

Examining the nutritional status of selected rural pre-adolescent children of Visakhapatnam, India

Dr.V. Premala Priyadharshini* and Pallavi Komba

Corresponding author Dr.V. Premala Priyadharsini

Asst. Professor (SG/Reader)

Dept. Food Service Management & Dietetics, Avinashilingam Institute of Home Science and Higher Education for Women, University of Coimbatore, Tamil Nadu India

E mail: premala09@hotmail.com

ABSTRACT

Pre-adolescents and adolescence is an intense anabolic period when requirements for all nutrients increase. Out of 23 villages in and around Visakhapatnam one village namely Sabbavaram was conveniently selected. A total of 500 pre-adolescents comprising 250 boys and 250 girls between the age group of 10-15years were purposively selected for the conduct of the study. The information on, demographic profile such as name, age, and sex, and family income, occupational status of the parents, birth order, poverty and type of family of the student, Anthropometric measurements like height and weight, clinical assessments, bio-chemical estimation, life style behavior like meal pattern, exercise, physical activity were collected using the interview schedule. Out of 500 students a sub sample of 40 boys and 40 girls with uniform age i.e. 15 years were selected randomly to assess their nutrient intake. A three days weight survey was carried out. A well attractive and an informative booklet was developed by the investigator as an Education tool to impart knowledge on enhancement of nutritional status and healthy living. The assessment on the nutritional status of the selected rural pre-adolescents identified the prevalence of nutrition problems such as anaemia, stunted growth and Vitamin B-complex deficiency. The rural pre-adolescent boys enjoyed a better nutritional status compared to pre-adolescent girls. Both the boys and the girls greater than 12 years of age showed deficient intake of nutrients for both micro and macro nutrients.

Key words: Nutrition, India, adolescents.

INTRODUCTION

The health and well being of children go a long way in nurturing them into better adults. Children's are the wealth of any nation as they constitute one of the important segments of the population¹. Children in the age group of five to 14 years are often considered as school age. It is recorded that in India one fifth population comprises of children between five and 14years, this age group covers the primary and secondary school age. Rightly ICDS clearly defines the age group of 11 to 18 years as adolescents. NIN further classify child between

10-13 years as pre-adolescents and 13-15 years as early adolescents².

There are about 55million children in the world. By 2020, the number of children between zero and 14 years was forecasted to comprise 24.5 per cent of the total world population down from the 26.2 per cent in 2010, with an extra 59.9 million children³.

The total population of India was a little over 1billion-1,027,015,247. To be exact (males 531,277,078; females: 495,738,169) of this number 157,863,145 are children up to the age of six years of which the population of children

living in rural and urban area account for 190,075,426 boys and 172,799,553 girls⁴.

Andhra Pradesh is the fifth largest state in the Indian Union both in terms of geographical area and population comprising of 23 districts. There are 1105 revenue mandals and 29,994 villages all over Andhra Pradesh. The total population of urban and rural children in Andhra Pradesh is 20,503,000 and 55,224,000⁵.

Pre-adolescents and adolescence is an intense anabolic period when requirements for all nutrients increase. During pre-adolescence period, 20% of final adult height and 50% of adult weight are attained, bone mass increases by 45% and dramatic bone remodeling occur and soft tissues, organs, and even red blood cell mass increase in size⁶. This situation is further complicated when pre-adolescents are often exposed to infections and parasites that can compromise nutritional status.

A nutrition transition, often accompanied by changes in physical activity levels, is being experienced in low- to middle-income countries (LMICs). Nutrition transition refers to changes in diet composition from traditional diets that are primarily derived from plant-based food sources low in fat and high in fiber, to more "Western" diets that are high energy dense and low in fiber. This transition is driven by rapid economic transition, urbanization, globalization, and technological and social changes⁷. Nutrition transition typically begins with urban populations and those in higher social economic status, but is not limited to these populations alone. Increased intake of animal source foods and edible oils has been documented even in many parts of rural Indian.

