Adolescent Nutritional Status among School Children in Eluru Town, West Godavari District, Andhra Pradesh

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Abstract:
AIMS and Objective:
- *To assess the nutritional status among the adolescent population studying in and around the secondary schools of Eluru district.*
- *To study the socio-demographic profile of the same study population and setting.*

MATERIALS and METHODOLOGY
Research design: Cross-sectional and Institutional based study.
Study Universe: Eluru adolescent population.
Study period: October 2012 to September 2013
Study Setting: Four Government and four Private Secondary schools
Study Population: Total 1520 adolescent school children
Results: Health and nutritional status among adolescents were found to be low, more so in girls than in boys. Under nutrition (weight/age) was highly prevalent with boys – 47.42%, girls 41.09%, with p value < 0.001. Stunting was seen in significant proportion more in girls 60.30% than boys 48.9%, government schools 68.95% and private schools 37.5% with significant p value < 0.001. Stunting is increasing from upper class to lower class with significant p value < 0.0001. As per BMI 24.9% of boys and 19.5% of girls were underweight. Overweight and obesity are more among private schools and upper class.
Conclusion: Investing in young people will yield large return for generation to come. Failing to act on other hand, may result in tremendous costs to individuals, society and the world.
Keywords: Adolescent, BMI, Stunting, Wasting

I. Introduction

Adolescence means "to grow to maturity". This is a period of metamorphosis of a child into adult. A very crucial and stressful period in an individual's life with rapid changes occurring in physical, cognitive, psychological, emotional and social domains of life.

Adolescence includes the period from 10-19 years (WHO) (1). Adolescents form 21% of Indian Population, though they constitute such a major proportion of population the data available regarding the health status and the specific causes of morbidity in this age group are very meagerly available in India (2).

Along with the physical and reproductive maturation, an adolescent goes through immense stress related to defining self identity, facing new life situations, struggle towards autonomy, peer pressure, issues related to sexuality and academic pressure. Habits and behavior picked up during adolescence (risk taking behavior, substance abuse, eating habits, conflict resolution) have lifelong impact. Adolescence is the last chance to correct the growth lag and malnutrition. The 70% of the mortality in adulthood is linked to habits picked up during adolescence (risk-taking behavior, substance abuse, eating habit and conflict resolution (3). Prevailing malnutrition, anaemia, stunting and lack of immunization have adverse impact on MMR, IMR, morbidity and have intergenerational effects. The story is well known that a stunted adolescent getting married giving rise to a low birth baby, that too female, again unable to develop or develop in to a stunted female and the cycle keeps on repeating. Lack of "connectedness" with parents and other adults prevents transmission of health messages and crucial skills leading to adoption of risky behavior, substance abuse, early sexual debut and STI, HIV etc.

The present study aims to determine the common health problems among adolescents and also to determine level of malnutrition and other nutritional deficiencies prevalent among teens so that appropriate

health programmes can be planned. As most cause of morbidity in adolescent age group are preventable, it becomes an even more pressing issue to take up appropriate measures.

II.   Materials And Methods

A cross-sectional survey was conducted among school students in Eluru district, Andhra Pradesh in total 8 schools of which 4 of government and 4 of private sectors from 6th class to 10th class. About 1520 adolescent school children in the age group of 10-16 years studying at various secondary schools were included in the study. A predesigned and pilot tested tool was used to collect the required data, height measuring rod, electronic weighing machine etc. We conducted the oral interview of the selected population with help of pre-tested question format to get the basic Socio-demographic information of the study subjects.

Selection of the study population:

 (i). Inclusion Criteria:

-The children who are in the age group of 10 to 16 years.

-Who present on the day of the study

-Who gave informed consent

(ii). Exclusion Criteria:

-The children who are less than 10yrs and more than 16years.

-Who were not present on the day of the study

-Who did not give informed consent

Anthropometric measurements were used for assessment of nutritional status and growth as there are no gold standard measurements presently (4). The anthropometric measurements taken were weight, height and the corresponding body mass index (BMI).

Standardization of the weighing machine and height rod (stadiometer) was done as well as standardization of person measuring, to prevent intra and interpersonal error is done. Errors allowed are for weight 100gms and for height 0.5cm. Standards used for comparison were IAP growth charts (2007). We have recorded body weight to the nearest 0.1 kg using a standard balance scale with the subjects bare foot and wearing light indoor clothing. Body height was measured to 0.1 cm with a free standing height measuring rod which was available at Anganwadi centers. A growth chart based on weight, height and BMI is appropriate for practical purposes and Eliz Health Path for adolescents and adults (EHPA) was considered apt for this purpose.

