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Assessment of Nutritional Status of Adolescents (13-14 Years of Age) in Rural Areas of Kurnool, Andhra Pradesh

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Abstract: ***Nutritional requirements during adolescence increase tremendously compared to preceding years of growth. The aim of this present study was to assess the nutritional status based on the dietary intake among the adolescents in rural areas. A community based cross-sectional study was carried out in rural areas of Kurnool, Andhra Pradesh and 180 adolescents were selected from the age group 13 - 14 years. The tools used for the study are a pre-tested, well designed questionnaire that included anthropometric measurements, socio-demographic data & 24-hour diet recall. The daily nutrient intake was compared with the ICMR Recommended Dietary Allowances. Nutritional status was assessed by comparing obtained values with reference values for Height-for-age and BMI- for-age growth standards, WHO, 2007. The mean height observed in boys was 154.2 cm whereas in girls, it was 152.1 cm. From the Height for Age parameters, data revealed that majority of the adolescents fell in the normal range, i.e., 75.3%. Stunting was seen in boys (14.2%) more than in girls (10.5%). BMI for Age parameters revealed that most of the adolescents i.e., 46.1% fell in the normal range whereas wasting was seen more in girls (17.8%) than in boys (14.9%). It also showed that more boys (23%) were at a high risk of being overweight than girls (12%) and overweight was seen in both boys (2.1%) and girls (2.5%). Only 4.2% boys were recorded to be Obese. The study also revealed that nutrients intake of Energy, Protein, Fat, Carbohydrates, Calcium and Iron were significantly lower than the RDA at 5% significance level.The findings reiterate the fact that dietary deficiencies among adolescents adversely affect their nutritional status. Hence health education and nutrition intervention programs are needed on priority basis.***

Keywords: Nutritional assessment, Rural areas, Adolescents

1. Introduction

The World Health Organization (WHO) has defined adolescence as the age group of 10-19 years. It is a period of rapid growth and development, physiologically, psychologically and socially. During this period, adolescents gain up to 50% of their adult weight, 20% or more than that of their adult height and 50% of their adult skeletal mass [1]. Their nutritional requirement is more due to the rapid growth spurt and increased physical activities. So a poor intake of nutrients (and in addition menstrual loss among the girls) put them at a higher risk of nutritional deficiencies and their ill effects. The malnourished children are likely to grow into malnourished adults with greater risk of disease and death [2]. The adverse situation such as poor socio-economic conditions, demographic situations, environmental conditions, sanitation and nutrition awareness attributed to developing such linear retardation in physical growth attainments or under nutrition (e.g., stunting) among children and adolescents (WHO 2008). Diets of Indian adolescents especially in rural areas are inadequate both in terms of quality and quantity. They mainly consume cereal based food but grossly deficient in legumes, animal foods and green leafy vegetables [3]. Malnutrition which refers to an impairment of health from a deficiency or imbalance of nutrients is of public health significance among adolescents all over the world. It creates lasting effect on the growth, development and physical fitness of a person. It is well recognized worldwide that anthropometric measurements are indispensable in diagnosing under nutrition [4]. Three commonly used indicators of under nutrition among children are stunting (low height for age), thinness (low Body Mass Index for age) and underweight (low weight for age). Stunting is an indicator of chronic under nutrition, the result of prolonged food deprivation and/or disease or illness; thinness is an indicator of acute under nutrition, the result of more recent food deprivation or illness; underweight is used as a composite indicator to reflect both acute and chronic under nutrition, although it cannot distinguish between them. This study was undertaken with the following objectives:

- Assess the nutritional status of adolescents (13–14 years) in rural areas.
- Impact of socio-economic status on the nutritional status of the adolescents.
- To assess their dietary pattern and its adequacy.
- Calculate macronutrient and micronutrient intake by analyzing the results obtained from the 24 hr diet recall method and comparing it against the RDA, 2010 Dietary Guidelines for Indians.

2. Methodology

Adolescence is an intense anabolic period when requirements for all nutrients increase. The ultimate intention of nutritional assessment is to improve human health. There is a need to develop a database on the diet and nutritional status of the adolescents from different parts of the country to enable the governments and other non-governmental agencies to formulate policies and initiate strategies for the well-being of adolescent children. Malnutrition is a silent emergency, and it continues to be a major public health problem worldwide, especially in South-East Asia and sub-Saharan Africa. It is an indicator of poor nutrition, having a major consequence on human health as

well as for the social and economic development of a population. It is one of the most common causes of morbidity and mortality among children and adolescents throughout the world (UNICEF, 2005). Every year, more that 10 million children worldwide die from preventable and treatable illnesses. At least half of these deaths are caused by malnutrition [5]. The health consequences of a prolonged state of malnutrition among children and adolescents include delayed physical growth and impaired motor and cognitive development, diminished cognitive performance, lower Intellectual Quotient (IQ), poor social skills, greater behavioral problems and vulnerability to contracting diseases. Moreover, malnutrition also leads to important consequences in adult life in terms of physical growth, work capacity, reproductive performances and risk of chronic diseases. The primary causes of under-nutrition in India are its large population, socio-economic differences and inadequate access to health facilities. Nutritional assessments among adolescents are important as they are the future parents and constitute a potentially susceptible group. Studies on the assessment of nutritional status of adolescents are less in number and a National database has not yet been developed [6].

