

## Research Article

# Nutritional assessment of teenage girls at Tando Allahyar, Sindh, Pakistan

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### Abstract

Young Girls at adolescence stage need high calorie intake and a balanced diet consisting of good quality protein, calcium, iron, folic acid and vitamin B12 to avoid calcium and iron deficiency disorders. In this regard, this study was designed to explore the dietary behavior, nutritional status, calcium and iron levels in teen age girls of UC-1 district Tando Allahyar, Sindh. 200 participants were included in the study and were asked to fill a questionnaire consisting of questions about dietary patterns and food habits. The complete blood count, body mass index (BMI), serum calcium and serum iron levels were assessed to check their nutritional status. All the age groups depicted a lower BMI and underweight condition. The teen age girls in our study were either found to ignore a balanced diet or had less access to it due to poor household income. The hemoglobin level of adolescents was moderately low, especially 18-19 years' age group girls were anemic. Although calcium levels were in normal range but majority of girls experienced weakness during their routine work. Anemia, low socioeconomic levels, less consumption of meat and milk, skipping meals behavior, skipping breakfast or only taking tea as breakfast were found to be major factors associated with undernutrition of teen age girls of Tando Allahyar district. Conclusively, the present research elucidates major factors contributing to undernutrition in adolescent girls which will help them to overcome any nutrition related deficiencies. Moreover, there is a dire need to raise such nutrition awareness in teenage girls to benefit the community health.

**Keywords:** Anemia; Adolescent age; BMI; Calcium; Iron; Underweight

### Introduction

Adolescence is considered as vibrant stage of life and supplied with a number of changes. Such growth and developmental changes result in cognitive, emotional and social capabilities and help to upgrade their behavior and health [1]. Henceforth, at adolescent age, women symbolize a nutritionally susceptible group in life growth. Further, throughout adolescence growth is

seen to be substantially rapid [2]. On an average basis, growth marks, have been seen to increase among the teen aged girls (around 9 years of age). Consequently, biological and environmental factors contribute to the variation of the onset of social life time. For both genders, the adolescent age period is observed as vital period in a human society. Thus, the analysis facts particularly focus on feminine development and revealing the

detailed nutrition behaviors [3]. These factors point out that we should raise our daughters in an executable social location, through secure; schooling; healthcare equal job opportunities in each department, and practically equal health should be the foremost right of every adolescent girl. Particularly in rural areas, the diet of adolescent girls is seen to be compromised in terms of quality and amount. In rural areas, cereal based food is primarily used which is lacking in legumes and foliate vegetable [4]. Calcium is renowned essential mineral of bone-structure associated with an additional peak bone Mineral (PBM) and 99% of inside skeleton frame is composed of calcium. Life style and behavioral choices actually determine around one third of PBM and 95% of it is achieved at adolescent age. It has been reported that 10% rise in PBM leads to 50% less risk of having late life fractures and also causes delayed osteoporosis [5]. At initial adolescence phase, around 20-30 g of calcium is present inside the skeleton frame whereas at maturity 1200 g is disclosed inside teeth and various bones. Calcium serves as essential component required for blood coagulation, nerve transmission and works also as tertiary messenger. Therefore, inadequate calcium levels during adolescence may lead to bone susceptibility to fractures, stunted growth and increased osteoporosis incidence in adulthood [6]. Iron deficiency is another challenging problem nowadays in adolescent girls. Knowledge regarding recommended daily intake (RDI) of iron is a dire need to understand all information related to adolescent's activity, basal iron losses and dietary habits [7]. Consumption of vegan or vegetarian or only relying on plant-based diet (non-heme iron), has drastically decreased bioavailability when compared with heme iron and requires an increased total iron intake. Progression of anemia and a rise in iron deficiency depend upon basal iron

provisions, age of people, absorption, balance and loss of iron [8].

Based on above facts, this research aimed to determine dietary habits and pattern of teen age girls residing in District Tando Allahyar-Hyderabad Division, Sindh – Pakistan. Further, the nutritional status reflecting either adequate or malnutrition was assessed via serum calcium and iron levels. girls from rural and urban perspectives as aimed for this research task.

