

# Anaemia Frequency and its Socioeconomic and Dietary Determinants among Teenage School Girls of Karachi

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## Abstract

**Objective:** To assess the frequency of anaemia and to determine its socioeconomic and dietary determinants among teenage school girls of Karachi.

**Methods:** A cross-sectional study was carried out from January to July, 2015. The study subjects were chosen from four schools, two each from high socioeconomic and poor neighbourhoods of Karachi. Our study was conducted on 497 school girls aged 13 to 18 years, who were enrolled by employing convenient sampling, after informed consent of parents and principal of the school. All study subjects were interviewed using a questionnaire, clinically examined for signs of anaemia and measurements taken for anthropometric and haemoglobin estimation.

**Results:** The primary study outcome was the anaemia status of the study participants as determined by their haemoglobin level using a cut off of 11 gm/dl. The study results showed that only 167 (36.5%) of the participants were anaemic and majority of them was negative for signs of skin pallor (66.6%), conjunctival pallor (79.8%), koilonychia (95.8%) or brittle hair (86.4%). The factors found to be significantly associated with anaemia included lower socioeconomic status ( $p < 0.0001$ ), paternal illiteracy ( $p = 0.022$ ) and paternal unemployment ( $p < 0.0001$ ). Furthermore, the study findings also revealed infrequent consumption of eggs ( $p = 0.015$ ), milk ( $p = 0.019$ ), spinach/green leafy vegetables ( $p = 0.004$ ) and chocolates/candies/biscuits/cakes ( $p = 0.039$ ) to be significantly associated with anaemia.

**Conclusion:** The study suggest that frequency of anaemia in teenage school girls was significantly associated with lower socioeconomic status, paternal illiteracy, unemployment, infrequent consumption of eggs, milk, spinach/green leafy vegetables and chocolates/candies/biscuits/cakes. Hence, urgent needs of improving paternal illiteracy, decreasing unemployment and increasing educational awareness in teenage girls regarding the consumption of iron rich foods.

**Keywords:** Anemia, frequency, socioeconomic factors, diet, teenagers, hemoglobin.

**IRB:** Approved by Ethical and Scientific Review Committee of Karachi Medical and Dental College.

**Dated:** 31<sup>st</sup> October 2013

**Citation:** Batool , Karim SA, Begu A. Anaemia Frequency and its Socioeconomic and Dietary Determinants among Teenage School Girls of Karachi [Online]. *Annals ASH KM&DC* 2017;22:81-8. Available from: [www.annals-ashkmdc.org](http://www.annals-ashkmdc.org)

(ASH & KMDC 22(3):200;2017)

## Introduction

Anaemia is a public health problem that affects the population in both rich and poor countries, but is more common in the latter. As reported by the World Health Organization in 2002, iron deficiency is among the ten leading risks for disease and one of the most prevalent nutritional deficiencies

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**Date of Submission:** 13<sup>th</sup> March 2017

**Date of Acceptance:** 9<sup>th</sup> September 2017

in the world, affecting an estimated two billion people worldwide and causing a million deaths annually<sup>1</sup>. Globally the most significant contributor to the onset of anaemia is iron deficiency so 'iron deficiency anaemia' and 'anaemia' are often used synonymously. It is estimated that 50% of all cases of anaemia are due to iron deficiency<sup>2</sup> although the extent of overlap between rates of total anaemia and of iron deficiency anaemia also differs with the population observed<sup>3</sup>.

The main risk factors for iron deficiency anaemia include low iron intake, poor iron absorption and phases of life with increased iron requirements such as growth and pregnancy. The

association between iron deficiency and poor cognitive development, decreased resistance to infection, reduced work capacity, growth faltering and increased maternal mortality during pregnancy has already been established<sup>3</sup>. Adolescence is a crucially vulnerable period because physiological demand of the body increases. Although the body make-up is determined genetically but besides heredity, nutrition plays an important role. Even though nutritional anaemia affects both genders and all age groups, the problem is more serious among women and young girls. It is estimated that nearly all women are to some degree iron deficient, and that more than half of the pregnant women in developing countries suffer from anaemia<sup>2</sup>.

