ORIGINAL ARTICLE

ASSOCIATION OF ANAEMIA WITH DIETARY PRACTICES IN ADOLESCENT GIRLS

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Background: Anaemia is one of the ten most serious public health problems world over. Adolescent girls are more at risk to be anaemic due to their rapid growth, hormonal changes, imbalance between food intake and requirement and onset of menarche. This may lead to impaired intellectual growth, development, immunity and reproductive abilities. This study was planned to assess the prevalence of anaemia and its association with dietary habits in adolescent girls of District Rawalpindi. **Methods:** This cross-sectional analytical study was conducted in six villages of two union councils of district Rawalpindi. A sample of 104 randomly selected unmarried adolescent girls (11–19 years) was included in the study. Portable haemoglobin meter (Hemocue) was used to estimate haemoglobin levels. Demographic data was obtained by a self-structured questionnaire. Dietary variables were collected by using food frequency questionnaire and 24 hour's dietary recall method. Analysis was done using SPSS-21 and Nutrisurvey software. **Results:** The study revealed that 71.2% of adolescent girls were anaemic. The prevalence of mild, moderate and severe anaemia amongst the girls was found to be 53.8%, 15.4% and 1.9% respectively. The results revealed that girls who had anaemia were also found deficient in vitamin A and zinc. **Conclusion:** Anaemia in girls of rural area in district Rawalpindi was found to be substantially high in younger adolescents (9–14 years). Anaemia was significantly associated with vitamin A and zinc deficiency. Nutritional awareness and counselling for adolescent girls in community and educational institution is recommended.

Keywords: Adolescents, Anaemia, Vitamin A, Zinc, Dietary Practices

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INTRODUCTION

According to World Health Organization (WHO) anaemia is one of the ten most serious public health problems. Adolescent girls are more at risk to be anaemic due to their rapid growth, hormonal changes, imbalance between food intake and requirement and onset of menarche. This may lead to impaired, intellectual growth, development, immunity and reproductive abilities.[1] The WHO defined adolescence as the period between childhood and adulthood (10–19 years of age).[2] Prevalence of iron depletion in girls has been found to be 21.6% which suggested that special attention is required for girls.[3] Inadequate menstrual history, poverty, poor socioeconomic status, lack of knowledge, increase iron requirement and poor dietary habits are also the contributing factors for anaemia among females in developing countries. South Asia has the highest prevalence of anaemia in the world. Half of the global maternal deaths occur due to anaemia. In South Asian countries 80% maternal death are due to anaemia. Micronutrient deficiencies are prevalent in India, Pakistan, Bangladesh and Srilanka. Anaemia is multifactorial disorder that requires a multi-pronged approach for its prevention and treatment. More than two billion people worldwide are anaemic due to nutritional and non-nutritional factors. Shill *et al*[4] observed that in Nokhali region of Bangladesh, prevalence of anaemia was reported to be 55.3%. It was found to be a consequence of bad food habits and lack of awareness.[4]

Signs and symptoms of anaemia may be non-specific and difficult to detect but are diagnosed during routine examination. During a survey of symptom-based evaluation in Bahawalpur by Khan *et al*[5], an unexpected increase in the number of girls suffering from anaemia was observed; 65.5% girls exhibited symptoms of anaemia. Amongst them 77% had problems in learning, 88% had brittle nails, dizziness and fatigue, 87% had glossitis, 84% experienced ringing in the ears and 62% complained of headache.[5] Adolescents face a lot of nutritional challenges which affect their physical and mental growth and development. This in turn decreases their work ability and effects economic development of the country. Iron deficiency anaemia is considered a third leading cause of disability for females of reproductive age group.[6] Iron requirements are increased in adolescent girls due to increased nutritional demand in the growing age and onset of menstruation.[7] Iron status varies significantly during menstrual cycle.[8]

Nutritional status is an important indicator of the overall health status of an individual. Research has revealed that malnutrition is high in Bangladesh. More than 60% of adolescent girls in Dhaka consumed less than 75% of protein, iron and energy when compared to recommended dietary allowance (RDA) of their age.

Fifty-four percent of the target population showed vitamin A deficiency.[9] A meta-analysis of papers published in Spanish, Portuguese or English between 2000 and 2013 revealed 20% anaemia with iron deficiency.[10] Micronutrient deficiency found in early childhood may lead to critical effects on the growth and development, immune system, cognitive development and reproductive health. In rural areas of Egypt 39.9% girls were found to be anaemic with Vitamin and mineral deficiency.[11] Literature review shows complex relationships between anaemia and eating behaviour. Adolescents are considered as future of the nation so it's time to focus on them. Prevention of anaemia in adolescent girls would not only improve maternal and neonatal health but would also bring productivity gains from improved physical activity, increase cognitive ability and intergenerational benefits. This study was conducted on rural adolescent girls of District Rawalpindi to assess the prevalence of anaemia and to determine the association of anaemia with their dietary habits.