### **Materials and Methods**

This research was conducted on teen age girls of 13-19 years' age residing in union council (UC) municipal committee No.1 at Tando Allahyar city, studying at chosen rural colleges and native space of mentioned UC municipal committee. This was a cross sectional study consisting on 200 adolescent girls and was started after the ethical approval from the ethical committee (during July 2022-July 2023) at the Institute of Biochemistry, University of Sindh (Jamshoro) with a reference number IOB/295/2022. A probability random sampling method was used for sampling and sample size was calculated using online sample size calculator. The study was executed with the help of a questionnaire including questions regarding dietary habits, skipping meal patterns, food sources, socioeconomic status, age and college activity status. The Blood sample was also collected from those girls who were willing to give sample for analyzing serum calcium, iron levels and CBC.

### **BMI calculation**

Body mass index (BMI) was calculated by the following formula:

$$\text{BMI} = \text{Weight (Kg)} / \text{Height (m)}^2.$$

### **Determination of complete blood count (CBC)**

Whole blood was used for complete blood count on Sysmex XP 100. RBCs, WBCs, platelets, hematocrit and hemoglobin was determined through CBC count.

### Analysis of calcium

The serum calcium was analyzed using photometric method in the instrument modular analytics 600 Roche.

### Analysis of iron

The serum iron was analyzed using calorimetric method in the instrument Modular analytics Roche 600.

### Results and Discussion

Findings of this study emphasize that unbalanced diet may cause problems specifically in teenaged girls. In this age of rapid growth, iron and calcium demand is increased due to muscle mass expenditure, increased bone density, blood volume, raised hemoglobin and enzyme synthesis [9]. Particularly in developing countries, adolescence is therefore the vulnerable period for development of Iron and calcium deficiency disorders if no heed is paid towards good nutrition [10].

BMI is considered as a marker to judge nutritional status [11]. Current study depicted that most of the girls were underweight with BMI lower than 18.5 (Table 1). It may be because 64% girls belonged to labor class with a monthly income of around 15000. The underweight of respondents in our study may be due to unavailability of good nutrition as most of them cannot afford to buy nutritious food [12]. A recent study has reported five key factors contributing to underweight and stunting condition of adolescents which include low income and poverty, short birth intervals, maternal education, premature childbirth, and low birth weight [13].

Moreover, the mean hemoglobin levels of teen age girls (18-19 years of age) participated in our study was quite low i.e. 9 mg/dl (Table 2). It may be because participants with underweight and anemic presentation usually have low nutritional intake which may lead to nutritional deficiencies particularly iron. This is in line with our results as all teen age groups showed decreased serum iron levels (28 µg/dl) as

shown in (Fig. 1) as compared to recommended normal Iron values (i.e. 33-193 µg/dl). Due to decreased serum iron, body experiences a lack of building material of red blood cells as a result RBCs will not be able to provide oxygen and thus result in anemia. It is in accordance with a recent study, which reported that in Sindh around 58.8% of the adolescent girls' experience anemia out of which 63.1% belong to rural districts of Sindh [14]. Another recent research has documented sociocultural determinants, comprising age, female gender, less income, early marriage and family size. This study also listed some physiological parameters (including duration of menstrual cycle and use of sanitary pad) and dietary variables (such as Skipping meals etc.) causing iron deficiency in adolescent girls [15].

