuous variables (age, HB levels) were expressed as Mean ± Standard Deviation (SD). Categorical variables were expressed as numbers and percentages. Group mean differences were evaluated with independent sample t-tests. Pearson's Chi-Square ($\chi 2$) test was used to examine the relationships between categorical variables. Pearson's correlation coefficient (r) was used to determine correlations between hygiene scores and HB levels. Statistical significance was set at $p < 0.05$.

RESULTS

Socio-Demographic Distribution and Haemoglobin Levels

The mean age of 150 participants was 19.6±1.4 years. Anaemia was present in 44.0% of the total with 66 people being anaemic. The mean haemoglobin concentration of the total participants in the study was 11.18±1.14 g/dl.

The cohort was divided into three groups based on age as shown in Table 1. 18-19 years (n=45,30.0%), 19-20 years (n=60,40.0%) and 20-23 years (n=45,30.0%). The lowest mean HB level was in the age group 19–20 years (10.8±1.3 g/dl) and the highest frequency of anaemia was observed in this age group (51.7%).

Table 1: Age-wise Distribution, Mean Haemoglobin, and Anaemia Prevalence (N=150)

Age Category (Years)	Sample Size (N)	Percentage (%)	Anaemic n (%)	Non-Anaemic n (%)	Mean HB Level (g/dl)	SD (g/dl)
18–19 years	45	30.00%	18 (40.0%)	27 (60.0%)	11.2	±1.1
19–20 years	60	40.00%	31 (51.7%)	29 (48.3%)	10.8	±1.3
20–23 years	45	30.00%	17 (37.8%)	28 (62.2%)	11.5	±1.0
Total Cohort	**150**	**100.00%**	**66 (44.0%)**	**84 (56.0%)**	**11.18**	**±1.14**

Impact of Daily Meal Frequency on Haemoglobin Status

Dietary intake assessment patterns showed that the prevalence of anaemia was significantly higher in children who took less than 2 main meals per day (64.3%) than in children who took 3 or more meals per day (39.3%).

Table 2: Association Between Meal Frequency and Haemoglobin Status

Daily Meal Frequency	Participants (N)	Mean HB (g/dl±SD)	Anaemia Prevalence (n,%)	Chi-Square ($\chi 2$)	p-Value
<2 meals/day	28	10.4±1.2	18 (64.3%)	9.54	**0.002***
≥3 meals/day	122	11.8±0.9	48 (39.3%)		

**Statistically significant at p<0.05*

Meal Timing Regularity and Anaemia Severity

Haemoglobin levels were substantially correlated with meal chrono nutrition. Anaemia frequency was 31.7% among those who followed regular meal plans and 58.8% among those who reported irregular meal schedules.

Table 3: Cross-Tabulation of Meal Timing Regularity vs. Anaemia Status

Meal Timing Category	Total (N)	Anaemic n (%)	Non-Anaemic n (%)	Chi-Square ($\chi 2$)	p-Value
Regular Meal Timing	82	26 (31.7%)	56 (68.3%)	11.23	**0.001***
Irregular Meal Timing	68	40 (58.8%)	28 (41.2%)		

**Statistically significant at p<0.05*

Hygiene Score and Haemoglobin Correlation

Hygiene practices were significantly and positively associated with systemic haemoglobin concentration. The mean HB of participants in the Good Hygiene category was 11.9±0.8 g/dl compared to 10.6±1.2 g/dl in the Poor Hygiene group.

Table 4: Haemoglobin Levels Across Personal Hygiene Categories

Hygiene Status	Participants (N)	Mean HB (g/dl)	Standard Deviation	Pearson Correlation (r)	p-Value
Poor Hygiene (0–5)	55	10.6	±1.2	r=0.41	**<0.001***
Good Hygiene (6–10)	95	11.9	±0.8		

**Statistically significant correlation at p<0.01*

DISCUSSION

The overall prevalence of anaemia in the study (44.0%) is in line with regional trends for rural Haryana reported in NFHS-5 (54.2% statewide over larger age cohorts). High educational attainment does not always serve as a nutritional defence against iron deficiency, as evidenced by the high rates among college-attending girls.