Selection of Area:
A cross-sectional study was conducted at ZillaParishad High School in Kurnool, Andhra Pradesh, to assess the nutritional status and dietary adequacy of adolescent students aged between 13 and 14 years, both boys and girls.

Sample Size:
Adolescents in the age group of 13 – 14 years from a rural school located in Kurnool were selected to be a part of the current study. The total sample size is 180 adolescents, out of which 83 were girls and 97 were boys.

Tools of the Study:
A pre-tested, well designed questionnaire, consisting of questions was used to gather information. A list of open-ended and closed-ended questions were developed that were targeted to yield information required in the research study. The information collected can be discussed under the following headings:

General Information:
Information regarding the subject's Name, Age, and Gender were collected.

Anthropometric Measurements:
Anthropometry is defined as measurement of the body to assess the nutritional status of an individual. It can be sensitive indicators of health, growth and development in infants and children. In particular, anthropometry has been used during adolescence in many contexts related to nutritional status. Anthropometry includes measurement of height, weight and Body Mass Index (BMI).

Measurement of Height (cm):
The rate of length or gain reflects the long term nutritional adequacy. The height of the subjects were measured using a measuring tape. Standing height of the students was measured using a height measuring tape and was recorded in terms of centimeters.
The obtained results were compared to the WHO standards and the individuals were classified as normal, stunted and severely stunted according to their height.

Measurement of Weight (kg):
Body weight is the simplest and most widely used anthropometric measurement to assess the nutritional status of an individual. The weight was measured using a weighing machine and recorded in terms of kilograms.

Body Mass Index (BMI):
Body Mass Index is a measure that is used to determine the nutritional status of the individual in terms of underweight, overweight or obese. It was calculated using the height and weight of the individual by using the formula:

$$BMI = \text{Weight in Kg/ height in } m^2$$

The obtained results were compared to the WHO standards and the individuals were classified as wasted, normal, overweight and obese according to their BMI.

Family Details:
Information regarding the type of the family, number of members in the family, qualification and occupational status of the parents and monthly household income were collected from the subjects to analyze their socio-economic status.

Nutritional Information:
Frequency of consumption of food groups as they provide a variety of nutrients and have a role in helping the body function. In particular, vegetables, legumes and fruits protect against illness and are essential to a healthy diet. Data was collected from the subjects to know the food preferences whether they are vegetarian, ovo-vegetarian or non-vegetarian, frequency of consumption of meals in a day, fruits and vegetables, milk and milk products and non-vegetarian foods and type of food consumed outside.

24 hour Dietary Recall:
24 hr. diet recall method is a dietary assessment tool that consists of a structured interview in which the subjects are asked to recall all the food and drinks consumed in the past 24 hours. The information was recorded and the nutritive value calculation for Energy, Protein, Fat, Calcium and Iron was calculated using the nutritive value of Indian foods by ICMR. The mean intake of the above mentioned nutrients were compared with the RDA, 2010 Dietary Guidelines for Indians.

Health Status:
WHO has defined health as "a state of complete physical, mental and social well-being, and not merely the absence of disease". Health can be considered in terms of a person's body structure and function and the presence or absence of disease or signs (Health status) their symptoms and what they can and cannot do i.e. the extent to which the condition affects the person's normal life (Quality of life). The subjects were questioned regarding the symptoms of deficiencies of calcium, iron, folic acid and zinc.

Tools used to assess the Nutritional Status of Adolescents:
The WHO growth charts are the standards which show how children should grow when provided optimal conditions.

The WHO standards are based on a high-quality study designed explicitly for creating growth charts. The WHO standards were constructed using longitudinal length and weight data measured at frequent intervals. The Z score was used to determine the nutritional status of the adolescents through the parameters Height-for-Age and BMI-for-Age and was compared against the WHO standards. Z score is a numerical measurement used in statistics of a value's relationship to the mean of a group of values, measured in terms of Standard Deviation (SD) from the mean. If the Z score is 0, then it indicates that the data point's score is identical to the mean score. A z-score of **zero** shows that the value is exactly average while a score of +3 shows that the value is much higher than average and a score of -3 shows that the value is much lower than the average.

The Z score can be calculated from the following formula
$Z=(X-\mu) / \sigma$
Where, Z is the Z score,
X is the value of element,
M is the population mean,
σ is the Standard Deviation (SD)
The following table provides summary of definitions of growth problems in terms of Z score.

Z score	Growth indicators			
	Length/height-for-age	Weight-for-age	Weight-for-length/height	BMI-for-age
Above 3	See note 1	See note 2	Obese	Obese
Above 2	Normal		Over-weight	Over-weight
Above 1	Normal		Possible risk of over-weight	Possible risk of over-weight
0 (median)	Normal	Normal	Normal	Normal
Below -1	Normal	Normal	Normal	Normal
Below -2	Stunted	Under-weight	Wasted	Wasted
Below -3	Severely Stunted	Severely under-weight	Severely wasted	Severely wasted

Note 1: The child in this range is very tall. Tallness s rarely a problem, unless it is so excessive that it may indicate an endocrine disorder such as growth-hormone-producing tumor.

Note 2: A child whose weight-for-age falls in this range may have a growth problem, but this is better assessed from weight-for-length/height or BMI-for-age.

Statistical Analysis:
The data obtained from the questionnaire was compiled in the MS Excel sheet 2013.