Adolescents girls selected in our study showed normal serum levels of (Fig. 2) calcium, although majority of them were not taking milk daily. Moreover, most of them were using buffalo milk instead of other milk sources. The normal calcium level in spite of low intake of milk may be because of other factors contributing to absorption of calcium. Oxalates and phytates are known to inhibit absorption of calcium and dietary sodium is known to increase urinary calcium loss [16]. Moreover, vitamin D intake, nutrition factor of plant composition and properties of soil in which food was grown all may influence calcium availability [17]. Furthermore, 75% teen age girls complained of weakness in body which may be due to unavailability of high protein diet as they were mostly using seasonal vegetables instead of meat, eggs etc. Either breakfast skipping behavior or only taking tea as breakfast may also be the reason of their weakness. Eating less, skipping meals, and drink tea are the major dietary variables that can result in iron deficiency, weakness and anemia in adolescent girls which may give rise to fatigue, low academic

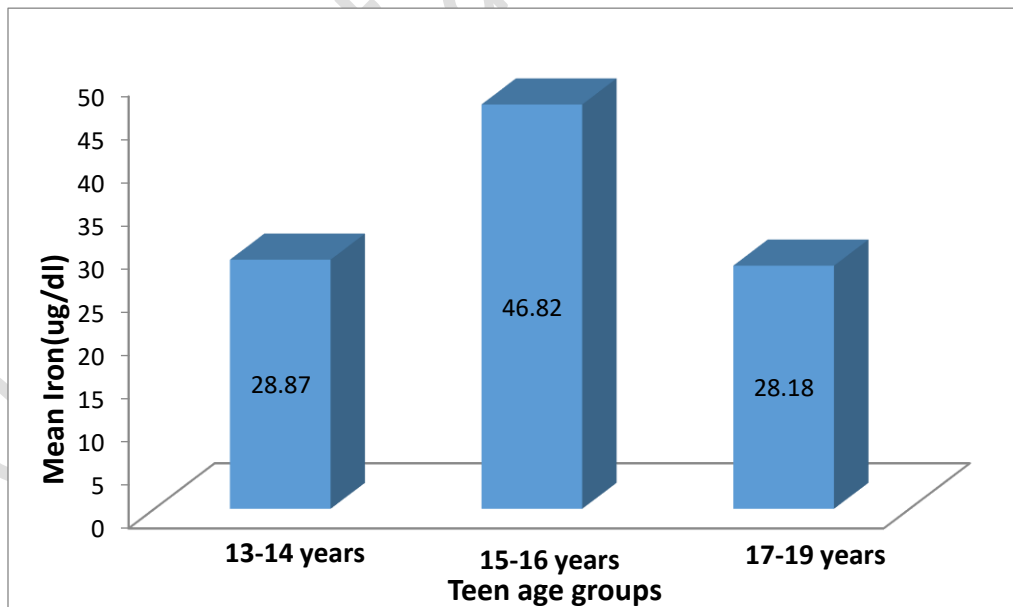
achievement, poor mental health, and developmental delays [15].