The dramatic health effects of anaemia, i.e. increased risk of maternal and child mortality, are well-documented<sup>4-6</sup>. Pakistan lies in the region of moderate anaemia prevalence (20.0% to 39.9%), in both pregnant and non-pregnant girls<sup>3</sup>. Adolescence is an age of high metabolic activity and demand due to the growth spurt and hormonal changes taking place during that time. Girls are at a higher risk than their male counterparts due to the menstrual blood loss occurring every month. Also in our part of the world male children of the family are given priority over female children in food and education. Since these girls are the future mothers of the nation, it is extremely important to realise the magnitude of the problem in young girls to prevent them from its dire consequences in their future reproductive life.

Given the importance of this scenario in the world, numerous countries have conducted interventions to reduce anaemia. In order to assess the impact of these interventions, the adequacy of the strategies implemented and the progress made on the fight against anaemia, information on anaemia prevalence must be collected. This study, therefore, aimed to assess the frequency of anaemia and determine its socioeconomic and dietary determinants among teenage school girls of Karachi.

## Subjects and Methods

The present study was planned to determine the presence and frequency of anaemia in school-going teenage girls of two different socioeconomic classes in Karachi. The sample size was calculated

by using the formula and the index study<sup>7</sup>. estimated using openepi sample size calculator version 3.02 after assuming the expected prevalence of outcome (50%) at 95% confidence interval and 5% margin of error we need 384 samples, however to increase the strength of study we did work on n= 497 samples<sup>8</sup>. Due to resource limitation, convenience sampling was employed instead of random sampling for school selection. After obtaining approval from the institutional review board (IRB), a cross-sectional study was carried out enrolling school girls aged 13 to 18 years from four schools; two schools each from rich and poor neighbourhoods of Karachi. The schools catering to lower socioeconomic class were further subdivided into lower-middle and the low socioeconomic class on the basis of school fee structures. The schools catering to the rich class had monthly tuition fees of between Rs. 12000 to Rs. 18000 and those catering to lower socioeconomic group had a monthly fees of Rs. 2000 and Rs. 600 for lower middle and lower class, respectively. All four schools were conveniently selected after getting their principal's approval. A total of 497 subjects were enrolled if they met the study criteria, after obtaining both their assent and their parent's informed written consent. The inclusion criteria of the study were subject's ages between 13 to 18 years and informed written consent of her parents, whereas the exclusion criterion was existence of any disease such as tuberculosis, asthma, thalassemia, epilepsy, diabetes or renal pathology. Also, self-reported diagnosis was used for the exclusion of participants with any disease enlisted in the exclusion criteria. Prior to enrolment, all relevant information pertaining to the study was provided to both the subjects and their parents.

All study subjects were interviewed using a questionnaire, designed especially for the study, containing questions regarding their socioeconomic and demographic profile, menstrual pattern and dietary habits. The dietary questionnaire was based on a daily and weekly recall of food items consumed e.g. roti (flatbread), meat, milk, fruits etc. The questionnaire was qualitative to assess the quality of food consumed per week. Each girl was examined by a physician for pallor of skin and conjunctiva as well as for koilonychias. Anthropometric

estimation was done by measuring height and weight in order to calculate the body mass index (BMI) to see the effect of iron deficiency on the growth of individuals, whereas haemoglobin estimation was done by pricking the finger tip of the individuals with a sterile lancet drawing a small drop of blood which was then analysed by the analyser using the haemoglobin strips. The analyser used to test the blood was POC haemoglobin analyser (portable), HDX Hemostat. A study subject was classified as anaemic if her haemoglobin level was less than 11 gm/dl. The data collection was completed in a period of 2 months. The data was analysed using SPSS version 10. The variables which were observed were parental literacy level, employment status, average haemoglobin level of girls, their height and weight, weekly consumption of different dietary components such as milk, meat and green leafy vegetables etc. Inferential analysis was performed using independent sample t-test while setting the level of significance at 5%.

## Results

The average age of study participants was  $14 \pm 1.24$  years whereas 346 (69.6%) of them were either in 8th or 9th class. The mean count of their family members was  $6.78 \pm 2.56$ . Only 11.7% of the fathers and 16.6% of the mothers were illiterate. Majority of the fathers were either self-employed (30.6%), worked in a private organisation (29.5%) or were government servants (23.3%), whereas majority of the mothers (74.8%) were housewives.