Mean: The mean was calculated using the formula -
$X = \frac{\Sigma x}{N}$
Where, X is the symbol for mean
∑x is the sum of scores
N is the number of samples

Standard Deviation (SD): The standard deviation of the mean was calculated using the formula -
$SD = \frac{\sqrt{\Sigma(x-\bar{x})}}{\sqrt{n}}$
Where,
x is value of each data set
$\bar{x}$ is the mean of all values in the data set
n is the number of observations

Test: The 't' values were obtained using the formula -
$t = \frac{\bar{x}-\mu}{s}\sqrt{n}$
Where,
x is the mean of the sample
μis the actual/hypothetical mean
n is the sample size
S is the standard deviation

3. Results and Discussion

Malnutrition (under nutrition or over nutrition) which refers to an impairment of health either from a deficiency or excess or imbalance of nutrients, is of public health significance among adolescents all over the world. It creates lasting effects on the growth, development and physical fitness of a person. It is well recognized worldwide that anthropometric measurements are indispensable in diagnosing undernutrition. It has now been well established that the Body Mass Index (BMI) is the most appropriate variable for determining nutritional status among adolescents (WHO, 1995). Adolescents have been considered to have the lowest mortality among different age groups and have therefore received low priority in terms of nutritional status assessment

General Information:
Out of the total sample size of 180 adolescents, 97 (53.8 %) were boys and 83 (46.2 %) were girls where 95 (52.7%) of the total sample were 13 year olds (Girls = 44; Boys = 51) and 85 (47.3%) of the total sample were 14 year olds (Girls = 39; Boys = 46)

Anthropometric Measurements
Anthropometric measurements gives the information about the Height (cm), Weight (kg), BMI (kg/m^2) and Grading of the sample. It shows the mean ± SD of the mentioned measurements.

Table 1: Mean and SD of Anthropometric measurements of the sample (n=180)

S. No	Parameters	13 year Girls	14 year Girls	13 year Boys	14 year Boys
1	Height (cm)	152.5 (±7.30)	151.7 (±7.62)	155 (±10.59)	153.5 (±10.31)
2	Weight (kg)	38.955 (±7.66)	41.65 (±8.78)	45.27 (±10.48)	44.67 (±11.24)
3	BMI (kg/m^2)	16.63 (±2.32)	18.08 (±3.03)	18.79 (±3.73)	18.93 (±4.76)

The table represents the Mean ± SDof anthropometric measurements of the sample (n=180) with parameters age, height, weight and BMI.

Mean ± SD of height of girls of age 13 and 14 years is lower when compared to the Mean ± SD of height of boys of the same ages.

Mean ± SD of weight of girls of age 13 and 14 years is low when compared with the Mean ± SD of weight of boys of same ages.

Mean ± SD of BMI of girls of age 13 years is very low when compared to the Mean ± SD of BMI of boys of the same age. In 14 year old age category, the Mean ± SD is slightly lower when compared with that of the boys.

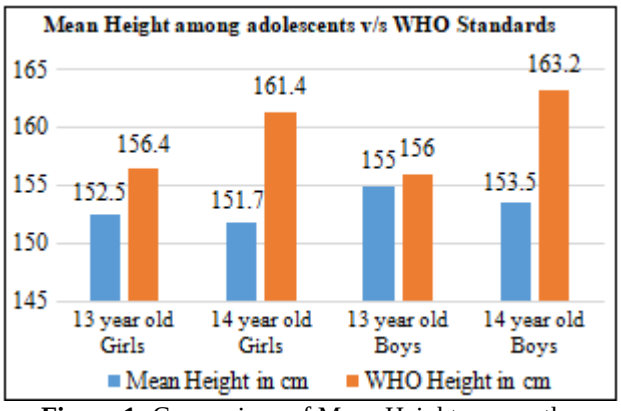

Figure 1: Comparison of Mean Height among the adolescents with the WHO Height Standards

Figure 1 shows the comparison of mean height among the adolescents with the WHO Height Standards. The mean height for the age for girls of 13 and 14 years was 152.5cm and 151.7 cm which was low when compared with the WHO standard height 156.6 cm and 161.4 cm respectively. The mean height for the age for boys of 13 and 14 years was 155cm and 153.5 cm which was low when compared with the WHO standard height 156 cm and 163.2 cm respectively.

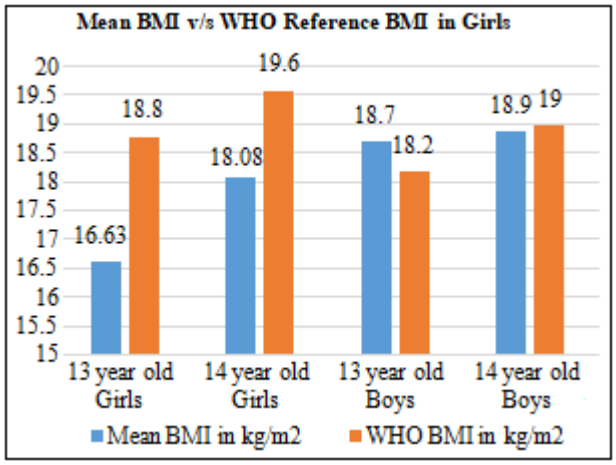

Figure 2: Comparison of Mean BMI of adolescents with WHO BMI Standards

Figure 2 shows the comparison between the mean BMI and WHO BMI standards for the adolescents of age groups 13 and 14 years. The mean BMI for the age 13 and 14 year old girls was 16.61kg/m^2 and 18.08kg/m^2 which was low when compared with the WHO standard BMI 18.8 kg/m^2 and 19.6 kg/m^2 respectively. Whereas the mean BMI for the age 13 and 14 year old boys was 18.7kg/m^2 and 18.9kg/m^2 which was compared with the WHO standard BMI 18.2 kg/m^2 and 19 kg/m^2 respectively.

