

# HIDDEN HUNGER: MICRONUTRIENTS DEFICIENCY AMONG PRE-ADOLESCENT GIRLS IN PAKISTAN'S RURAL REGIONS

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### Abstract

This research is about the micronutrient deficiency in pre-adolescent girls in rural areas of Pakistan. Pre-adolescence and adolescence are a highly anabolic time when more of all nutrients are needed. One city, Faisalabad, was chosen out of the 100 in and surrounding Pakistan. Some specific rural areas of Faisalabad such as Chak Jhumra and Banga Chak were selected for this study. Sample of 45 pre-adolescent girls in between ages of 10-15 years were purposefully chosen for the study. The interview schedule was used to gather data on the student's demographic profile, including name, sex, and age; household income; parent's occupation; birth order; food insecurity; and the student's type of family. Additionally, anthropometric measurements, including height and weight; lifestyle behaviors, including eating habits; exercise; and physical activity, were also obtained. The frequency of nutrition issues such as anemia, stunted development, and a lack of vitamin B-complex was shown by the examination of the nutritional condition of the chosen rural pre-adolescents. All the results were obtained by testing blood sample of each girl and by estimating their nutrient intakes. To put it in a nutshell, girls older than 12 years old both had inadequate intakes of micronutrients and macronutrients in these rural areas of Pakistan.

**Keywords:** Micronutrient, Deficiency, Pre-adolescent Girls, Hidden Hunger, Assessment, Anthropometric Measurements, Pakistan.

## 1. INTRODUCTION

Micronutrients are the components of the nutrients that our body needs in particularly small amounts. Micronutrient deficits are disproportionately prevalent in low- and middle-income areas. Worldwide, especially in children and pregnant women are those in iron, vitamin A, and iodine. Vitamins are natural products made by both plants and animals that are susceptible to oxidation by air, acid or heat (Galloway *et al.*, 2002). After the first year, Adolescence is the second most important time period for physical growth, when 25 percent of average height, 45 percent of bone mass, and 50 percent of the ideal weight

are achieved (DESA, 2019). Due to their physical development, adolescent girls are more nutrient-demanding during pregnancy, menstruation and medical care. They also have a higher risk of, vitamin deficiencies, malnutrition, late sexual maturity, and poor growth pattern (FAO, 2016). Some important micronutrients that play a vital role in the growth of pre-adolescent girls are Iron, Vitamin A, Vitamin D, Iodine, Calcium, Vitamin B12, Magnesium etc. Minerals like iron are necessary (Hulten et al., 1995). Iron is important for everyone who has anemia or any blood-related condition. Many different foods naturally contain iron, which seems to be more easily absorbed when ingested naturally as opposed to as a supplement. Before making large dietary changes or beginning a new vitamin, see a doctor about your existing iron levels and needs (Allen et al., 2000).

Cobalamin, another name for vitamin B12, is indeed a water-soluble vitamin. Blood clotting, as well as nerve and brain function, depend on it. B12 is required for every cell in the human body to function effectively. According to studies, up to 90% of vegans and vegetarians may not obtain enough vitamin B12. Since this vitamin's absorption declines with age, over 20% of older persons also might be vitamin D deficient (Ezzati et al., 2002). The body needs magnesium as a vitamin to remain healthy. The creation of protein, bones, and DNA, as well as the regulation of blood pressure, blood glucose, as well as muscle & neuron activity, are just a few of the many biological processes that require magnesium. It is essential for the synthesis of DNA, RNA, glutathione, and other antioxidants, and it promotes the structural development of bone (Yi et al., 2016).

Almost thirty trace elements known as "essential micronutrients" are those that your body is unable to create in sufficient quantities on its own. Many low-income countries still commonly see people suffering from a variety of nutrient-deficiency illnesses nowadays. Even if you don't get enough of some vitamins, minerals, or other nutrients, you run the risk of developing significant health issues like osteoporosis, heart disease, type 2 diabetes, and cancer (Tshala-Katumbay *et al.*, 2015). These micronutrients play a vital role in the healthy growth and mental development in adolescents. (Jalajakumari & Krishanan, 2011). inadequate nutritional knowledge, lack of food choices, low household income, wrong cultural feeding (breastfeeding and complementary) practices, lack of health care facilities, immunization status, and seeking medical treatment for the children were the contributing factors of malnutrition among children (afzal., et al., 2024).