Table 1 shows the data about the anthropometry, menstrual characteristics and clinical examination of the study participants. Their mean height was  $154.49 \pm 10.99$  cm, whereas their mean weight was  $43.49 \pm 17.21$  kg. Overall the mean haemoglobin level was  $12.23 \pm 1.83$  mg/dl. 412 (92.6%) of the girls were menstruating. A majority of them was negative for signs of skin pallor (66.6%), conjunctival pallor (79.8%) or koilonychia (95.8%). Only 62 (13.6%) of them had brittle hair.

The majority of anaemic girls belonged to the lower class (54.5%), whereas that of non-anaemic girls belonged to the middle class ( $p < 0.0001$ ). About, 167 (36.5%) of the participants were found

to be anaemic (haemoglobin  $< 11$  gm/dl). The fathers of non-anaemic girls were less likely to be illiterate and more likely to have had higher education than those of anaemic girls ( $p = 0.022$ ). The fathers of non-anaemic girls were less likely to be unemployed or self-employed and more likely to have their own business or working in a private organisation than those of anaemic girls ( $p < 0.0001$ ). Girls' age, family size and the education and profession of their mothers did not show any significant association with their anaemia status. Similarly, none of the general health indicators of the study participants i.e. self-reported weakness, exercise time, sunlight exposure, general health and history of any self or family disease showed any significant association with their anaemia status.

The data shows significant associations between menstrual characteristics and clinical features of the study participants and anaemia. The anaemic girls are more likely to have shorter menstrual cycle, positive skin pallor, koilonychia and brittle hair than non-anaemic girls. None of the body mass index (BMI), age at menarche, menstruation status, and quality of menstrual flow, regularity of menstrual cycle or use of spectacles by the study participants showed any significant association with their anaemia status.

Table 3 shows the data about associations between frequency of food item consumption by the study participants and anaemia. The frequency of consumption of eggs, milk, spinach, green leafy vegetables and chocolates/candies/biscuits/cakes was significantly lower in anaemic girls than in non-anaemic girls. The frequency of consumption of none of the other food items was significantly different between the two groups of girls.

## Discussion

Anaemia in adolescence is worthy of particular attention as the consequences are both far-reaching and dire. The case is particularly relevant for Pakistan as according to the World Health Organization, the greatest number of pregnant and non-pregnant women affected by anaemia is in Southeast Asia<sup>9</sup>.

Though there are numerous risk factors potentially contributing to the prevalence of anaemia, the current study helped to narrow them down to lower socioeconomic status, paternal illiteracy and unemployment and infrequent consumption of eggs, milk, spinach/green leafy vegetables and chocolates/candies/biscuits/cakes in the sample studied.

**Table 1.** Details of anthropometry, menstrual characteristics and clinical examination of the study participants

Variables	Frequency (%) / Mean $\pm$ SD
Height in cm (n= 419)	154.49 $\pm$ 10.99
Weight in kg (n= 419)	43.49 $\pm$ 17.21
Haemoglobin level in mg/dl (n= 419)	12.23 $\pm$ 1.83
Menses started (n= 419)	
Yes	412 (92.6%)
No	33 (7.4%)
Age of menarche (n= 419)	12.32 $\pm$ 1.54
Cycle length	26.26 $\pm$ 12.86
Flow Quality (n= 419)	
Scanty	31 (7.3%)
Moderate	325 (76.3%)
Heavy	70 (16.4%)
Regularity of Cycle (n= 419)	
Regular	260 (62.1%)
Irregular	159 (37.9%)
Anaemic (n= 419)	
Yes	167 (36.5%)
No	291 (63.5%)
Skin Pallor (n= 419)	
Positive	152 (33.4%)
Negative	303 (66.6%)
Conjunctival Pallor (n= 419)	
Positive	92 (20.2%)
Negative	364 (79.8%)
Koilonychia (n= 419)	
Positive	19 (4.2%)
Negative	437 (95.8%)
Hair Condition (n= 419)	
Brittle	62 (13.6%)
Healthy	394 (86.4%)
Use of Spectacles (n= 419)	
Yes	119 (26.2%)
No	336 (73.8%)

() = Column Percentage.