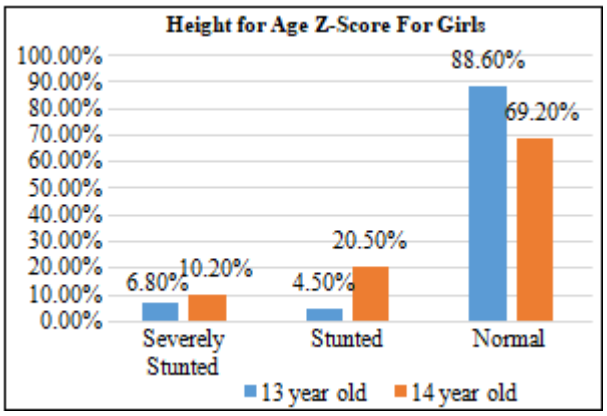

Figure 3: Distribution of Height for Age Z-Score in Girls (13-14 year old)

Figure 3 shows the distribution of the adolescent girls according to the height for age z-score. It was observed that 88.6% and 69.2% of the 13 and 14 year old girls, respectively were normal. Whereas 6.8% and 10.2% of them were severely stunted and 4.5% and 20.5% of the 13 and 14 year old girls, respectively were stunted.

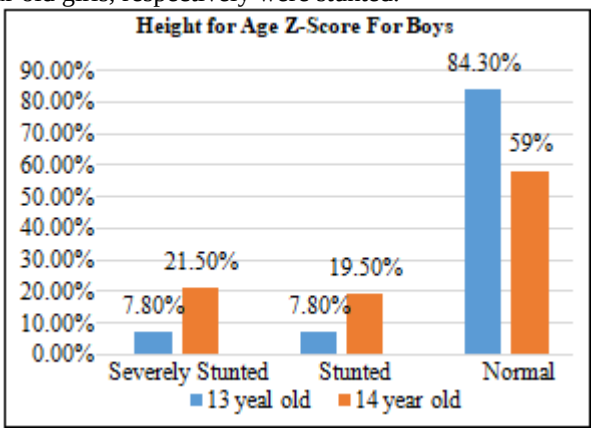

Figure 4: Distribution of Height for Age Z-Score in Boys (13-14 year old)

Figure 4 shows the distribution of the adolescent boys according to the height for age z-score. It was observed that 84.3% and 59% of the boys of age 13 and 14 years old were normal. Whereas 47.8% and 19.5% were stunted and 7.8% and 21.5% of the 13 and 14 year old boys, respectively were severely stunted.

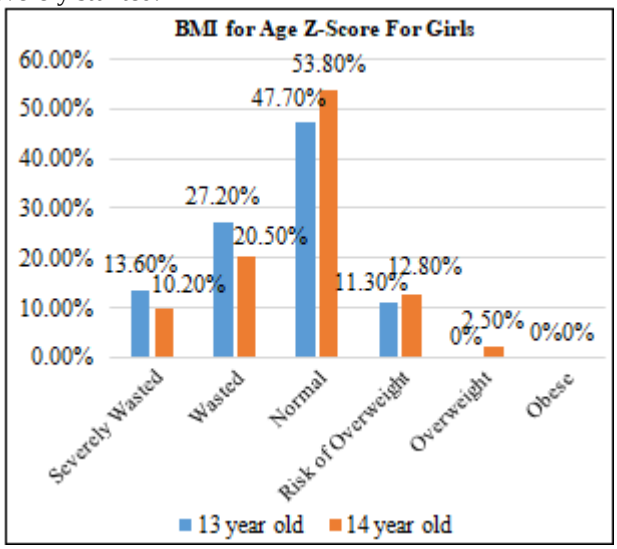

Figure 5: Distribution of BMI for Age Z-Score in Girls (13-14 year old)

Figure 5 shows the distribution of the adolescent girls according to the BMI for age z-score. It was observed that 47.7% and 53.8% of the girls of age group 13 and 14 year old were normal. Whereas 27.2% and 20.5% of the 13 and 14 year old girls, respectively were wasted; 13.6% and 10.2% of them were severely wasted, 11.3 and 12.8% of 13 and 14 year old girls, respectively were at the risk of overweight. Only 2.5% of the 14 year old girls were overweight.

