

ORIGINAL ARTICLE

PREVALENCE OF IRON DEFICIENCY ANAEMIA IN YOUNG ADOLESCENT GIRLS AT UNIVERSITY OF PESHAWAR

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Background: Anaemia is one of the most frequent and important health problems among the adolescent girls throughout the world. Iron deficiency anaemia constitutes major anaemia due to rapid growth, hormonal changes, menarche, and malnutrition due to poor dietary intakes. The current study was designed to investigate the role of dietary intake patterns in prevalence of anaemia among the teenage girls residing in hostels. **Methods:** A convenient random sample of 237 college/undergraduate students residing at girls' hostels was subjected to anthropometry, biochemical tests for blood iron indices, and dietary intake analysis. **Results:** Normal mean anthropometric measurements were observed among the sampled students. Sixty-one percent (61%) of girls had haemoglobin (Hb) level below normal, 85% had low haematocrit percent and 82% had low serum iron. The highest category of sub normal Hb level was in the range of 9–11.9 g/dl (48%), haematocrit 25–29.9% (52%), and Serum iron 26–35 µg/dl (34%). The daily dietary intake pattern showed good breakfast consumption (82%), snacking on fried and starchy foods and carbonated beverages a common practice, and skipping of major meals a regular feature. Cereals and grains based diets and lack of fresh fruits and vegetables were found to be contributing factors to the gross prevalence of anaemia among this age group. **Conclusion:** Anaemia is the most prevalent dietary deficiency disorder among undergraduate students mainly caused by poor dietary intake patterns.

Keywords: Anaemia, Haemoglobin, Hb, Serum Iron, Haematocrit, Anthropometry, Dietary pattern

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INTRODUCTION

Nutritional anaemia is a major disease caused by iron deficiency in developing countries like Pakistan. The World Health Organization has defined anaemia a condition in which haemoglobin content of blood is lower than normal as a result of one or more essential nutrients regardless of the cause of such deficiencies.¹ The most frequent cause of nutritional anaemia is dietary iron deficiency and less frequently folic acid and vitamin B12. Iron deficiency anaemia is the most wide spread nutritional deficiency affecting 3.5 billion people especially 42.3% girls in the developing countries.¹ This includes 35% of adolescent girls of 15–19 years.² In adolescent girls it occurs due to heavy menstrual losses and inadequate dietary intake of iron.^{3,4}

Iron perform several important functions in the body including carrier of oxygen as haemoglobin and as an integral part of several oxygen systems especially those of respiration.^{4,5} As reported, anaemia can lead to reduced physical and mental capacity. It can cause diminished concentration in work, affecting educational performance. Among females it is a major health risk for future life.^{5,6} The objective of the current study was to investigate the prevalence of anaemia among the teenage college girls residing in hostels.

MATERIAL AND METHODS

In order to minimize the impacts of diverse family dietary patterns and establish the generalize food preferences of girls, a sample of 237 college students,

aged 16–19 years residing at girls hostels (dormitories) at the University of Peshawar was selected at random. Written informed consents were taken from participants of the study. Data was collected through questionnaire consisting of the ABD (Anthropometry, Biochemical blood indices, and Dietary intake record) of the nutritional status assessment. The study was approved by the Ethical Committee and Board of Studies, College of Home Economics, University of Peshawar.

Apparently healthy, non-athlete teenage girls without near history of infection, in the mid of academic session (to avoid the stress of examination), with low history of regular medications and normal menarche were included in the study. Students with regular history of medications, B-complex supplementation, irregular/heavy menstruation, and excessive tea/coffee intake were excluded from the study.

Anthropometric measurements for height weight, skin fold thickness (SFT), and BMI as per WHO procedures and standards were recorded for the subjects.⁷ Biochemical assessment of each subject was made thrice with the interval of 35 days and mean values were recorded. Haemoglobin was assessed through hemoQ while serum iron was estimated through serum iron kit containing ferene-S (Chromogen), acetate buffer (pH 4.5), ascorbic acid, and standard iron. Absorbance of the sample blanks against reagent black was done on Spectronic 20[®]. Haematocrit values were measured in the Wintrob's tubes centrifuged at 3,000 rpm for 5 minutes.

Food intake of sample was recorded for 7 days in the hostel dining room. Each serving was weighed before serving and the left over as well in order to estimate portion size. For the breakfast and snacks each subject was provided with pre-weighed paper cups, plates, glasses and spoon along with diet record sheets.

Statistical analysis was performed on SPSS-19 for means, standard deviation, and frequencies and percentages.