The micronutrient deficiencies rural areas in pre-adolescent girls of Pakistan is the problem of a big concern today. Malnutrition has a significant impact on critical developmental outcomes such as delayed physical and mental maturation in children, susceptibility to or escalation of disease, mental disabilities, blindness, and overall losses in productive output and potential. Micronutrient deficiencies are a significant global health problem. Almost every country has paid attention to the micronutrient deficiency in pre-adolescent girls and effect of micronutrient deficiency in Pakistan is studied in this research. The study discussed here was aimed to assess the following components were to evaluate the effect of micronutrient deficiencies on the growth and development of pre-adolescent girls in rural areas of Pakistan and to measure the ratio of nutritional literacy in rural areas of Pakistan.

## 2. MATERIALS AND METHODS

The methods and parameters that were employed to investigate the impact of micronutrient deficiency on the development and growth of preadolescent girls are described in this chapter. This methodology part of a research paper gives the reader the chance to assess the validity of the investigation. Five separate treatment trials made up the research.

### 2.1 Study Design

Anemic preadolescent girls, girls with stunted growth, preadolescent girls with malnutrition sample size= 45 were selected. Volunteers were screened according to following inclusion and exclusion criteria. The selected subjects were given consent form, anemia check list clinical checklist, blood pressure check list, physical signs and symptoms the sample size was 45 girls for the procurement of study subjects were divided into 05 groups (9) in each group. The CBC, protein and were evaluated before the treatment. After respective treatments were given to the subjects they were analyzed repeatedly at 15, 30 and 45 days. The eggs, milk and red meat was prepared by boiling them under heat. The foods rich with micronutrients were prepared, the first (T1) eggs whilst other (T2) milk. The third (T3) was red meat. The fourth (T4) was bananas. All the treatments were given to the subjects in the mid-morning.

**Table 2.1: Table for Treatments**

Treatment	Description
T0	Control (Without Treatment)
T1	Eggs & Vegetables (for vitamin A, b12 & vitamin D)
T2	Milk & its products (for calcium, iodine)
T3	Red Meat (for iron)
T4	Fruits i.e. Banana (for magnesium)

### 2.2 Selection of Subjects

Preadolescent girls having BMI (<30 kg/m<sup>2</sup>) (Ihmels et al., 2009) with 9-14 age limit were short listed from certain rural areas of Faisalabad. Subjects completed the Multi-Factor Treatment Questionnaire as per their treatment group. Hence, 45 participants were recruited for the experiment. The participants were divided into five groups of twenty each.

### 2.3 Exclusion criteria

Subjects will be excluded if

- 2.3.1 Any metabolic disorders
- 2.3.2 Already taking any medications for micronutrient deficiency
- 2.3.3 Already on any other diet plan for malnutrition
- 2.3.4 Participated in any other nutrition related studies within 2 months before the present study.

## 2.4 Inclusion Criteria

- 2.4.1 Pre-adolescent girls
- 2.4.2 BMI (<30 kg/m<sup>2</sup>)
- 2.4.3 Non-smoking
- 2.4.4 Willing to intake of different treatments
- 2.4.5 Using no medications, or diet plans

## 2.5 Development of Questionnaire

Questionnaire was developed in simple language. The questionnaire the feasibility and validity check by pre testing among 13-16 years adolescent girls (Taherdoost et al., 2016). There were several parts to the questionnaire. Such as, Socioeconomic status

- Anthropometric measurements
- Physical examination
- Clinical and Bio-chemical assessment
- Dietary Information
- Metabolic stress

## 2.6 Anthropometric Measurements

Adolescent girls' physical growth was measured. Several anthropometric indicators, including weight, height, and body mass index were applied (Ihmels et al., 2009). To measure height, non-stretch tape was fix on flat wall and respondents wee asked to stand erect, look straight and hands were hanging in natural manner and recorded height nearest 0.5 cm.