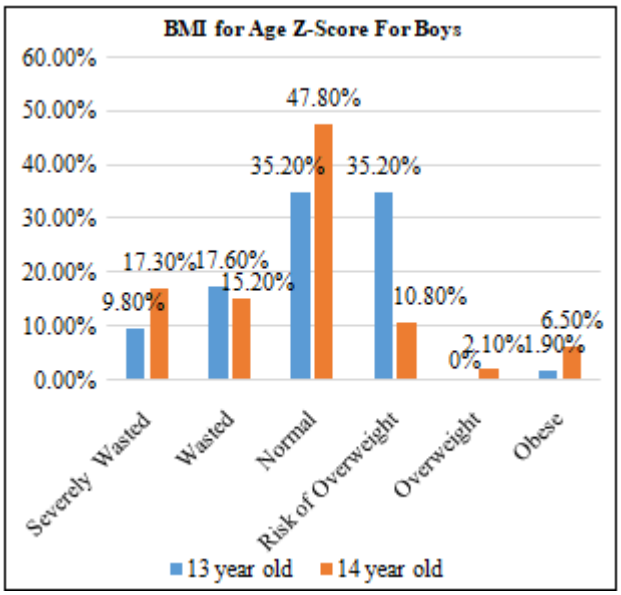

Figure 6: Distribution of BMI for Age Z-Score in Boys (13-14 year old)

Figure 6 shows the distribution of the adolescent boys according to the BMI for age z-score. It was observed that majority of boys of 13 and 14 year old, i.e. 35.2% and 47.8% were normal. Whereas 35.2% and 10.8% boys of age 13 and 14 years, respectively were at the risk of overweight; 17.6% and 15.2% were wasted and 9.8% and 17.3% of them were severely wasted. 1.9% and 6.5% of the 13 and 14 year old boys, respectively were obese and only 2.1% of the boys of 14 year old were overweight.

Demographic Data:

Table 2: Distribution of adolescents according to the qualification of their parents

	Subjects (n=180)	
Qualification	Father	Mother
Illiterate	106 (58.8)	139 (77.2)
High School	57 (31.6)	37 (20.5)
Intermediate	10 (5.5)	1 (0.5)
Graduation or above	7 (3.8)	3 (1.6)

The values given in parenthesis {( )} are percentages

The data in table no.2 represents the distribution of the adolescents according to the qualification of their parents. It was observed that most of the adolescents' parents did not complete their schooling i.e. 58.8% of the fathers and 77.2% of the mothers. 31.6% of the fathers and 20.5% of the mothers, respectively, completed their high school. And 5.5% of the fathers and 0.5% of the mothers, respectively, completed their intermediate. While only 3.8% of the fathers and 1.6% of the mothers, respectively, completed their graduation and above.

Table 3: Distribution of the adolescents according to the occupation of their parents

	Subjects (n=180)	
Occupation	Father	Mother
Labourers	93 (52.7)	86 (47.7)
Business	62 (34.5)	41 (22.8)
Private job	21 (11.5)	8 (4.5)
Government job	2 (1.1)	3 (1.6)
Unemployed	2 (1.2)	42 (23.4)

The values given in parenthesis {( )} are percentages

The data in table no.3 represents the distribution of the adolescents according to the occupation of their parents. It was observed that most of the parents of the adolescents were daily wage laborers with the distribution of 52.7% and 47.7% of the fathers and mothers respectively. 34.5% and 22.8% of the fathers and mothers, respectively had a business of their own. While 11.5% and 4.5% of the subjects' fathers and mother, respectively worked in private companies. 1.1% and 1.6% of the subjects' father and mother, respectively, had Government jobs. Only 1.2% of the subjects' father whereas a considerably high no of the subjects' mothers i.e. 23.4% were unemployed.

Table 4: Distribution of the adolescents according to their household monthly income

Monthly Income	No. of sample (n=180)
<6,000/-	92 (51.1)
6,000-10,000/-	67 (37.2)
10,000-25,000/-	17 (9.4)
>25,000/-	4 (2.2)

The values given in parenthesis {( )} are percentages

The data in table 4 shows the distribution of the adolescents according to their monthly household income. It was observed that majority of the income in the adolescents' household is <6,000/- per month. 51.1% had the income of 6,000/- while 37.2% had the income within the range of 6,000/- and 10,000/-. 9.4% of them had the monthly income range between 10,000/- and 25,000/-, while only 2.2% of the subjects' household had the monthly income above 25,000/-.

Dietary Information:

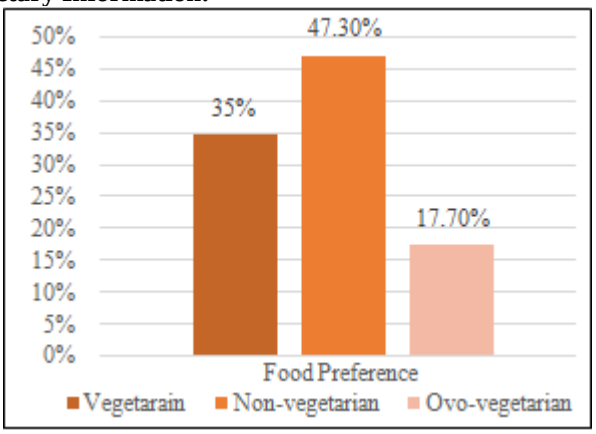

Figure 7: Distribution of the adolescents according to their food preferences.

Figure 7 shows the distribution of the adolescents according to their food preferences. It was observed that 47.3% of them preferred non-vegetarian while 35% of them preferred vegetarian. Only 17.7% were ovo-vegetarian.