**Table 1. Demographics of adolescent girls at Tando Allahyar UC-1**

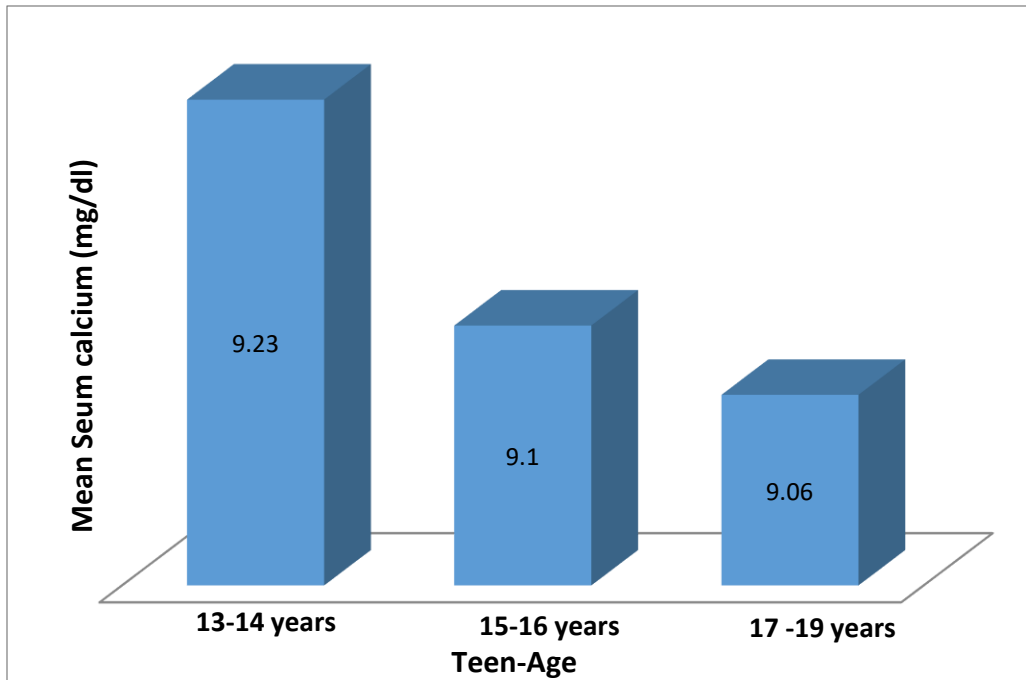
Parameters	Means or Percentage	Parameters	Percentage %
<b>BMI (Age In Years)</b>		<b>Girls' Parents Occupation</b>	
13-14	15.4±0.66	Labor	64%
15-16	15.72±0.021	Govt..empolyee	24%
17-19	16.85±0.98	Farmer	6%
		Businessman	5%
<b>Age wise Distribution</b>		Driver	2%
13 Y	27%	shopkeeper	4%
14 Y	21%	Retired	1%
15 Y	13%	<b>Parents monthly income</b>	
16 Y	9%	7000-15000	69%
17 Y	10%	16000-30000	20%
18 Y	15%	>40000	11%
19 Y	55%	<b>Diseases in a family</b>	
		None	85%
<b>Education</b>		Skin disease	4%
Primary	17%	Anemia	4%
Middle	39%	Night blindness	2%
Secondary	30%	Mental disease	2%
H. Secondary	14%	TB	2%
<b>Meal time in day</b>		Asthma	1%
1 time	6%	<b>Vegetables consumption</b>	
2 time	32%	Seasonal	51%
3 time	55%	Weekly	25%
4 time	6%	Every day	20%
5 time	1%	Occasionally	4%
<b>Breakfast</b>		<b>Types of vegetables</b>	
Only tea	36%	Leafy	55%
Paratha with tea	64%	Underground	30%
<b>Milk consumption</b>		Legumes	15%
Not taken	43%	<b>Pulses consumption</b>	
Daily	22%	Daily	10%
Weekly	5%	Weekly	32%
Occasional	30%	Occasional	8%
<b>Type of milk</b>		Monthly	50%
Buffaloes milk	63%	<b>Type of pulses</b>	
Cow milk	25%	Moong daal	55%
Goat milk	10%	Channa daal	39%
Commercially packed	2%	Masoor daal	6%
<b>Girls feeling weakness</b>			
Yes	75%		
No	25%		