To measure weight of respondents digital weight machine was used. For accuracy, thrice weight were measure and then recorded. Body Mass Index (BMI) was computed by dividing weight in kilograms by height in meters square.

$$\text{Body Mass Index (BMI)} = \text{Weight (kg)} / \text{Height (m)}^2$$

*The calculator was compared by sample standard classification.*

**Table 2.2: Reference values and health risks**

Classification of BMI	Body index (Kg/m <sup>2</sup> )	Health risk Associated
Underweight	Below 18.5	Low
Normal range	18.5 – 25.0	Moderate
Over weight	25.1 – 29.1	High
Obesity	30 above	Very high

### 2.6.1 Dietary Information

In this section various questions related to dietary information of the individual were put forth. Questions regarding intake of junk foods, frequency of taking green leafy vegetables in their diet, consumption of different foods like fruits, milk etc. were asked to the respondents using food intake analysis system FIAS).

### 2.7 Clinical and Bio-Chemical Assessment

Clinical examination is the key element of any nutrition survey. The method consists of looking for modifications in the individual's condition that are thought to be related to different nutrient deficiencies that can be experienced in shallow epithelial tissues, like the skin, eyes, hair, tongue, teeth, etc. This section of the study focused on identifying different malnutrition and nutritional deficient disease indicators and symptoms. Ratings for the overall look, eyes, tongue, skin, hair, nails, teeth, and gums were part of the clinical assessment, which assisted in identifying any indications of nutritional inadequacies.

#### 2.7.1 Pre Test:

All 45 samples had their hemoglobin levels estimated with the collaboration of a reputable clinical laboratory. The measurement was contrasted with WHO guidelines for identifying anemic individuals.

**Table 2.3: Classification of anemia**

Mild	10.11.9
Moderate	7-9.9
Severe	Less than 7

### 2.8 Nutrition Education

Health and nutritional knowledge develop good health and dietary patterns. It's a planned attempt to improve health and nutritional state in which people change their behaviour. Consequently, this study, implemented health and nutrition knowledge among adolescent girls.

#### 2.8.1 Post Test

Then, 15, 30 and 45 days all 45 respondents were measured for hemoglobin level. All respondents were measured for iron and ferritin serum.

### 2.9 Hematological Analysis

The white and red blood cells index was measured from experimental adolescent girl's blood. Red blood cells was included of total red blood cells, hematocrit (Hct) hemoglobin (Hb), and mean corpuscular volume (MCV), MCH, MCHC, platelet count white blood cells count consist on white blood cells count, lymphocytes, monocytes by the method of (Abd Rahman et al., 2011).

## 2.10 Validity and Reliability of the Tool

The validity of the tool will be established in consultation with nursing experts, nutritionist, pediatrician, obstetrics & gynecologist, biochemistry; Bio statistician. The reliability was established by an inter rater method to assess the internal consistency of the test on the bases of reliability of scores.

## 2.11 Statistical Analysis

The collected data were analyzed statistically through completely randomized design (CRD) using Statistics 8.1. Level of significance ( $p < 0.05$ ) will be estimated by using the analysis of variance technique (ANOVA) with two factor factorial under CRD (Steel *et al.*, 1997).

## 3. RESULTS

Preadolescent girls are especially at risk for iron deficiency anemia and other forms of micronutrient malnutrition. Globally, iron deficiency due to inadequate food intake, rapid growth, and iron losses due to parasite infection are thought to be the main causes of anemia and other micronutrient deficiency diseases in pre-adolescent girls.

It is commonly known that vitamin C increases iron absorption. Anemia in pre-adolescent girls can develop as a result of iron and blood loss. Anemia can co-occur with a wide variety of illnesses, including cancer, jaundice, hepatitis, and mental disorders.

The interpretation of data is the subject of this study. In the current study, fresh food dietary interventions such as eggs, bananas, milk, and red meat were investigated for their potential to treat anemia and other micronutrient deficiency illnesses in school-going preadolescent girls. First, anthropometric measurements were taken to assess the girls' health and the prevalence of anemia.

The investigation was split into two experiments for the convenience. Foods were prepared for the first experiment, and the results of the proximate analysis of the foods are discussed in the chapter that follows. In the second experiment, all the subjects were divided into five groups, each with 9 participants, and each group received a different treatment, such as T0 for the control group, T1 for the second group, T2 for third, T3 for fourth, and T4 for fifth group.