RESULTS

The mean height was 159.39 ± 5.69 (Range: 147.3–172.7) which was 2% lesser than the reference value of 162.5 for height-for-age standard. Mean weight of the sample was 54.71 ± 8.97 Kg (Range: 41–83 Kg), which was +0.5% of the standard weight-for-height reference. Mean BMI was 21.60 ± 4.75 (Range: 15.5–41.4) which was +0.4% of the given normal range of 19–24 for BMI for this age group. The triceps skin fold thickness of the sample was 1.93 ± 0.55 Cm (Range: 1.00–3.00 Cm) which was 7.2% higher than the standards⁷. Weight distribution of the sample when compared with WHO classification of BMI; 22% of sample fell in the underweight category while 66% were of normal weight. About 9% of the sample was overweight and 3% were obese (Table-1).

Biochemical variables for blood iron values indicated that mean haemoglobin was 9.48 ± 2.21 g/dL against the recommended standard of 12 g/dL for this age group. Mean haematocrit was $29.87 \pm 5.10\%$ (Range: 17.70–39.60). Mean serum iron was 82.2 ± 17.72 μ g/dL (Range: 5.02–72.40) which was 33.9% of the reference values range (37–145 μ g/dL) for teenage girls. (Table-2).

The mean biochemical indices of blood iron status indicated a strikingly high percentage (61%) of teenage girls' haemoglobin level was below 12 g/dL. More than 82% of the girls had low percentage haematocrit, while 64% girls had serum iron below normal range of 37–145 μ g/dL. (Table-3)

Highest percent of respondents had haemoglobin <11 g/dL being classified as moderate anaemia followed by mild anaemic students with haemoglobin levels <12 g/dL. About 17.5% of the sample had normal haemoglobin level. Results of the serum iron and haematocrit percent also followed the same pattern signifying the situation to be due to chronic dietary deficiency. (Figure-1).

The average daily nutrient intake as calculated and compared with the recommended daily allowances indicated that the mean intake of carbohydrates (292 gm) was 97% of the reference values. Mean intake of iron per day was 13.52 ± 1.72 mg and was 52.7% of the reference values (18 mg) per day for this age group. Caloric intake per day was 2162 ± 67.6 kcal which was 102.9% of the reference value (2,100 kcal) for this age as recommended for Pakistani teenage girls. (Table-4).

Table-1: Weight distribution of the sample

| Classification | Number | Percentage | BMI reference |
|-------------------|--------|------------|---------------|
| Thin under weight | 52 | 22 | <19 |
| Normal weight | 157 | 66 | 19–24.9 |
| Over weight | 21 | 9 | 24.9–30 |
| Obese | 7 | 3 | >30 |

Table-2: Biochemical indices for blood iron of subjects

| Variables | Mean \pm SD | Range |
|-----------------------|------------------|-------------|
| Haemoglobin (g/dl) | 9.48 \pm 2.21 | 7.60–18.00 |
| Haematocrit (%) | 29.87 \pm 5.10 | 17.70–39.60 |
| Serum iron μ g/dl | 82.2 \pm 17.72 | 15.4–102.8 |

Table-3: Distribution of anaemia [n (%)]

| Parameters | >Normal | Normal | <Normal |
|-------------|----------|-----------|------------|
| Haemoglobin | 19 (8) | 73 (31) | 145 (61) |
| Haematocrit | 10 (4.3) | 32 (13.5) | 195 (82.2) |
| Serum Iron | 0 | 85 (36) | 152 (64) |

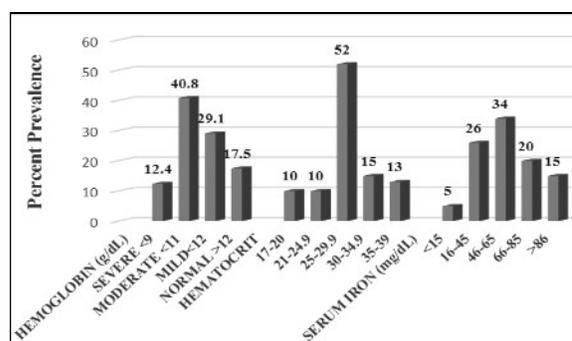


Figure-1: Classification of anaemia on the basis of severity among teenage girls

Table-4: Daily nutrient intake of the participants

| Nutrients | Range | Mean \pm SD | RDA |
|--------------------|-------------|------------------|------------|
| Carbohydrates (gm) | 130–420.5 | 292 \pm 72.1 | 250–300 gm |
| Proteins (gm) | 32.80–48.73 | 36.8 \pm 12.7 | 45 gm |
| Iron (mg) | 7.5–16.47 | 13.5 \pm 1.72 | 18 gm |
| Energy (kcal) | 763–2,370.6 | 2,162 \pm 67.6 | 2,100 kcal |