The results of this study showed the prevalence of anaemia in teenage school girls to be 36.5%, which lies well within the range reported in earlier studies by Ahmed F et al., Shahid A et al. and Premalatha T et al. i.e. from 32% to 43.5% in adolescent school and college girls respectively<sup>10-12</sup>. Alarming, this showed that at least a third of adolescent school and college girls are anaemic; a proportion high enough to have serious repercussions. Like two earlier studies by Ahmed F et al.<sup>10</sup> and Chaudhary SM et al.<sup>13</sup>, the results of this study re-

**Table 2.** Associations between menstrual characteristics and clinical features of the study participants and anaemia

Variable	Hb<12 mg/dl Frequency(%) /Mean $\pm$ SD	Hb>12 mg/dl Frequency(%) /Mean $\pm$ SD	X <sup>2</sup> /t- value	p-value
BMI (n= 381)	17.87 $\pm$ 2.98	17.90 $\pm$ 3.71	-0.104*	0.917
Age at Menarche (n= 381)	12.26 $\pm$ 1.73	12.35 $\pm$ 1.49	0.500*	0.617
Menses Started(n= 381)				
Yes	140 (92.7%)	236 (91.8%)	0.103	0.748
No	11 (7.3%)	21 (8.2%)		
Cycle Length (n= 381)	24.09 $\pm$ 10.29	27.78 $\pm$ 14.35	-2.715*	0.007
Flow Quality (n= 381)				
Scanty	11 (7.4%)	17 (7.1%)	3.519	0.172
Moderate	107 (71.8%)	191 (79.3%)		
Heavy	31 (20.8%)	33 (13.7%)		
Regularity of Cycle (n= 381)				
Regular	93 (63.3%)	143 (60.6%)	0.273	0.601
Irregular	54 (36.7%)	93 (39.4%)		
Skin Pallor (n= 381)				
Positive	71 (42.5%)	80 (28.0%)	12.287	0.006
Negative	96 (57.5%)	206 (72.0%)		
Conjunctival Pallor (n= 381)				
Positive	50 (29.9%)	42 (14.6%)	18.417	<0.0001
Negative	117 (70.1%)	245 (85.4%)		
Koilonychia (n= 381)				
Positive	9 (5.4%)	10 (3.5%)	10.024	0.007
Negative	157 (94.6%)	278 (96.5%)		
Hair Condition (n= 381)				
Brittle	34 (20.5%)	27 (9.4%)	13.135	0.001
Healthy	132 (79.5%)	261 (90.6%)		
Use of Spectacles (n= 381)				
Yes	40 (24.0%)	79 (27.6%)	5.385	0.146
No	127 (76.0%)	207 (72.4%)		

\* = t statistic.

() = Column Percentage

vealed lower socioeconomic status to be significantly associated with anaemia, although an earlier study by Premalatha T et al.<sup>12</sup> reported contrary findings. This difference in findings could be attributed to different population characteristics or to use of different operational definitions of socioeconomic status in both studies.

The study results showed that 96.4% of fathers were currently employed, which is very similar to the figure of 96.8% for province of Sind, as reported by Pakistan Demographic and Health Survey, 2012-13<sup>14</sup>. Moreover, the study results demonstrated that almost 11.7% of fathers and 16.6% of mothers were illiterate, percentages which are quite comparable to those reported in an earlier study by Ahmed F et al.<sup>10</sup> i.e. 11% and 22%, respectively.

Mixed findings have been reported in literature regarding the association of parental education with anaemia in adolescent girls. Although two earlier studies by Ahmed F et al.<sup>10</sup> and Shah BK et al.<sup>15</sup>

did not find this association to be significant, contrary findings were reported in an earlier study by Chaudhary SM et al.<sup>13</sup>. In this study, however, only father's education was found to be positively associated with anaemia in adolescent girls. Therefore, literature suggests inconclusive evidence to support the existence of such an association. Interestingly and as expected, the study results showed the presence of skin pallor, conjunctival pallor, koilonychia and brittle hair in study participants to be significantly associated with anaemia, which are few of its well established signs.

The results of this study did not show any significant association between age of participants and anaemia. Likewise, BMI too was not found to be significantly associated with anaemia. Two earlier studies by Ahmed F et al.<sup>10</sup> and Shah BK et al.<sup>15</sup> reported similar findings. The study results also showed that the age of participants at menarche was not significantly associated with anaemia. An earlier study by Premalatha T et al.<sup>12</sup> reported similar results, adding validity to the study findings.