Along with the inadequate dietary habits, non-availability of protective foods, low purchasing capacity, illiteracy and ignorance about the importance of nutrition during this period, poor sanitary living conditions and prevalence of infectious diseases are some of the main causes of nutritional problem.

Occurrence of series of nutritional problems like under nutrition, anemia, vitamin A deficiency, iodine deficiency and overweight or obesity may be a threat to the rural pre-adolescents. For prevention of these problems, WHO has emphasized that the mass information and awareness programs should be organized to

alert government and communities about the importance of health and nutrition⁸.

Nutrition education is an important strategies to combat many nutritional issues like anaemia, under-weight, obesity and other disorders in pre-adolescent girls, stressing the importance of nutrients and consumption of nutritious foods which are excellent source of protein, iron and other micronutrients¹⁰.

Child-to-child education method is a new technique in nutrition education; where in a group of children will be trained by nutrition experts, who in turn will teach their fellow mates¹¹. This method can be especially beneficial in pre-adolescent girls because of the reasons viz., they are open minded and friendly in their age groups and as a result they can communicate more freely with their fellow mates. Another advantage of this method is that, one can reach the large group in a short period¹².

The need of the nutrition education is to determine strategies to prevent the occurrence of both under nutrition and over nutrition to avoid nutritional deficiency among pre-adolescents in order to increase their capacity in education as well as extracurricular activities to enable them to grow into complete individuals, with mental as well as physical wellbeing.

Also pre-adolescence is the future generation of any country. Their nutritional needs are critical for not only for the well being of a society, but for many years, their health has been neglected because they are considered to be less vulnerable to diseases compared to relatively young children or the old people. If the pre-adolescents are well-nourished, they can make optimal use of their skills, talents and energies and would be healthy and responsible citizens. Pre-adolescence, a second period of rapid growth may serve as an opportunity for compensating faltered early childhood growth though the potential for significant catch-up.

Therefore nutritional status among pre-adolescents is an important health indicator. The up-to-date information about nutritional status and food consumption pattern pre – adolescence, in the rural area is required for effective public health interventions in the rural areas of the country as a whole. Hence the study titled "Nutritional Status of Selected Rural

Pre-adolescents of Visakhapatnam" was carried out with the objective of studying the nutritional status of selected rural pre-adolescent children of Visakhapatnam. The researchers collected the background information and set out to assess the nutritional status of the selected pre-adolescents and then sought to impart very important nutrition education to the selected rural pre-adolescents who are considered to be malnourished.

II METHODOLOGY

The methodology of the present study entitled "**Nutritional Status of Selected Rural Pre-Adolescents of Vishakhapatnam**" (Fig 1) was carried out under the following headings:

A. SELECTION OF THE AREA

Out of 23 villages in and around Visakhapatnam, one village namely Sabbavaram, was conveniently selected to study the nutritional status of selected rural pre-adolescents living in a rural village setting. Since the investigator hailed from Vishakhapatnam and was interested in the benefits of rural people living in and around Vishakhapatnam, only one rural area from this area was selected for the conducting of the study which follows.

B. SELECTION OF THE SAMPLES

One Government aided high school from the village of Sabbavaram was also selected for the conduct of the study. A total of 500 pre-adolescents comprising 250 boys and 250 girls between the age group of 10-15 years were purposively selected for the conduct of the study.

C. COLLECTION OF DATA AND CONDUCT OF STUDY

A well structured interview schedule was framed by the investigator to collect the information on, demographic profile of the student, Anthropometric measurements, clinical assessments, bio-chemical estimation, lifestyle behaviour and dietary pattern of the selected subjects.

i. Demographic profile

The information of the student for name, age, and sex, and family income, occupational status of the parents, birth order, poverty and type of family were collected using the interview schedule.

ii. Anthropometric Measurements

Since the body measurements are an indicator of nutritional status, the following parameters were assessed for the selected rural pre-adolescents using standard techniques.

Weight

Using bathroom scale weighing balance the weight of 500 students was taken. Weight was measured for the individual under basal conditions with minimum clothing and without shoes. The zero error of the weighing scale was checked before taking the weight and corrected when required.