Table 5: Distribution of adolescents according to their frequency of food consumed

Food group	How often consumed by adolescents	No. of sample (n=180)
Green leafy vegetables (GLV)	Daily	72 (40)
	Weekly	59 (32.7)
	Occasionally	43 (23.9)
	Never	6 (3.4)
Fruits and vegetables	Daily	67 (37.2)
	Weekly	57 (31.6)
	Occasionally	52 (28.9)
	Never	4 (2.3)
Milk and milk products	Daily	111 (61.6)
	Weekly	32 (17.7)
	Occasionally	24 (13.4)
	Never	13 (7.3)
Non-vegetarian foods	Daily	11 (6.1)
	Weekly	145 (80.3)
	Occasionally	16 (8.4)
	Never	10 (5.2)

The values given in parenthesis {( )} are percentages

The data in table 5 shows the distribution of the adolescents according to their food consumption. It was observed that 40% of the adolescents eat green leafy vegetable every day, 32.7% of them eat it once in a week, 23.9% eat GLVs occasionally and 3.4% never have green leafy vegetables. 37.2% of the adolescents eat fruits and vegetables every day, 31.6% eat it once in a week, 28.9% eat it occasionally while 2.3% of them never consume fruits and vegetables. 61.6% of the adolescents have milk and milk products on a daily basis while 17.7% have it once in a week, 13.4% have it occasionally and 7.3% never have milk and milk products. 80.3% of the adolescents eat non-vegetarian weekly once while 8.4% eat occasionally, 6.1% have it every day and 5.2% never consume non-vegetarian food.

24 HR Dietary Recall

Table 6: Nutritional intake of girls in the rural areas

Nutrients	RDA	13 year old		14 year old	
		Dietary Intake	Calculated 't' value	Dietary Intake	Calculated 't' value
Energy	2330 K.cal	1304.7±295.03	-23.04	1437.4 ± 404.1	-13.7
Protein	51.9 g	39.8 ± 8.6	-9.3	41.4 ± 10.3	-6.3
Fat	40 g	30.8 ± 17.9	-3.3	33.8 ± 21.08	-8.7
Calcium	800 mg	293.4 ± 148.3	-22.6	272.9 ± 139.9	-23.5
Iron	27 mg	11.2 ± 4.02	-25.9	11.2 ± 2.8	-34.1

(- : Non-Significant)

The 't' table value at 5% significance level is 2.021.

The data in table 6 shows the mean nutrient intake of the female adolescents in the rural areas.

Energy:
It was observed that the mean Energy intake of the female adolescents of age 13 and 14 year old to be 1304.7 and 1437.4 K.cal respectively, which is significantly lower than the RDA at 5% significance level. Low intake of Energy is due to small portion sizes and skipped meals.

Protein:
The mean Protein intake of the female adolescents of age 13 and 14 years old was found to be 39.8 and 41.4 g respectively. This is significantly lower than the RDA at 5% significance level because the diet was not rich in Protein food and some of them were vegetarian.

Fat:
The mean Fat intake of the female adolescents of age 13 and 14 year old was found to be 30.8 and 33.8 g respectively, which is significantly lower than the RDA at 5% significance level. This is because of skipping of meals by the adolescent girls.

Calcium:
The mean Calcium intake of the female adolescents of age 13 and 14 year old was 293.4 and 272.9 mg respectively and is significantly lower than the RDA at 5% significance level. This is because of low intake of Calcium rich foods among these subjects.

Iron:
The mean Iron intake among the female adolescents of age 13 and 14 year old was found to be 11.2 and 11.2 respectively and is significantly lower than the RDA at 5% significance level. This was mainly because many of the subjects had low consumption of Iron rich foods in their diet.

Data in the table shows that the female adolescents' dietary intake failed to meet the ICMR recommended level with respect to Energy, Protein, Fat, Calcium and Iron.

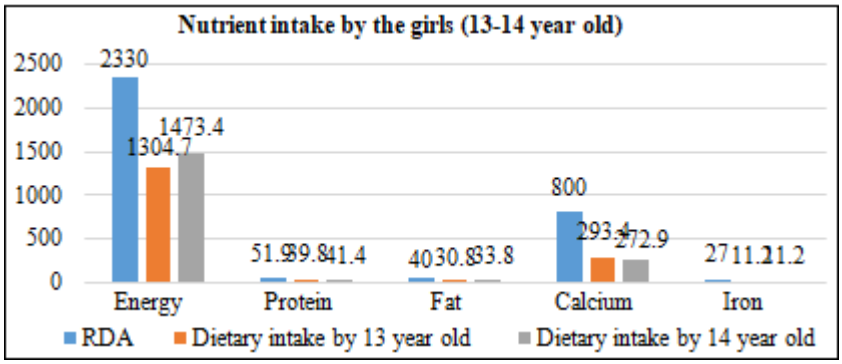

Figure 8: Nutritional intake by the adolescent girls of age 13 and 14 years

Figure 8 shows the Mean nutrient intake of the adolescents. It was observed that the nutrient intake by the adolescent girls is less than that of the RDA and this can lead to many health problems in the future.

Table 7: Nutritional intake of male adolescents in the rural areas

Nutrients	RDA	13 year old		14 year old	
		Dietary Intake	Calculated 't' value	Dietary Intake	Calculated 't' value
Energy	2750 K.cal	1373.6±260.8	-37.6	1105.1±176.2	-63.2
Protein	54.3 g	54.1 ± 12.9	-0.07	35.5 ± 8.3	-15.2
Fat	45 g	22.3 ± 7.7	-20.9	16.9 ± 6.2	-30.4
Calcium	800 mg	275.4 ± 124.6	-30.04	185.1 ± 97.7	-42.6
Iron	32 mg	12.9 ± 2.8	-47.04	9.5 ± 1.5	-95.8

(-Non-Significant)
The 't' table value at 5% significance level is 2.021.