**Table 2. CBC in different age groups of teenage girls**

CBC parameter (s)	Mean±SD Min-Max (13Y)	Mean±SD Min-Max (14Y)	Mean±SD Min-Max (15Y)	Mean±SD Min-Max (16Y)	Mean±SD Min-Max (17Y)	Mean±SD Min-Max (18Y)	Mean±SD Min-Max (19Y)	Normal Values
RBC	4.6±0.60 3.17-5.33	4.43±0.37 3.95-4.83	4.48±0.25 4.18-4.78	4.75±0.60 4.32-5.18	4.67±0.46 4.34-5.0	4.26±0.51 3.33-4.8	4.46±0.46 4.0-5.21	4.3-5.9 10 <sup>x6</sup> /uL
HB	10.83±1.55 8.7-13.3	10.25±1.77 8.0-13.2	10.42±2.28 7.1-12.2	10.4±0.14 10.3-10.5	10.75±1.06 10.11.5	8.4±3.30 5.0-12.8	8.98±0.73 8-10	12.0- 16.0g/dL
HCT	37.74±3.56 31.10-43.0	35.67±4.46 30.5-42.4	38.12±6.33 29.7-43.2	38.3±0.56 37.9-38.7	35.2±6.22 30.8-39.6	32.78±4.67 23.7-44.6	34.18±2.09 30.9-36.7	42-52%
MCV	84.53±10.56 69.30-98.30	81±12.86 64.1-98.6	84.48±9.77 71.19-93.20	81.2±9.19 74.7-87.7	89.3±2.68 87.4-9.12	76.48±12.30 64.1-92	77.02±6.77 65.6-83.1	76-96FL
MCH	24.33±4.34 18.60-30.80	23.37±4.48 16.8-29.1	23.10±4.19 17.0-26.0	22.1±3.11 19.9-24.3	28.25±2.47 26.5-30	19.43±5.67 14.2-26	19.96±3.84 13.4-23.3	27-32 PG
MCHC	28.60±1.88 25.10-31.40	28.64±2.18 26.2-32	27.15±2.38 23.9-29.30	27.15±0.77 26.6-27.7	33.7±6.64 29-38.4	25.37±3.37 21.1-28.8	26.32±2.52 23.4-30.01	32-36g/dl
WBC	10.13±2.0 7.08-12.85	10.04±2.78 7.27-	10.51±3.83 6.95-14.50	8.07±1.66 6.9-9.25	11.65±6.91 6.76-16.54	7.51±2.18 5.47-11.18	7.6±2.61 4.46-11.65	4.0- 10.0 (10*3ul)
NEUTROPHILs	50.07±11.45 37.50-69.10	52.78±11.13 37.40-	55.99±8.92 49.3-68.6	48.4±13.01 39.2-57.6	44.65±5.86 40.5-48.8	46.41±14.86 31.8-68.5	52.84±6.31 43.7-58.6	40-75%
LYMPHOCYTES	35.88±9.30 21.60-47.60	35.31±8.48 19.80-	32.32±7.23 23.5-40.70	29.6±3.67 27.0-32.2	37.6±16.8 25.7-49.5	41.21±13.54 20.8-58.8	36.42±4.82 30.7-41.9	20-45%
MONOCYTES	7.03±1.83 4.3-9.0	7.5±2.31 5.1-11.8	6.77±0.6 6.1-7.5	7.95±0.21 7.8-8.1	5.8±2.68 3.9-7.70	7.95±1.53 6.4-10.7	6.7±1.29 5.4-8.3	2-10%
EOSINOPHIL	6.67±3.08 1.7-11.0	4.7±3.03 1.5-2.0	5.05±3.47 1.7-8.1	13.85±16.33 2.3-25.4	11.6±13.85 1.8-21.4	4.3±3.44 1.5-9	4.36±3.49 1-8.8	1-6%
PLATELETS	444.72±106.51 275-671	398.57±150.9 263-702	386.25±79.36 298-487	298±29.69 319-277	456.4±62.22 412-500	426.16±62.83 349.592	454.8±55.16 374-514	150-400 10 <sup>^</sup> 9L



**Figure 1. Serum iron levels of teenage girls at Tando Allahyar UC-1**



**Figure 2. Serum calcium levels of teenage girls at Tando Allahyar UC-1**

### Conclusion

All age groups of adolescent girls were found to be underweight along with low hemoglobin levels particularly in 18-19 age group. Most of them belong to labor class and suffer from insufficiency of good nutrition and awareness regarding a balanced diet. The measurement total serum iron was found low in all age groups so it need attention, whereas serum calcium was in normal ranges. Skipping breakfast with only tea consumption was found to cause weakness in majority of teen age girls. Different community health programs at such rural areas should be conducted for the teen age girls to reduce malnutrition and making them aware of a balanced diet during adolescent period.

### Authors' contributions

Conceived and designed the experiments: AM Shah, Performed the experiments: AU Nisa & JM Larik, Analyzed the data: AU Nisa & AM Shah, Contributed reagents/materials/analysis tools: S Jabeen & JM Larik, Wrote the paper: B Khanzada.

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