**Table 3.1: Anthropometric measurements of human efficacy trial**

Treatment Groups	Age (years)	Height(ft)	Weight (kg)	BMI (kg/m <sup>2</sup> )	IBW(kg)
1	11.80±1.01	5.18±0.41	45.60±4.46	18.42±1.30	49.40±4.50
2	10.20±1.20	5.82±0.44	39.00±4.43	18.50±1.40	45.66±4.10
3	14.40±1.03	5.34±0.43	50.60±4.44	19.58±1.50	50.42±4.20
4	9.00±1.04	5.16±0.45	50.60±4.51	18.22±1.30	49.00±4.50
5	14.60±1.10	5.20±0.51	45.20±4.39	17.00±1.40	49.60±4.52
Mean	12.00±1.41	5.23±0.49	44.67±4.33	18.29±1.40	45.07±4.30



Values are means  $\pm$  standard deviation (n=45). Subjects = pre-adolescent girls, exclusion criteria = severe < 7 anemic and micronutrient deficient girls and with chronic anemia. The table shows the mean values, observed in anemic girls. The mean of age, height, weight, BMI and IBW of studied groups is shown in the table. The maximum students who were participating as volunteers have the mean age 12.00 years' height was 5.23 feet mean weights was 44.67 kg. Mean values of body mass index (BMI) were nearby normal, but maximum participants have a lower body mass index, which indicated participants of studied group were under weight. The mean BMI of participants was 18.29 and IBW was 45.07.

**Table 3.2: Frequency of Clinical sign and symptoms of respondents**

Symptoms	Sign	Frequency	Percentage
Edema	Present	4	8.7
	Absent	41	89.1
Muscles wasting	Present	0	0
	Absent	45	100
Ascites	Present		
	Absent	45	100
Skin condition	Healthy	22	47.8
	Dry	9	19.6
	Scaly	4	8.7
	Patchy	10	21.7
Skin color	Normal	22	47.8
	Pale	20	43.5
	Red	1	2.2
	Yellow	2	4.3

Table 3.2 shows the frequency and percentages of clinical signs and symptoms of the anemic girls which observed. In this anemic group the lowest percentage i.e. 8.7% girls had edema and highest percentage, i.e. 89.1% had not edema sign. Muscles wasting and ascites were not seen in any girl. Almost 21% of the girls had patchy skin condition 19.6% had dry, while 47% had healthy in appearance. Patchy skin is the symptom of anemic patients. 47% age of participant had normal skin color while 43% had pale skin, which indicated anemic sign; only 2% had healthy red skin color in appearance.

**Table 3.3: Frequency of Clinical sign and symptoms of participants**

Description	Sign	Frequency	Percentage
Mouth	Normal	32	69.6
	Sore	5	10.9
	Alter taste sensation	8	17.4
Tongue	Deep red	1	2.2
	Rough	20	43.5
	Swollen	1	2.2
	Smooth	23	50.0
Nails	Pink nail beds	5	10.9
	Smooth	16	34.8
	Spoon shaped	3	6.5

	Pale	21	45.7
Teeth	Cavities	3	6.5
	Erupting abnormally	9	19.6
	Missing	2	4.3
	Normal	31	67.4
Hair	Dull	1	2.2
	Dry	1	2.2
	Rough	43	93.5
Eye	Dry membrane	9	19.6
	Redness	8	17.4
	Red rimmed	7	15.2
	Pale	21	45.7

Table 3.3 shows the frequency and percentages of clinical signs and symptoms of the anemic girls which observed. In this anemic group the lowest percentage i.e. 17.4% girls had altered taste sensation and highest percentage, i.e. 69.6% had normal mouth feelings and almost 10% of girls had a sore mouth. The Maximum percentage of girls i.e. 45.7% had palenails, 34.8% had 34.8%.10.9% had pink nails beds and 6.5 % of girls had spoon shape nails. Almost 19.6 %of girls had an eruption of her teeth and 67% had normal. The Highest percentage of girls had rough and dry hairs.45.7% of volunteers had pale yellow eyes, which were the strongest evidence for anemia 15% of girls had red rimmed eyes while 19 % had drymembrane. These deficiency symptoms provide the evidence of anemia.