Weight is the most reliable criterion for assessment of nutritional status. From the observed weight and height, percentage of weight and height for age was calculated using 50th percentile of IAP height & weight for boys from 2-18 years, 2007 (Khadilkar et al) (5) & Height and weight for girls from 2-17 years standards as expected weight for that age. From the % weight age are assigned nutritional status as per IAP classification of malnutrition, placing them as normally nourished or Grade I to Grade IV malnutrition/ PEM (6). Height for age along with weight for height indicates the chronic nutritional status. From the % height age students are placed as normal or with stunted growth (First to third degree stunting) using WATERLOWS classification for height for age (7).

Body Mass Index (BMI) gives the relationship between weight and height. It is calculated as weight in Kg per (Height in meters). Reduced BMI is an indicator of chronic energy deficiency (CED), raised BMI is an indicator of adiposity (overweight, obesity). For those in growing age or height up to 150cm, BMI < 15 indicates chronic energy deficiency or underweight, BMI > 22 indicates tendency for obesity. BMI is calculated by using IAP BMI charts (Redesigned by Agarwal et al) also (8).

The socio economic status of the local adolescent population included in the study belong to various socio economic status adolescents starting from Class I to Class IV as per Modified Kuppuswamy scale (9).

Chi-square test was used for comparison of frequencies. A p value below or equal to 0.05 was considered to be statistically significant for a 95%CI. The data were analyzed through SPSS 10.0 (SPSS Inc.)

III.   Results

The distribution of boys and girls was 35.92% and 64.14% respectively. In government schools girls are more 74.19% when compared to boys 25.80%. In private schools boys are more with 50.72% and girls are 49.27%. Study shows distribution of early adolescents more 63.61% when compared to middle adolescents 36.38%.

Study shows normal 287 (52.56%), grade I malnutrition (wasting) 104 (19.04%), grade II 121 (22.16%), grade III 34 (6.22%) and grade IV are not found in boys. Overall malnutrition status in table 1 shows Grade I, II, III includes total 47.42% according to IAP classification and acute malnutrition is more among 12, 13, and 14yrs of age indicating the pubertal spurt and inadequate nutritional supplementation. Chi-square value 17.80, p<0.006,df=6(not significant). Wasting as per IAP classification overall (Grade I, II, III) is more among early adolescents (50.8%) when compared to middle adolescents (41.06%) with Chi-square value 4.70, p<0.03,df=1 significant.

This study shows that according to IAP, wasting in girls table 1 shows grade I 251 (25.74%), grade II 114 (11.69%) and grade III 44 (4.51%), grade IV not found. Study shows wasting is more among 10, 11, 12, 13 and 14yrs of age among females. It may be due to pubertal spurt and inadequate nutritional supplementation. Chi-square value 11.03,p > 0.05,df=6 not significant. Early adolescent (normal) = 352 (62%), overall under nutrition among early adolescent girls (grade I, II, III overall) is 276 (43.94%). Middle adolescent (normal) = 215 (37.9%) under nutrition among middle adolescent girls is (overall grade I, II, III) 133 (38.2%). Under nutrition is more among early adolescents compared to middle adolescents with Chi-square value 3.02, p < 0.08, df=1 not significant.

Table 1: Distribution of Weight for Age (Wasting) Among Boys and Girls

IAP	Boys	Girls
Normal	52.56%	58%
Grade I	19.04%	25.74%
Grade II	22.16%	11.69%
Grade III	6.22%	4.51%
Early adolescent	50.08%	43.94%
Middle adolescent	41.06%	38.2%
Overall	47.42%	41.09%

Acute malnutrition is more among boys (47.42%) when compared to girls (41.09%) and it is more among early adolescent when compared to middle adolescents in both boys and girls.