DISCUSSION

Anaemia is one of the most prevalent micronutrient deficiencies around the globe. Nutrients' deficiencies that can lead to anaemia are iron, folic acid, vitamin B₁₂, vitamin B₆, vitamin C, and protein. Iron deficiency anaemia accounts for 75% of all types of anaemia in the third world affecting 30% of population.⁸ Among women of child bearing age the most common causes of iron deficiency anaemia are reported to be blood losses during menstruation, poor dietary habits, and to lesser extent, diseases of the gastrointestinal tract that can affect iron absorption. Recently the focus of the health systems is diverted from maternal and child nutrition to the reproductive health of young women, i.e., the life cycle approach aiming at nutritional intervention well before these prospective young ladies enter into motherhood.^{9,10} As evident from the results of the current study, weight status of the sample was satisfactory; however, the lower heights might be

attributed to early childhood malnutrition. The present data coincide with the findings of other studies stating 1.8 Cm for the skin fold thickness and weight status as compared to dietary intake among the teenage girls.^{11,12} The weight status based on BMI was also satisfactory. These results were according to the findings of Hanan *et al*¹³ who found that 42.07% of the teenage girls were underweight, 60% had normal BMI and 1% were overweight. The prevalence of moderate anaemia was the most striking finding of the current study and these results are in accordance with the findings of Sultan¹⁴ who observed that moderate anaemia was more common (43.11%) followed by mild anaemia (23.7%) along with 88.4% anaemia in students overall in Sharjah. These results are also clearly inline with the findings of other researchers who found anaemia being highly prevalent among young females confirming the findings of WHO which stressed on the prevention of iron deficiency anaemia among the teenage population.¹²⁻¹⁴

According to the National Nutrition Survey of Pakistan iron deficiency anaemia pose to be one of the major health problems among women of child bearing age.¹⁵ The dietary intake patterns indicated that majority of the respondents in the current study were in the habit of regular breakfast intake when compared with the non-boarding students who occasionally consume breakfast (authors unpublished observations). The snacking behaviour on the other hand were quite monotonous comprising mainly of fried and starch based products. As reported by the respondents their food choices during snacks are highly affected by availability of food, their limited pocket money and lack of time to prepare snacks for themselves. These findings positively coincide with other findings.^{16,17} As suggested University students living away from their home seems to be the group most affected by nutrition transition. Several studies have shown that young adults when living away from home for educational purposes can experience various health related behavioural changes including unhealthy food habits. Similar to our findings, the previous studies reported these drastic changes to be due changed environment, available resources, and frequent exposure to unhealthy, energy-dense nutrient-poor foods along with lower consumption of fruits and vegetables.¹⁶⁻²⁰

In the current study, poor dietary intake patterns with marginal intake of fresh fruits and vegetable were observed which can be a contributing factor in the prevalence of anaemia in the present sample. As reported, fresh fruits and vegetables in the diet of young adults are an important source of vitamin C and folates needed for the absorption of iron from the diet.^{21,22}

Low intake of ascorbic acid, folate, protein from animal sources are the major contributing factors

towards highly prevalent iron deficiency anaemia. A diet poor in fresh fruits and vegetables usually lack adequate vitamin C that help improve the absorption of iron from the diet in the gut.²³⁻²⁵ The intake of carbohydrate based diet might have added to the normal weight status of the sample but with compromised blood iron indices. Similar observations were also made by another study which reported that carbohydrate intake is at peak during adolescence (10-19 year).²⁶ In the current study the mean iron intake per day was much lower than the recommended daily allowance. These low intakes along with less heme iron consumption may have added to the gross prevalence of anaemia in our study. According to Thankachan *et al*²⁷ inadequate and low intake of heme iron from red meat may lead to high prevalence of iron deficiency anaemia. Another study reported that inadequate iron and vitamin C intake, infrequent consumption of red meat, frequent tea, and anaemia since early adolescence are associated factors in prevalence of iron deficiency anaemia among young females of Saudi Arabian university students.²⁸

The present study was an attempt to assess iron deficiency status of young university students residing in the hostels in order to identify factors that cause anaemia among this age group. Although studies have been conducted in the past on adolescent girls but none of the study was based on assessing the blood iron indices of young females living in the hostels. This descriptive analytical study will provide new dimensions for future studies among different socio-economic and geographical settings over an extended time period and on a larger scale.

CONCLUSION

Poor food choices, irregular meals and inadequate dietary and nutrient intake have bearing on blood iron indices and prevalence of iron deficiency anaemia among the adolescent girls residing in hostels. We suggest focused nutrition education and awareness strategies to improve the dietary intake patterns and the importance of taking diverse and nutritious foods.

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