Height

The height of the selected rural pre-adolescents was measured using a stadiometer. The subjects were asked to stand straight on a leveled surface with heels together and toe apart, without shoes. The moving head piece of the stadiometer was lowered to rest flat on the top of the head and reading was noted. Height nearest to $\frac{1}{4}$ or 0.5cm was taken as the final measurement.

Body Mass Index

Anthropometry is especially important during pre-adolescence because it allows for the monitoring and evaluation of the hormone mediated changes in growth and maturation during this period. However, there are no well defined criteria or cut off values that relate to specific risks or aspects of health amongst individuals. Weight/height relationship changes dramatically with age (and probably with maturational status) during pre-adolescence. Consequently at a given height, the weight corresponding to a particular percentile is not the same for all ages. Because of these limitations, Body Mass Index (BMI) for age and gender specific centile recommended CDCH was adopted to calculate the BMI of the selected pre-adolescents. BMI of $<5^{\text{th}}$ centile for age and gender is considered as undernourished, BMI between 5^{th} and 85^{th} centile as overweight and more than 95^{th} centile considered obese.

iii. Clinical Assessment

Using the Jellif's table of clinical assessment, and with the help of practicing physician, the sign and symptoms exhibited by the rural pre-adolescents for micro and macronutrient deficiency were recorded. A general health camp was conducted in the school to screen the students for the presence of any nutritional and associated health problems.

iv. Bio-Chemical Assessment

Based on the symptoms exhibited by the pre-adolescents, biochemical estimation for total haemoglobin, iron binding capacity, serum protein/albumin, and blood glucose level were done for a sub-sample of 40 boys and 40 girls selected at random of uniform age (15years). The biochemical values obtained were then compared with standard laboratory values.

v. Lifestyle Behaviour

Using the same interview schedule information on meal pattern, exercise, physical activity, hygiene and sanitization practices of these pre-adolescents were elicited in order to find out their life style behavior, relating to their nutritional status.

Physical Activity

Physical activity such as participation in indoor and outdoor games (hrs/week), aerobic exercises (hrs/day) like jogging, cycling, walking, gym and other activity like swimming, yoga, dancing, shopping, time spent on watching television and Bollywood movies, video and

computer games during school time and holidays was also collected.

vi. Dietary assessment

The dietary habits of the selected rural pre-adolescents for meal pattern, snacking habits, skipping of meal, and their dining out practice were elicited with the help of an interview schedule. Using a food frequency table, quantum and the frequency of food intake for all the five food groups were also obtained.

Weight Survey

Out of 500 students a sub-sample of 40 boys and 40 girls with uniform age i.e. 15 years were selected randomly to assess their nutrient intake. A three days weight survey was carried out. The food intake of the subject was weighed both in raw and cooked form before and after cooking and eating. The leftover food on plate was also weighed. The cooked volume of the actual food intake was then converted into raw equivalent. The nutrient intake was calculated for both micro and macro nutrients using NIN table of Nutritive Value of Indian food. The computed nutrient intake was then compared with the RDA of ICMR of Indian foods for nutrient adequacy. The data were treated using appropriate statistical tools.

D. NUTRITION EDUCATION

Apart from individual diet counseling, a well attractive and an informative booklet was developed by the investigator as an Education tool to impart knowledge on enhancement of nutritional status and healthy living. Care was taken to include necessary inputs relevant to the students based on the problem identified during course of the study.

RESULTS AND DISCUSSION

Background Information

The majority of the pre-adolescent boys and girls were in the age group of 14+ years (Boys 90 and girls 87) followed by this 60 Boys and 59 girls were at the age of 13+ years.

Occupational status of the parents;

Majority of parents of pre-adolescent boys (152) and girls (145) parents were employed as skilled labors. The parents of 48 pre-adolescent boys

and 47girls parents were found to be professionals.

Income level of the parents:

Thirty two per cent pre-adolescent of boys and 35 per cent of girls belonged to an economically weaker section (lower caste) with a monthly earning of Rs. 3000 (Indian Rupees-1 South African Rand = Rs. 5) or less (Table I) .Similarly 36 per cent of pre-adolescent boys and 37 per cent of girls parents were reported to be low income earner with their monthly earning between Rs.3000 and 7000. Only four percent of

pre-adolescent boys and two percent of pre-adolescent girls belonged to a high income group.