The highest anaemia burden of 51.7% in the 19–20 age group is in agreement with empirical data of Singh et al. This stage coincides with the beginning of the second year of university studies and is characterised by a rise in academic pressure, hormonal fluctuations related to stress, irregular sleep patterns, and inconsistent eating habits.

The strong correlation between meal skipping (<2 meals/day, p=0.002), irregular meal timing (p=0.001) and decreased concentrations of haemoglobin highlights the physiological relevance of

chrononutrition. Disrupted eating patterns disturb normal GI enzyme rhythm, reduce gastric acid output, and thus impair the conversion of insoluble ferric iron (Fe3+) to bioavailable ferrous iron (Fe2+). This mechanism supports the findings of Sharma & Verma (2021) who reported that meal skipping has significant deleterious effects on haematological parameters irrespective of total daily caloric content.

The strong positive association ($r=0.41$, $p<0.001$) between haemoglobin and cleanliness scores (WHO, 2020) supports further the pathophysiological paradigm of the World Health Organization. Poor hand hygiene and unsanitary water handling increase exposure to parasitic helminths and intestinal infections. Helminth infections result in systemic inflammatory responses and chronic intestinal microbleeding. Cytokine activation (e.g. IL-6) causes production of hepcidin which inhibits iron export into the systemic circulation, trapping iron in macrophages, leading to both conventional iron deficiency and anaemia of chronic inflammation.

CONCLUSION & RECOMMENDATIONS

Conclusion

This study indicates high prevalence of anaemia (44.0%) among undergraduate girls of Kaithal, Haryana. Most affected age group was 19-20 years. The timing and number of meals was found to be an important predictor, with girls eating fewer than two meals a day or with irregular schedules showing significantly lower haemoglobin levels and higher incidence of anaemia, illustrating chrononutrition as an independent determinant from dietary sufficiency. Furthermore, a high positive association was found between personal hygiene and haemoglobin levels, indicating the significance of sanitation-related infection and inflammation. To summarise, anaemia in this population is not due to a single cause, but the result of the interaction between age-related susceptibility, irregular eating habits and inadequate hygiene. All controllable determinants have effective interventions beyond iron supplementation, such as counselling on meal regularity and promotion of cleanliness in the student health programs.

Recommendations

To mitigate anaemia among undergraduate students, a multi-pronged institutional intervention framework is recommended:

1. **Institutional Weekly Iron-Folic Acid Supplementation (WIFS):** Establish mandatory, supervised weekly distribution of WIFS tablets (containing 60 mg elemental iron + 500 mcg folic acid) across college campuses under the *Anaemia Mukt Bharat* initiative.
2. **Chrononutrition & Dietary Counselling Services:** Organise structured campus seminars educating students on the biological importance of regular meal timing, breakfast consumption, and local iron-rich foods combined with Vitamin C enhancers.
3. **Bi-Annual Mass Deworming Campaigns:** Administer single-dose Albendazole (400 mg) twice yearly to all enrolled students at the beginning of academic terms, alongside clean drinking water audits in college facilities.

REFERENCES

1. Kumar, S. (2023). Dietary diversity and haemoglobin status among college-going adolescent girls in Haryana. *Asian Journal of Home Science*, 18(1), 23–29.
2. Ministry of Health and Family Welfare. (2021). *National Family Health Survey (NFHS-5), 2019–21: India Fact Sheet*. International Institute for Population Sciences (IIPS), Government of India.
3. Sharma, P., & Verma, R. (2021). Impact of meal timing patterns and dietary skipping on anaemia prevalence among young college adults. *Indian Journal of Community Health*, 33(4), 512–518.
4. Singh, A., Kaur, M., & Kumar, R. (2022). Determinants of iron deficiency anaemia among young adult females: A cross-sectional analysis. *Journal of Nutritional Science*, 11, e45.
5. World Health Organisation. (2020). *Nutritional anaemias: Tools for prevention and control*. World Health Organisation.

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