The data in table 7 shows the mean nutrient intake of the male adolescents in the rural areas.

Energy:
It was observed that the mean Energy intake of the male adolescents of age 13 and 14 year old to be 1373.6 and 1105.1 K.cal respectively, which is significantly lower than the RDA at 5% significance level. Low intake of Energy is due to small portion sizes and skipped meals.

Protein:
The mean Protein intake of the male adolescents of age 13 and 14 years old was found to be 54.1 and 41.4 g respectively. This is significantly lower than the RDA at 5% significance level because the diet was not rich in Protein food and some of them were vegetarian.

Fat:
The mean Fat intake of the male adolescents of age 13 and 14 year old was found to be 22.3 and 16.9 g respectively, which is significantly lower than the RDA at 5% significance level. This was because of skipping of meals by the adolescent boys.

Calcium:
The mean Calcium intake of the male adolescents of age 13 and 14 year old was 275.4 and 185.1 mg respectively. It is significantly lower than the RDA at 5% significance level. This is because of low intake of Calcium rich foods among the boys.

Iron:
The mean Iron intake among the male adolescents of age 13 and 14 year old was found to be 12.9 and 9.5 mg respectively and is significantly lower than the RDA at 5% significance level. This was because many of the subjects had low consumption of Iron rich foods in their diet.

Data in the table shows that the male adolescents' dietary intake failed to meet the ICMR recommended level with respect to Energy, Protein, Fat, Calcium and Iron.

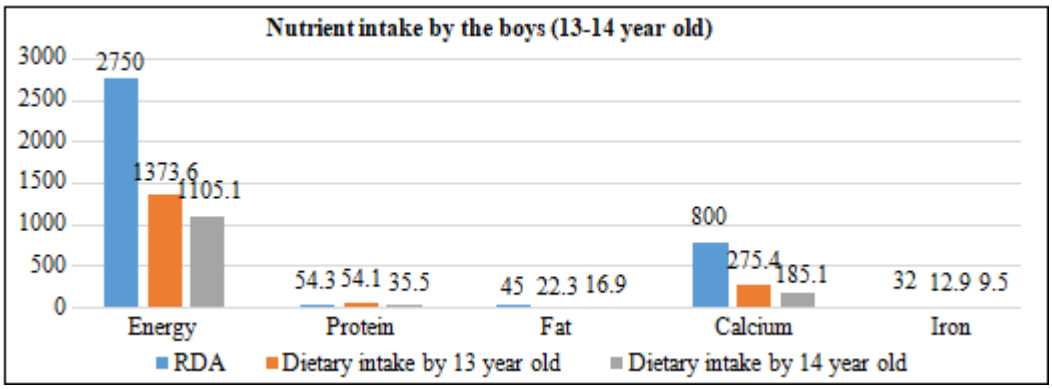

Figure 9: Nutritional intake by the adolescent boys of age 13 and 14 years

Figure 9 shows the Mean nutrient intake of the adolescent boys. It was observed that the nutrient intake by the adolescent boys is less than that of the RDA and this can lead to many health problems in the future.

Health Status

Table 8: Distribution of the adolescents according to their health condition

Nutrient Deficiency	Symptoms	No. of sample (n=180)
Zinc	Bruises and cuts took long time to heal	65 (36.1)
	Dry/damaged skin	28 (15.6)
	Hair loss	66 (36.7)
	Grey hair	29 (16.2)
	Sores at corner of mouth	14 (7.8)
Iron	Extreme fatigue and unusual tiredness	49 (27.2)
	Shortness of breath	20 (11.2)
	Headache or dizziness	65 (36.2)
Calcium	Feel numb in extremities or face	88 (48.9)
	Muscle cramps	67 (37.3)
Folic acid	Ulcers in mouth	8 (4.4)
	Swollen tongue	5 (2.8)

The values given in parenthesis {( )} are percentages

The data given in table no. 8 is the distribution of the adolescents according to their health condition. It was observed that 48.9% of the adolescents feel numbness of the face or extremities frequently, 37.3% of the adolescents suffer with muscle cramps, 36.7% suffer hair loss, 36.2% suffer headache or dizziness, 36.1% of the adolescents' wound take a longer time to heal, 27.2% of them feel extremely fatigue and unusually tired, 16.2% had grey hair, 15.6% had dry and damaged skin, 11.2% suffer with shortness of breath, 7.8% suffer with sores at the corner of their mouth frequently, 4.4% had ulcers in their mouth and 2.8% had swollen tongue.

4. Summary and Conclusion:

A cross-sectional study was conducted at ZillaParishad High School in Kurnool, Andhra Pradesh, to assess the nutritional status and dietary adequacy of adolescent students aged between 13 - 14 years, both boys and girls. A pre-tested, well designed questionnaire, consisting of questions was used to gather information. A list of open-ended and closed-ended questions were developed that were targeted to yield information required in the research study.

The main objective of the study was to assess the nutritional status of the adolescent boys and girls of age group 13 and 14 years. The secondary objectives were to know the Impact of socio-economic status on the nutritional status of the adolescents; assess the dietary pattern and its adequacy; to calculate the macronutrient and micronutrient intake and comparing them against the RDA, 2010 Dietary Guidelines for Indians.