TABLE-I
INCOME LEVEL OF THE PARENTS

Income (in Rs.)	Boys (n=250)	Per cent	Girls (n=250)	Per cent
Economically weaker section (<3000)	80	32	86	35
Low income (3000 – 7000)	90	36	93	37
Middle income (7000 – 10,000)	70	28	65	26
High income (>10,000)	10	4	6	2
Total	250	100	250	100

Number of siblings

Out of 500 pre-adolescents 60 boys and 64 girls had three siblings. Only nine pre-adolescents (5 boys and 4 girls) had more than three siblings.

Type of Family

Sixty two per cent of pre-adolescent boys and 64 per cent of pre-adolescent girls lived in nuclear families and the rest of the pre-adolescent lived in Joint family.

Height:

The mean height of the boys and girls above 11+ age showed a significant difference with that of the recommended standard height for age, at 1% level of significance. (Table II) Strongly suggesting a stunting of growth among the rural pre-adolescents. No significant difference in height was observed in both boys and girls for 10+ years.

ANTHROPOMETRIC DATA

TABLE- II
MEAN HEIGHT OF THE RURAL PRE-ADOLESCENTS

Age	Boys (n=250)				Girls (n=250)			
	WHO Std.	Mean	S.D.	't' value	WHO Std.	Mean	S.D.	't' value
10+	132.08	130.47	7.93	1.25 ^{NS}	132.08	131.76	9.87	0.81 ^{NS}
11+	147.32	137.83	5.71	7.98 ^{**}	152.4	137.08	8.09	11.35 ^{**}
12+	157.48	145.41	11.44	6.42 ^{**}	160.02	142.14	8.46	14.16 ^{**}

13+	160.02	153.05	10.96	5.13 **	160.02	145.37	9.53	11.41 **
14+	167.64	153.84	9.97	12.99 **	162.56	151.32	9.12	11.75 *

**Significant at 1% level; NS-Not Significant

Weight:

Boys and girls at the age group of 10+, 13+, and 14+ showed a significant difference in their mean body weight with that of the normal weight recommended by the WHO at 1% level of significance. It clearly indicates a low weight

gain pattern among the selected rural pre-adolescents. Boy at 12+ showed a significant difference in their weight gain over the recommended weight for age at 1% level of significance. (Table III)

TABLE III
MEAN WEIGHT OF RURAL PRE-ADOLESCENTS

Age	Boys (n=250)				Girls (n=250)			
	WHO Std.	Mean	S.D.	't' value	WHO Std.	Mean	S.D.	't' value
10+	35.4	27.11	6.03	8.41 **	31.5	26.09	7.05	3.68 **
11+	35.4	30.26	4.83	5.11 **	31.5	32.81	6.02	1.30 NS
12+	35.4	38.41	7.43	2.46 **	31.5	35.73	4.20	6.67 **
13+	47.8	43.63	10.99	3.06 *	46.7	39.86	7.11	7.13 **
14+	47.8	45.70	8.08	2.43 *	46.7	43.87	7.33	3.69 **

**Significant at 1% level; NS-Not Significant

Body Mass Index (BMI):

Out of 250 pre-adolescent boys and girls each 107 boys and 101 girls were found to be underweight with a BMI of <5th percentile and

only four boys and three girls were found to be overweight (Table IV) It was observed that none of the pre-adolescents were found to be obese.

TABLE IV
BMI OF RURAL PRE-ADOLESCENTS

Grade of BMI	Boys (n=250)		Girls (n=250)	
	Total number	Per cent	Total number	Per cent

<5 th percentile (under weight)	107	43	101	40
5 th -25 th percentile (normal)	139	55	146	59
85 th - 95 th percentile (overweight) > 95 th percentile (obese)	4 Nil	2 Nil	3 Nil	1 Nil

Clinical Examination

Out of 500 rural pre-adolescents, 39 boys and 43 girls had spooning of nail suggesting the presence of iron deficiency. Also pale conjunctivitis was observed among 19 pre-adolescent boys and 16 girls. Bitot spot a classical symptom of vitamin A deficiency was observed among 18 out of 250 boys and nine out of 250 girls. Pallor of tongue was seen among 17 boys and 15 girls respectively. In

general the clinical examination revealed that boy had more nutritional problems compared to girls.