METHODOLOGY

This cross-sectional analytical study was conducted on adolescent girls (11–19 years) in six villages of two union councils of Kallar Syedan (Bishandot and Darkali Mamoori), District Rawalpindi. This study was conducted according to the guidelines laid down in the Declaration of Helsinki and all procedures involving human subjects/patients were approved by the Ethical committee of Health Services Academy, Islamabad. Dietary habits were defined as regular food pattern which an individual often follows. It includes unique eating patterns for breakfast, lunch and dinner separately. Written informed consent was sought from all the participants of the study. Confidentiality of data was ensured at all levels.

The sample size was calculated by using simple proportion formula, $n= z^2 pq/d^2$. On the basis of expected 50.4% prevalence of anaemia in adolescent girls of Punjab[12], at 5% significance level and by adding 10% non-response/refusals, sample size was estimated as 104. The participants (n=104) for this study were selected by using simple random sampling technique from the list of adolescent girls registered with Lady Health Workers of the selected area. Girls (11–19 years) who were unmarried, willing to participate and permanent residents of Kallar Syedan were included in the study while those with debilitating illnesses and known blood disorders were excluded.

For data collection a structured questionnaire was developed with sociodemographic detail, haemoglobin estimation, and anthropometric measurements. Standard Food Frequency Questionnaire (FFQ) and 24 hour's dietary recall method, adopted from National Nutrition Survey 2011–12 were utilized to get information about food intake. To improve the accuracy of description of food, standard household measures like cup, plate and tablespoon were used.

Blood sample was obtained from fingertip prick using sterile disposable lancet.[13] Haemoglobin levels were assessed using Hemocue Hb 201 (Angelholm, Sweden) (sensitivity 99.4% and specificity 84.4%). Anaemia was categorized according to WHO guidelines as normal >12 gm/dl, mild 10–12 gm/dl, moderate 7–10 gm/dl, and severe <7 gm/dl.

Data analysis was done using SPSS-21 and Nutrisurvey software. Frequencies and percentages were calculated for categorical variables. Mean and standard deviation were calculated for numerical variables. Student's *t*-test was used to compare mean values, and $p \leq 0.05$ was considered as significant.

RESULTS

The mean age of the adolescent girls included in the study was 14.5±2.3 years (Range 11–19 years). Among the participants, 57 (54.8%) girls were in early adolescence. Only 30 (28.8%) adolescent girls were reported as normal, and 74 (71.2%) girls were found to be anaemic. Among these anaemic girls 56 (53.8%) had mild anaemia, 16 (15.4%) had moderate and 2 (1.9%) had severe anaemia.

After converting food items that the girls consumed before the day of data collection into nutrients by using Nutrisurvey Software it was found that consumption of energy, fat, carbohydrates, vitamin A and C, iron, zinc, calcium, and folic acid in the adolescent girls was significantly less ($p \leq 0.05$) than recommended daily allowance. (Table-1).

Table-1: Comparison of nutritional intake with recommended daily allowance (RDA)

Variable	Mean±SD	RDA	*p*
Energy (Kcal)	1141.36±764	1900	<0.001*
Protein (g)	53.7±57.91	48	0.31
Fat (g)	48.8±37.03	77	<0.001*
CHO (g)	117±37.78	351	<0.001*
Vit A (µg)	510.47±485.16	800	<0.001*
Vit C (mg)	61.71±102.45	100	<0.001*
Iron (mg)	10.02±2.56	15	<0.001*
Zinc (mg)	9.75±7	7	<0.001*
Calcium (mg)	191.7±101.88	1000	<0.001*
Folic Acid (mg)	58.04±22.07	400	<0.001*

*Significant

When food intake of girls was compared to the United States Department of Agriculture (USDA) Food Pyramid, it was noticed that diet of most participants did not fulfil the USDA standard guidelines. All respondent adolescent girls took carbohydrates less than six times per day while recommended intake is 6 to 11 servings per day. Few

respondents (16.3%) reported to take fruit more than twice daily but in majority of the girls it was less than twice daily. Vegetables and dairy intake was also reported as less than the standards which is 3 to 5 servings for vegetables and 2–3 servings for dairy products. Only protein intake was according to standard, i.e., 2 to 3 servings per day.

Comparison of normal and anaemic adolescent girls showed a significantly ($p \leq 0.05$) decreased intake of Vitamin A and zinc with *p*-values 0.04 and 0.01 respectively (Table-2).