Furthermore, with regard to relationship of anaemia with diet, the study findings revealed that infrequent consumption of eggs, milk, spinach/green leafy vegetables and chocolates/candies/biscuits/cakes, which are rich sources of proteins and important micronutrients, was significantly associated with anaemia. Although Rajini S et al.<sup>16</sup> reported similar findings regarding consumption of green leafy vegetables, contrary findings were reported by Al-Sayes F et al.<sup>17</sup>, alongside Ahmed F et al.<sup>10</sup> who also reported contrary findings regarding consumption of eggs and milk. This difference in findings could be attributed to different levels of recall bias in these studies.

The findings of this study need to be verified by studies with more rigorous designs to better understand the relationship between anaemia in adolescent girls and its various determinants. In light of the study findings, there is an urgent need to develop means and creating opportunities to address the issues of paternal illiteracy and unemployment and also of increasing awareness and giving education to teenage girls regarding the consumption of iron rich foods.

Table 3. Associations between frequency of food item consumption by the study participants and anaemia

Variable	Hb<12 mg/dl		Hb>12 mg/dl		t statistic	p-value
	Mean ± SD	Mean ± SD	Mean ± SD	Mean ± SD		
Roti (n= 413)	6.90 ± 3.25	6.70 ± 3.31	0.616	0.538		
Rice (n= 413)	3.88 ± 2.62	4.20 ± 2.82	-1.175	0.240		
Meat and its products (n= 413)	3.50 ± 2.35	3.99 ± 3.08	-1.741	0.082		
Eggs (n= 413)	2.02 ± 2.06	2.54 ± 2.35	-2.444	0.015		
Pulses/Lentils (n= 413)	2.50 ± 1.88	2.68 ± 1.96	-0.976	0.329		
Milk (n= 413)	2.90 ± 2.88	3.58 ± 2.98	-2.358	0.019		
Oil/Ghee/Butter/Margarine (n=413)	4.23 ± 3.14	4.73 ± 3.41	-1.528	0.127		
Yoghurt/Cheese (n= 413)	1.69 ± 2.17	2.10 ± 2.29	-1.827	0.068		
Dates (n= 413)	1.30 ± 5.80	1.30 ± 2.23	0.020	0.984		
Spinach/Green leafy vegetables (n= 413)	1.51 ± 2.06	2.11 ± 2.09	-2.868	0.004		
Red beans (n= 413)	0.50 ± 1.28	0.53 ± 1.37	-0.271	0.787		
Salads (tomatoes and cucumbers etc) (n= 413)	3.05 ± 2.84	3.51 ± 2.71	-1.658	0.098		
Fruits (n= 413)	4.24 ± 2.76	4.73 ± 2.46	-1.884	0.061		
Tea/Coffee (n= 413)	3.75 ± 3.67	4.27 ± 3.07	-1.498	0.135		
Junk foods (n= 413)	3.05 ± 2.66	2.98 ± 2.37	0.265	0.791		
Chocolates/Candies/Biscuits/Cakes (n= 413)	3.70 ± 2.98	4.30 ± 2.90	-2.069	0.039		
Pan/Beetle nuts (n= 413)	0.66 ± 1.75	0.48 ± 1.40	1.111	0.268		
Vitamins/Other Supplementations (n= 413)	1.05 ± 2.27	1.06 ± 2.33	-0.054	0.957		
Juices (n= 413)	1.68 ± 2.31	2.05 ± 2.32	-1.569	0.117		
Soft drinks (n= 413)	1.56 ± 2.01	1.81 ± 1.97	-1.231	0.219		