(Table V)

TABLE V
CLINICAL SIGNS OF RURAL PRE-ADOLESCENTS

Signs	Boys (n=250)	Girls (n=250)
Loss of subcutaneous fat	6	2
Constant hair fall	10	80
Pallor	17	15
Bitot spot	18	9
Pale conjunctivitis	19	16
Glossitis	1	3
Angular stomatitis	2	2
Discoloration of tooth enamel	22	13
Goiter	Nil	1
Muscle pain	13	4
Spooning	39	43
Cheilosis	3	6
Bone/Joint pain	Nil	1

Biochemical Assessment

Out of sub sample of 40 pre-adolescent boys and 40 girls, 27 pre-adolescent boys and 16 girls were found to be anemic.(table VI) Serum

protein and blood glucose were normal for all the sub samples. Out of 40 sub samples seven boys and 11 girls had less Iron binding capacity than the normal range of 250-370mg/dl.

(Table VI)

TABLE VI
BIOCHEMICAL PARAMETERS OF RURAL PRE-ADOLESCENTS

Biochemical Parameters	Boys (n=250)			Girl (n=250)		
	>Normal	Normal	<Normal	>Normal	Normal	<Normal
Hemoglobin total (11-15g/dl)	Nil	27	13	Nil	24	16
Iron binding capacity (250-370mg/dl)	15	18	7	2	27	11
Serum protein (3.4-5.4g/dl)	Nil	40	Nil	Nil	40	Nil
Blood glucose level (70-100 mg/dl)	Nil	40	Nil	Nil	40	Nil

FOOD HABITS AND MEAL PATTERNS

Out of 500 pre-adolescent boys and girls, 212 boys and 200 girls were found to be non-vegetarian. Also four boys and three girls were found to be ova-vegetarian and 11 boys and 18 girls were lacto-vegetarian. 204 boys and 215 girls followed three meal patterns. Thirteen boys and four girls had five meals a day representing breakfast, mid-morning, lunch, evening snack and dinner.

Skipping pattern

It was happy to observe that none of the pre-adolescent boys and girls skipped their meals daily, but skipping of breakfast once a week was observed among 54 pre-adolescent boys and 220 girls. It is shown that 170 pre-adolescent

boys and 190 girls skipped their meals because of lack of time and whereas 130 pre-adolescent boys and 140 girls skipped because of poor taste to food.

Snacking habit

The consumption of biscuits was observed among 199 pre-adolescent boys and 183 girls. Fifty nine boys and 58 girls had noodles once in a week; on the whole it was observed that more boys had the habit of eating more junk foods than girls, which can be attributed to the strong gender preference shown towards boys. It became evident that 79 pre-adolescent boys and 74 girls ate food sold on the streets daily. A greater number of pre-adolescent boys (247)

preferred to have *paratha* followed by *biryani* (240) and *poori* (238) while girls preferred *dosa* (224) followed by *biryani* (223) and non-vegetarian (222) foods. All 250 pre-adolescent boys preferred to have mixtures for their tea or in between the meals.

One hundred and ninety six boys liked to have commercial snacks and puffs and 190 boys preferred to have chips for their snack. Whereas for girls 208 girls preferred to have chips followed by commercial snacks (191) and mixtures (185). This clearly demonstrates that commercial products like snacks and chips, have replaced the healthy snacks like sprouts and salads. It was alarming to note that none of the pre-adolescent boys and girls ate any form of salad. Similarly the intake of sprouts was restricted to 90 pre-adolescent boys and 30 girls.