Table-2: Comparison of nutritional intake between normal and anaemic group

Nutrient	Normal Mean±SD	Anaemic Mean±SD	*p*
Energy (Kcal)	1350±13	1085±28	0.15
Protein (g)	60±31	55±74	0.77
Fat (g)	47±28	52±44	0.54
CHO (g)	115±37	118±39	0.70
Vit A (µg)	345±32	564±53	0.04*
Vit C (mg)	42±44	73±13	0.23
Iron (mg)	10±2	9±2	0.14
Zinc (mg)	12±10	8±4	0.01*
Calcium (mg)	171±63	209±122	0.11
Folic Acid (mg)	60±28	56±19	0.49

*Significant

DISCUSSION

Our study showed the prevalence of anaemia to be 71.2% which is higher than documented (50.4%) in national nutrition survey of Pakistan-2011. Prevalence of anaemia is also much higher as compared to countries like Turkey (8.3%), Alexandria (28.8%), Europe (2–7%), Ethiopia (15.2%) and Srilanka (3.9%).[1,3,7,14,15] These figures are in sharp contrast to our study. Our figures correspond to a study where anaemia had higher prevalence in Rajasthan reported to be 79.52%.[16] Another study from India revealed 60% prevalence of anaemia. It was observed that thin and severely thin adolescent girls were at increased risk of anemia.[17] Chatterjee *et al*[18] worked in West Bengal border area where anaemia prevalence among adolescents was found to be 83.3%. Anaemia affected more in early adolescence. Low literacy and poor socioeconomic status was also found to be significantly associated with anemia.[18]

Different studies have shown different level of haemoglobin and the associated dietary diversity all over the world. In our study diet of the girls was dominated by cereal based staple food and inadequate use of fruits, red meat, animal source foods like milk, butter, yogurt, meat and egg, which aggravates the risk of micronutrient deficiencies like iron, vitamin and zinc. Expensive animal source foods and lack of knowledge regarding nutritional value of food are the reasons behind the poor consumption of iron rich food. Foods available in school cafeteria are low nutrient energy foods and hence they also play a role in early age micronutrient deficiencies in girls. Under-nutrition of girls should be addressed before they enter into reproductive years. A study reported the prevalence of anaemia to be 68.9%, out of which 72% girls had low dietary intake of iron than required for age which exhibits that a common factor in anaemic girls is inadequate diet.[19]

More than half (52%) of the adolescent girls in a study conducted in Cherah, a rural area of Islamabad were anaemic. It was found to be significant in underweight girls who consume less meat than those who took sufficient intake of fruits, vegetable, meat and dairy product. This indicates positive impact of food on anemia.[20] Their results are similar to our findings. In another study, iron deficiency anaemia among girls was attributed to the intake of non-heme iron along with iron chelates like *roti* (روٹی) and tea which prevent absorption of dietary iron from intestine.[21] There are very few studies on prevalence of nutritional anaemia and its association in adolescent girls especially in the developing countries.

Our study showed zinc and vitamin A deficiency in anaemic girls. We found a significant association of these deficiencies with anaemia. Vitamin A is considered as an essential nutrient in growth and differentiation of red blood cells. It also prevents anaemia in infections and helps in transfer and utilization of iron for haematopoiesis from its reserves. Study by Garcia *et al*[22] also showed association of Vitamin A and anaemia. Deficiency of vitamin A contributes to causation of anaemia but there is lack of sufficient data to support this underlying cause. Vitamin A can also affect the nutrient absorption in gut and red blood cell formation in bone marrow. Studies on cereal based fortification with iron and vitamin A showed an improved absorption of non-heme portion of iron in adults.[23]

Zinc helps in mobilization of vitamin A from liver. Red meat, poultry and seafood are rich in iron and zinc both. Low serum zinc has been shown as an independent risk factor for anaemia in school children which indicated the role of multiple micronutrient deficiencies along with iron deficiency.[24] Prevalence of Zinc deficiency is four times more than iron deficiency and exhibit 2.3 times more stunting and is considered as one of the most prevalent micronutrient deficiency.[25] In a study by Houghton *et al* percentage of anaemia was recorded as 4.6 and it was found to be due to low serum zinc, selenium and vitamin D. Zinc was found to be significantly associated with anaemia and the only predictor of low hemoglobin.[26] A study by Lim *et al*[27] also showed positive association between dietary iron and zinc status in women.

In Pakistan under-nutrition associated with food shortage, lower socioeconomic status, poor

quality and quantity of food, repeated infections, poor knowledge along with lack of access to health services aggravate anaemia. Prevalence of anaemia can be decreased by the impact of community-based approach in schools by iron supplements, de-worming and repeated screening.

In our study, not a single participant reported to use supplements of iron, calcium or folic acid along with lack of knowledge about iron rich food. Parents of rural community with low income are not able to cover up nutritional requirement of their girls. Multiple Interventions are required at community level to improve the knowledge of community regarding iron rich food to reduce the prevalence of anaemia. Supplemental dietary iron may be needed because the average diet is not sufficient to meet the demand of adolescent girls so dietary survey is required to address this issue. There is need of counselling and awareness programs as a tool for primary prevention of micronutrient deficiency and anaemia, especially in young girls.

CONCLUSION

Prevalence of anaemia is substantially high in rural adolescent girls of Rawalpindi. Anaemia is associated with vitamin A and zinc deficiency with dearth of knowledge about anaemia and its prevention, and lack of using supplements among girls.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

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