**Table 3.4: Frequency table for Diet history of participants**

Diet history	Unit	Frequency	Percentage
Milk and it's Product	1cup/day	27	58.7
	2cup/day	4	8.7
	3cup/day	3	6.5
	4cup/day	1	2.2
Fruit Consumption	Daily	23	50.0
	Monthly	5	10.9
	Never	1	2.2
	Weekly	11	23.9
Vegetables & Eggs	Daily	21	45.7
	Monthly	5	10.9
	No	5	10.9
	Weekly	14	29.3
Bread and Cereals	2/day	5	10.9
	3/day	28	60.9
	4/day	3	6.5
	5/day	3	6.5
	6/day	5	10.9
	7/day	1	2.2
Meat and its products	Daily	5	11
	Weekly	15	33
	Monthly	25	55



Table 3.4 shows the frequency and intake of diet from all groups of food. The survey showed that target volunteer, not had a healthy intake of food. 58% of girls were consuming 1 cup of milk daily, lesser percentage of girls were consuming 2 and 3 cups on daily bases. They were consuming fruits, i.e. 50 %on daily bases and 23% girls were consuming fruits weekly. 55% were not consuming organ meat due to which they suffer from iron deficient only 11% of girls were consuming meat group on daily bases therefore they had the lowest percentage of anemia.45 % girls were consuming vegetables on daily bases 10% weekly 23% montly and 10% were not consuming vegetables.

Table 3.10 shows the frequency of subjective global assessment of respondents.41.3%of participant were well nourished, 41.3% were malnourished, 4.3 were severely malnourished while almost 11% were moderately malnourished.

**Table 3.5: Mean value of Total hemoglobin (HB g/dl) of adolescent girl**

Days	Control	Treatments				Mean
		T1	T2	T3	T4	
0	9.79±0.98	9.82±0.97	9.87±0.96	9.83±0.92	9.83±0.94	10.007±1.01
15	10.1±1.01	10.21±1.02	10.21±1.2	10.20±1.02	10.21±1.02	10.66±1.16
30	10.4±1.02	10.82±1.61	10.44±1.4	10.73±1.34	10.73±1.34	12.24±1.20
45	11.01±1.1	11.50±1.12	11.01±1.09	11.37±1.10	11.35±1.12	12.88±128
Mean	10.32±1.3	10.59±1.5	10.38±1.4	10.53±1.5	10.54±1.4	

This study shows that iron syrup is best for the improvement of hemoglobin. Eggs and Vegetables (T1), red meat (T3), and fruits i.e. bananas (T4) also well for improvement of hemoglobin. On the other side milk and its products (T2) don't have any major effect on HB level of girls. T1 also shows significant increasing result of improvement HB.

The results of hemoglobin mean and S.D of five groups in which each group had nine patients. Before the treatment of HB following are the results of each group 9.82±0.97 (T1), 9.82±0.97 (T2), 9.87±0.96 (T3), 9.83±0.92 (T4) respectively. After 45 days result shows the following improvement in HB 1.19g/dl (T2), 4.17g/dl (T1), 4.34g/dl (T3), 5.61 g/dl (T4). After completing the study statics 8.1 apply and ANOVA table shows highly significant result as compared to control of all the treatments.

**Table 3.6: Mean value of M.C.H (Pgm) of pre-adolescents' girls**

Days	Control	Treatments				Mean
		T1	T2	T3	T4	
0	26.12±2.61	26.22±2.61	26.20±2.61	26.17±2.62	26.19±2.51	26.32±2.62
15	26.89±2.67	27.18±2.71	27.18±2.73	27.16±2.71	27.17±2.61	27.61±2.76
30	27.86±2.77	28.19±2.81	28.45±2.81	28.17±2.82	28.22±2.81	28.73±2.86
45	28.95±2.79	30.07±3.01	29.99±2.98	29.84±2.97	29.85±2.97	31.29±3.12
Mean	27.45±2.74	27.92±2.75	27.95±2.78	27.84±2.77	27.86±2.78	

M.C.H means and S.D of five groups in which each group had nine patients. Before the treatment M.C.H following are the results of each group 26.22±2.61 (T1), 26.20±2.6 (T2), 26.17±2.62 (T3), 26.19±2.63 (T4) respectively. After 45 days result shows the following improvement in M.C.H3.85 Pgm(T1), 3.79Pgm (T2), 3.67Pgm (T3), 3.65Pgm (T4).