Consumption of bottle drinks and healthy drinks:

Two hundred and four pre-adolescent boys preferred to have commercial juices followed by artificial fruit pulp (154), where as girls, 200 girls preferred to have slice followed by commercial juices (164). Two hundred and thirty pre-adolescent boys and 227 girls had healthy eating habit of drinking milk every day. The intake of health drinks was high among boys (20, 19, 30) compared to girls (40) due to gender bias.

Physical activity

In general both pre-adolescent boys and girls played more of indoor games rather than outdoor games suggesting a very little of physical exercise. Compared to girls (100), boys (108) had better play pattern and play habits. Among the outdoor games *kho-kho* was played by 193 pre-adolescent girls and 150 boys.

Types of exercise

All the 250 pre-adolescent boys did cycling where as only 237 girls did cycling. Except for 20 girls the rest of the girls and none of the boys did yoga-an exercise which is highly beneficial to mental and physical well being.

Hygiene

Both pre-adolescent boys and girls had better hygiene practices. Brushing teeth twice a day was practiced more by girls (203) than boys (198). Washing face once in a day was seen more among boys (150) than girls (115). All 500 pre-adolescent boys and girls washed their hands before and after meal and play. Two hundred and thirty girls rinsed their mouth after every meal. Over all girls had far better hygiene practices than boys in the study.

Mean nutrient intake

Except for Vitamin A the boys showed a significant deficit in their mean nutrient intake for energy, protein, fat, iron, calcium, sodium, thiamine, riboflavin, niacin at 1% level of significant. Similarly except of vitamin A and thiamine, girls showed a significant deficit intake for rest of the nutrients at 1% level of significant.

CONCLUSION

To conclude, the assessment on the nutritional status of the selected rural pre-adolescents identified the prevalence of nutrition problems like anaemia, stunted growth and B-complex vitamin deficiency. The rural pre-adolescent boys enjoyed a better nutrition status compared to pre-adolescent girls and both the boys and the girls older than 12 years of age showed deficient intake of nutrients- both micro and macro nutrients. Sensitizing the pre-adolescents and their family members on the importance of nutrients and the pivotal role that they play in the growth and development process is urgently needed. Medical practitioners, Dieticians, Health Workers and especially school teachers, should co-operate as efforts are made to educate the children so as to bring about healthy changes in their lifestyle, as well as dietary and behavioural modifications that will serve them in good stead. The nutrition education given to pre-adolescents should thus be upgraded and revisited periodically and ultimately serve as a further guide in addressing the health issues of these blossoming youth in Visakapatnam who are greatly at risk due to malnutrition.

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TABLE VII

MEAN NUTRIENT INTAKE OF RURAL PRE-ADOLESCENTS

s.no	Type of nutrient	Boys (n = 40)				Girls (n = 40)			
		RDA for boys	Mean intake of boys	Standard deviation	t-values	RDA for girls	Mean intake of girls	Standard deviation	t-values
1	Energy (kcal)	2450	1399.20	117.51	56.55 **	2060	1376.35	135.97	31.79 **
2	Protein (gm)	70	43.45	10.35	16.23 **	65	43.35	7.23	18.93 **
3	Fat (gm)	22	29.02	7.15	6.21 **	22	27.63	6.48	5.49 **
4	Iron (mg)	41	18.25	5.55	25.94 **	28	18.95	4.53	12.64 **
5	Calcium (mg)	600	541.03	127.18	2.93 **	600	542.83	125.74	2.88 **
6	Vitamin- A (µg)	2400	2005.25	1702.62	1.47 ^{NS}	2400	2057.38	1870.39	1.16 ^{NS}
7	Sodium (mg)	3000	182.55	157.31	4.72 **	3000	177.45	73.81	10.50 **
8	Thiamine (mg)	1.2	1.13	0.21	2.14 *	1.0	0.99	0.14	0.33 ^{NS}
9	Riboflavin (mg)	1.5	1.04	0.05	9.94 **	1.2	0.97	0.24	6.13 **
10	Niacin (mg)	16	3.45	13.56	4.48 **	14	12.80	2.42	3.14 **

**Significant

at

1%

level;

NS-Not

Significant

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