The sample size taken for the study was n=180, where boys were 53.8% whereas girls were 46.2%. From the demographic data it was observed that majority of the adolescents i.e. 85.5% were from a nuclear family and comparatively less adolescents i.e. 14.5% were from joint family. Most of the adolescents' parents did not complete their high school and were working as labors. Very few of the adolescents' parents had completed graduation or above education. 23.4% of the adolescents' mothers were housewives. Working as labors, the monthly household income was mostly 6,000/- or below with a comparatively very less having a household income more than 25,000/-.

Anthropometric measurements like height, weight were recorded. The collected data was then analyzed and BMI was computed. Growth and health predicting parameters like Height for Age and BMI for Age were compared to the WHO standards to help assess their nutritional status. The collected data revealed from the Height for Age parameters that majority of the adolescents were normal. Stunting was seen in boys more than in girls. From BMI for Age parameters, it was observed that most of the adolescents were normal whereas wasting was seen more in girls than in boys. But comparatively more boys were at a high risk of overweight than in girls and overweight was seen in both boys and girls. Among the subjects, obesity was seen only in boys and not in girls.

The dietary information revealed that majority of the adolescents i.e. 47.3% were non-vegetarian whereas 35% were vegetarian and 17.7% were ovo-vegetarian. The consumption of milk and milk products among the subjects on a daily basis was more i.e. 61.6% followed by 37.2% fruits and vegetables, 40% green leafy vegetables and 6.1% non-vegetarian foods. Dietary intake of the adolescents, the mean ± SD of nutrients intake of Energy, Protein, Fat, Calcium and Iron was statistically non-significant at 0.05% level, indicating that inadequate nutrient intake among them. This was mainly because of skipped meals and less portion sizes.

From the health status of the adolescents, It was observed that 48.9% of the adolescents feel numbness of the face or extremities frequently, 37.3% of the adolescents suffer with muscle cramps, 36.7% suffer hair loss, 36.2% suffer headache or dizziness, 36.1% of the adolescents' wound take a longer time to heal, 27.2% of them feel extremely fatigue and unusually tired, 16.2% had grey hair, 15.6% had dry and damaged skin, 11.2% suffer with shortness of breath, 7.8% suffer with sores at the corner of their mouth frequently, 4.4% had ulcers in their mouth and 2.8% had swollen tongue. This shows that the adolescents suffer with nutritional deficiencies related to Zinc, Iron, Calcium, Folic acid. These deficiencies are because of lack of a balanced diet.

Thus from the results of the present study, it can be concluded that many of the adolescents were stunted and wasted. This was because of less knowledge among the family members about the healthy food choices as most of the adolescents' parents did not complete their studies. And also due to the low socio-economic status of their families resulting in a low consumption of balanced meals. Hence, great emphasis should be made to create awareness among the children and their family members about good nutritional support through low cost recipes and inclusion of healthy foods in the diet economically.

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Author Profile

Ms. Mogul Sana Tabassum, holds bachelor's degree in Applied Nutrition from a reputed college in Hyderabad, India. She is pursuing Masters from the same college and presently in final semester. She has done fairly well during her academics both in Bachelors and Masters. She has been showing keen interest in her academics throughout her bachelors as well as Masters. During her Masters she began involving in conducting counselling sessions and orientation sessions on diet and diet plan for the needy among friends and relatives. As part of her academics during her Masters, she chose to work on **"Nutritional Assessment of Adolescents (13 to 14 years of age) in Rural Areas of Kurnool, Andhra Pradesh state, India"**, based on her interest. She is more inclined towards understanding the dietary pattern that is followed in rural areas where no proper information or guidance is available for the rural people due to their socio economic conditions and she put a lot of efforts to study and assess Nutritional pattern followed among children in Kurnool. She intends to get into research programs in future related to the above and make best use of her knowledge and resources for improving nutritional health among populations of the rural areas.

Ms. Varsha R. Peram holds a Masters Degree in Nutrition and Dietetics and a Bachelor's Degree in Applied Nutrition & Public Health from Osmania University. She also holds an additional Associate Degree in Dietetic Technology from Camden County College, New Jersey, USA which is an accredited program as per the Academy of Nutrition and Dietetics, USA. Her Professional Certifications include the Nutrition and Diet Technician Registered (NDTR) as per the Commission on Dietetic Registration the credentialing agency for the Academy of Nutrition and Dietetics (USA), Certified Dietary Manager (CDM) and Certified Food Protection Professional (CFPP) as per the Association of Nutrition and Foodservice Professionals (USA) and Safe Serve Certified by National Restaurant Association (USA). She has worked as a Research Nutritionist with National Institute of Nutrition &South Asian Institute of Preventive Cardiology inHyderabad. Currently she functions in the role of an Assistant Professor in a city-based college for students pursuing M.Sc.in Nutrition and Dietetics at the Post-Graduate level. She teaches Basic and Advanced Nutrition courses like Human Nutrition, Principles of Dietetics, Diet in Disease, Food Science, Food safety and Quality Control , Food Service Management & Nutraceuticals to name a few. She has been with Celes Care (Now Ekincare) a Virtual Health Clinic for Women right from its inception in August 2016.She provides chat based and phone consultations specifically targeting their nutritional needs. Her work entails a detailed Nutritional assessment & diagnosis, provides Medical nutrition therapy through Diet counselling and planning of nutrition intervention programs for each stage in a woman's life.