**Table 3.7: Mean value of protein (g/dl) in adolescent girls**

Days	Control	Treatments				Mean
		T1	T2	T3	T4	
0	7.3±0.69	7.3±0.72	7.5±0.74	7.3±0.73	7.3±0.70	7.5±0.73
15	7.31±0.71	7.3±0.71	8.3±0.79	7.3±0.71	7.3±0.71	7.93±0.75
30	7.44±0.72	7.5±0.73	8.6±0.71	7.5±0.74	7.5±0.72	8.10±0.79
45	7.47±0.73	7.67±0.72	8.7±0.74	7.6±0.75	7.6±0.74	8.98±0.85
Mean	7.38±0.74	7.4±0.72	8.8±0.78	7.4±0.73	7.4±0.73	8.6±0.85

Protein means and S.D of treated five groups in which each group had nine participants. Before the treatment of protein following are the results of each group 7.3±0.26 (T1), 7.5±0.72 (T2), 7.3±0.74 (T3), 7.3±0.73 (T4) respectively. After 45 days result shows the following improvement in protein 0.37g/dl g/dl (T1), 0.86g/dl (T2), 0.3g/dl (T3), 0.3g/dl (T4).

#### 4. DISCUSSIONS

Anemic preadolescent girls, girls with stunted growth, preadolescent girls with malnutrition sample size= 45 were selected. Volunteers were screened according to following inclusion and exclusion criteria. The selected subjects were given consent form, anemia check list clinical checklist, blood pressure check list, physical signs and symptoms the sample size was 45 girls for the procurement of study subjects were divided into 05 groups (9) in each group. The CBC, protein and were evaluated before the treatment. After respective treatments were given to the subjects they were analyzed repeatedly at 15, 30 and 45 days. The eggs, milk and red meat was prepared by boiling them under heat. The foods rich with micronutrients were prepared, the first (T1) eggs whilst other (T2) milk. The third (T3) was red meat. The fourth (T4) was bananas. All the treatments were given to the subjects in the mid-morning.

The maximum students who were participating as volunteers have the mean age 12.00 years' height was 5.23 feet mean weights was 44.67 kg. Mean values of body mass index (BMI) were nearby normal, but maximum participants have a lower body mass index, which indicated participants of studied group were under weight. The mean BMI of participant's was 18.29 and IBW was 45.07.

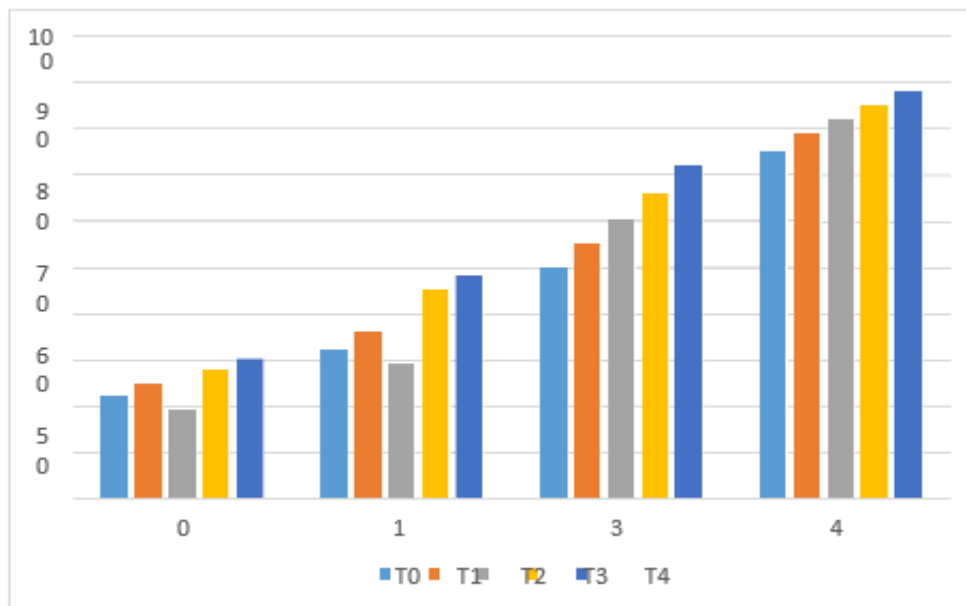
8.7% girls had edema and highest percentage, i.e. 89.1% had not edema sign. Muscles wasting and ascites were not seen in any girl. Almost 21% of the girls had patchy skin condition 19.6% had dry, while 47% had healthy in appearance. Patchy skin is the symptom of anemic patients. 47% age of participant had normal skin color while 43% had pale skin, which indicated anemic sign; only 2% had healthy red skin color in appearance.