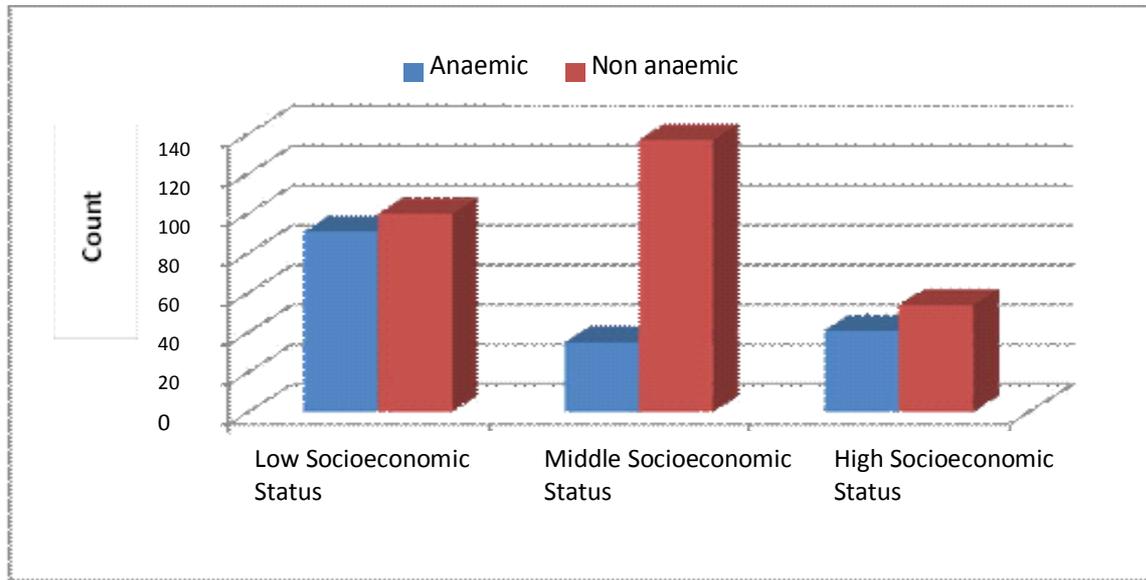


Fig 1. Socioeconomic status and anaemia

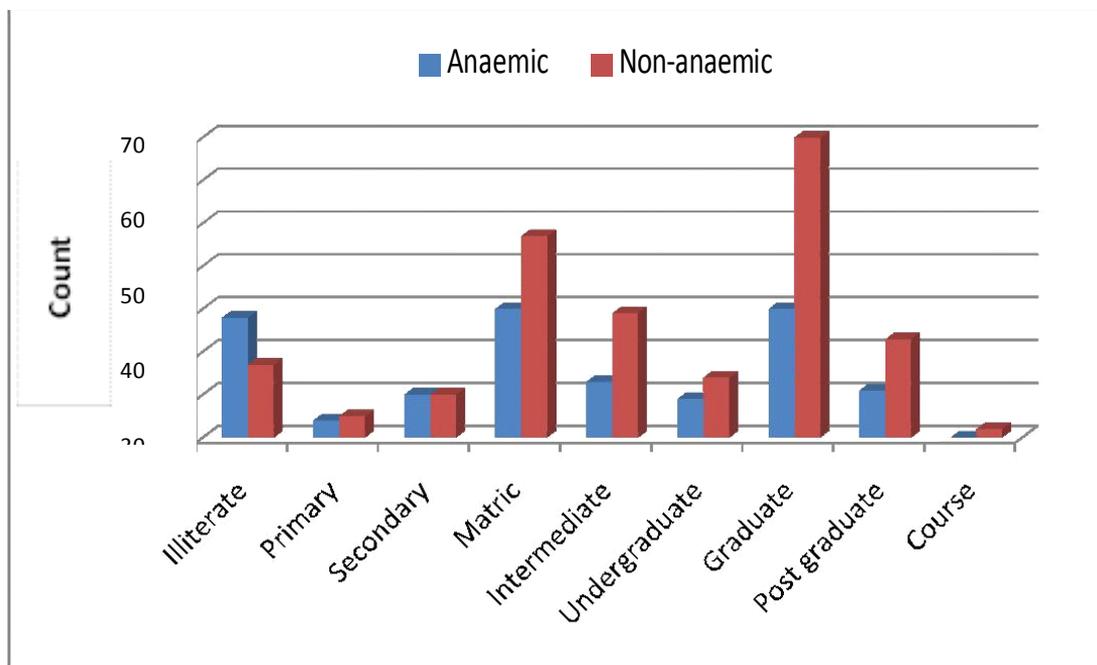


Fig. 2. Father's education and anaemia

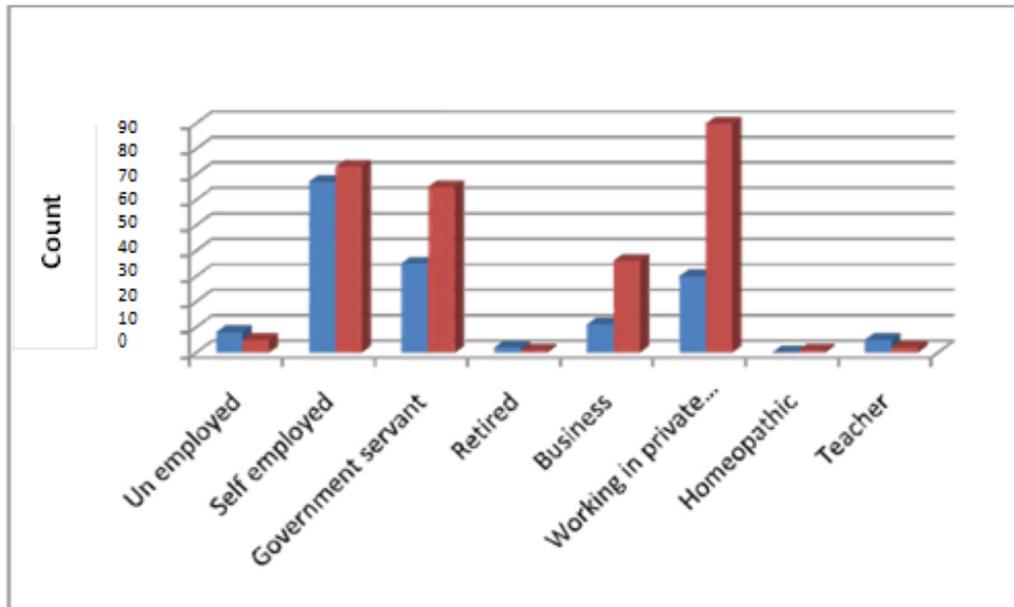


Fig. 3. Father's profession and anaemia in school girls

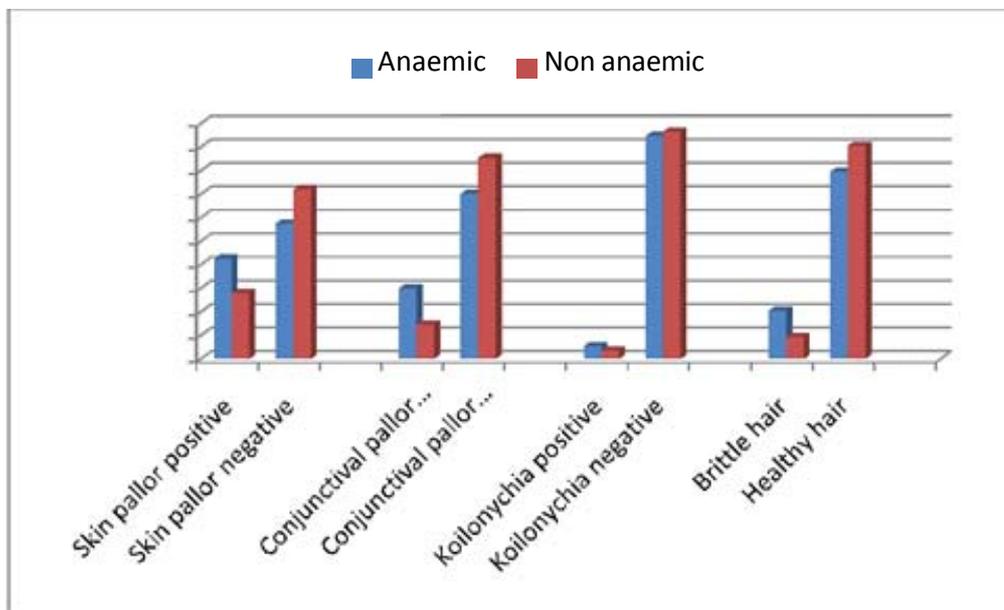


Fig. 4. Signs of anaemia in schoolgirls

## Conclusion

The overall prevalence of anaemia was found to be 36.5% in the sample studied. The findings of this study suggest the association of lower socioeconomic status, paternal illiteracy and unemployment and infrequent consumption of eggs, milk, spinach/green leafy vegetables and chocolates/candies/biscuits/cakes with anaemia in teenage school girls.

## Conflict of Interest

Authors have no conflict of interests. The study was funded by Ali Gohar Pharmaceuticals. The funding contributed to the provision of stationary and the provision of logistic facilities to the schools. They also contributed to the provision of the weighing machine and the haemoglobinometer.

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