The Maximum percentage of girls i.e. 45.7% had pale nails, 34.8% had 34.8%. 10.9% had pink nails beds and 6.5 % of girls had spoon shape nails. Almost 19.6 % of girls had an eruption of her teeth and 67% had normal. The Highest percentage of girls had rough and dry hairs. 45.7% of volunteers had pale yellow eyes, which were the strongest evidence

for anemia 15% of girls had red rimmed eyes while 19 % had dry membrane. These deficiency symptoms provide the evidence of anemia.

The survey showed that target volunteer, not had a healthy intake of food. 58% of girls were consuming 1cup of milk daily, lesser percentage of girls were consuming 2 and 3 cups on daily bases. They were consuming fruits, i.e. 50 %on daily bases and 23% girls were consuming fruits weekly. 55% were not consuming organ meat due to which they suffer from iron deficient only 11% of girls were consuming meat group on daily bases therefore they had the lowest percentage of anemia. About 45 % girls were consuming vegetables on daily bases 10% weekly 23% montly and 10% were not consuming vegetables.

The results of hemoglobin mean and S.D of five groups in which each group had nine patients. Before the treatment of HB following are the results of each group  $9.82 \pm 0.97$



T<sub>0</sub> = without any thing, T<sub>1</sub> = eggs & Vegetables, T<sub>2</sub> = Milk and its products T<sub>3</sub> =Red meat, T<sub>4</sub>=Fruits i.e. Bananas

(T<sub>1</sub>),  $9.82 \pm 0.97$  (T<sub>2</sub>),  $9.87 \pm 0.96$  (T<sub>3</sub>),  $9.83 \pm 0.92$  (T<sub>4</sub>) respectively. After 45 days result shows the following improvement in HB 1.19g/dl (T<sub>2</sub>), 4.17g/dl (T<sub>1</sub>), 4.34g/dl (T<sub>3</sub>), 5.61 g/dl (T<sub>4</sub>). After completing M.C.H means and S.D of five groups in which each group had nine patients. Before the treatment M.C.H following are the results of each group  $26.22 \pm 2.61$  (T<sub>1</sub>),  $26.20 \pm 2.6$  (T<sub>2</sub>),  $26.17 \pm 2.62$  (T<sub>3</sub>),  $26.19 \pm 2.63$  (T<sub>4</sub>) respectively. After 45 days result shows the following improvement in M.C.H 3.85 Pgm(T<sub>1</sub>), 3.79Pgm (T<sub>2</sub>), 3.67Pgm (T<sub>3</sub>), 3.65Pgm (T<sub>4</sub>).

Protein means and S.D of treated five groups in which each group had nine participants. Before the treatment of protein following are the results of each group  $7.3 \pm 0.26$  (T<sub>1</sub>),

7.5±0.72 (T2), 7.3±0.74 (T3), 7.3±0.73 (T4) respectively. After 45 days result shows the following improvement in protein 0.37g/dl g/dl (T1), 0.86g/dl (T2), 0.3g/dl (T3), 0.3g/dl (T4).

## 5. CONCLUSION

As a result of the examination of the nutritional condition of the chosen rural pre-adolescents, it was determined that anemia, stunted growth, and a lack of B-complex vitamins were among the most common nutritional issues. It is absolutely necessary to educate pre-adolescents and their families about the value of nutrients and the crucial part they play in the process of development and growth. As attempts are made to educate girls so as to bring about beneficial changes in the lives, as well as nutritional and behavioral adaptations that will keep them in good stead, medical professionals, dieticians, health care workers, and notably school teachers, should collaborate. Thus, the pre-adolescent proper nutrition education should be updated and reviewed on a regular basis. This would eventually serve as another guide in treating the health concerns of these developing young in rural Pakistan who are severely at danger because to malnutrition. Figure: 3.1 Effect of Healthy Diet on Pre-Adolescent Girls in Rural Areas of Faisalabad

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