Figure 1: Distribution of Weight for age (Wasting) among Govt. and Private Schools.
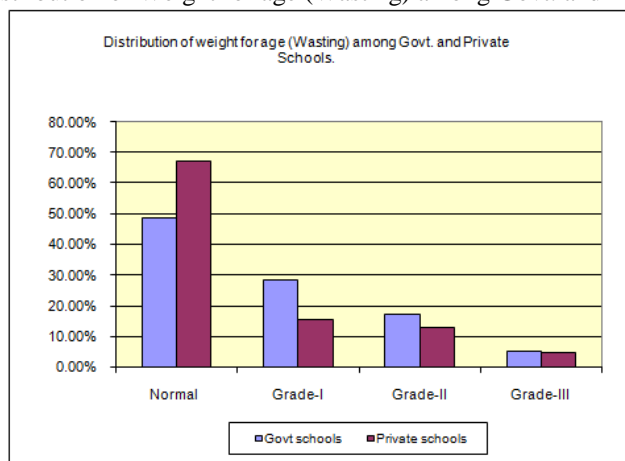

Figure 1 shows nutritional status in government schools, normal 442 (48.8%) and under nutrition (overall grade I, II, III) is 463 (51.16%) in government schools and in Private schools normal 412 (66.9%), under nutrition (overall grade I, II, III) is 204 (33.11%).

In Government schools (51.16%) overall acute malnutrition is more when compared to private schools (33.11%) with Chi-square value 49.36, p<0.001, df=1 significant.

Figure 2: Distribution of Weight for age (Wasting) among various Socio-Economic Status Adolescent according to IAP
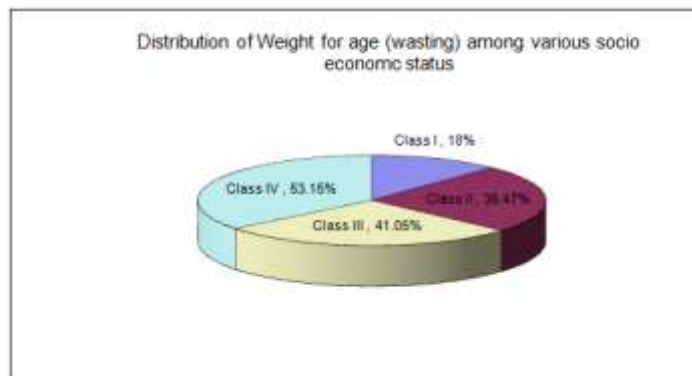
Figure 2 shows upper socio economic status class (I) overall acute malnutrition grade I, II, III is 9 (18%), upper middle socio economic status class (II) shows 151 (36.47%) and lower middle class (III) shows 186 (41.05%) and upper lower class (IV) 320 (53.15%). Lower (V) adolescents are not present. Under nutrition is increasing from upper class to lower class with Chi-square value 44.33,p<0.0001,df=3 significant.

**Table 2:** Distribution of height for age (Stunting) among Boys and Girls

	Boys	Girls
Normal	51.09%	39.67%
Stunting class I	25.09%	40.20%
Stunting class II	19.04%	15.58%
Stunting class III	4.76%	4.51%
Overall stunting (I+II+III)	48.9%	60.30%
Early adolescents	62.5%	61.05%
Middle adolescents	37.5%	48.09%

This study shows stunting in boys is more among 12,13,14,15 years of age indicating pubertal spurt in showing inadequate nutritional supplementation. Normal adolescents 279 (51.09%), class I stunting 137 (25.09%), class II 104 (19.04%), class III 26 (4.76%) overall stunting Class I, III, III is 267 (48.9%). In early adolescents normal is 172 (61.64%), overall stunting Class I, II, III is 167 (49.2%), middle adolescents normal is 107 (38.35%), overall stunting class I, II, III is 100 (48.30%) (Table 2).Stunting is more among early adolescents(62.5%) when compared to middle adolescents (37.45%) with Chi-square value 0.05, p>0.8, df=1, not significant.

Study shows chronic malnutrition is more among girls of 12, 13, 14 yrs of age may be due to pubertal spurt with increased demands and inadequate nutritional supply. Normal – 387 (39.67%), class I – 392 (40.20%), class II – 152 (15.58%), class III – 44 (4.51%), overall chronic malnutrition (stunting) among female adolescents is 588 (60.30%) (Table 2). Chronic malnutrition is more in early adolescents 359 (61.05%) and middle adolescents 229 (38.9%) with Chi-square value 7.28,p<0.05,df=1 significant.

Overall stunting is more among girls (60.30%) then boys (48.9%). Stunting is more in early adolescents than middle adolescents in both boys and girls.

Figure 3: Distribution of Chronic Malnutrition (Stunting) among Govt. and private Schools according to Waterlows classification.
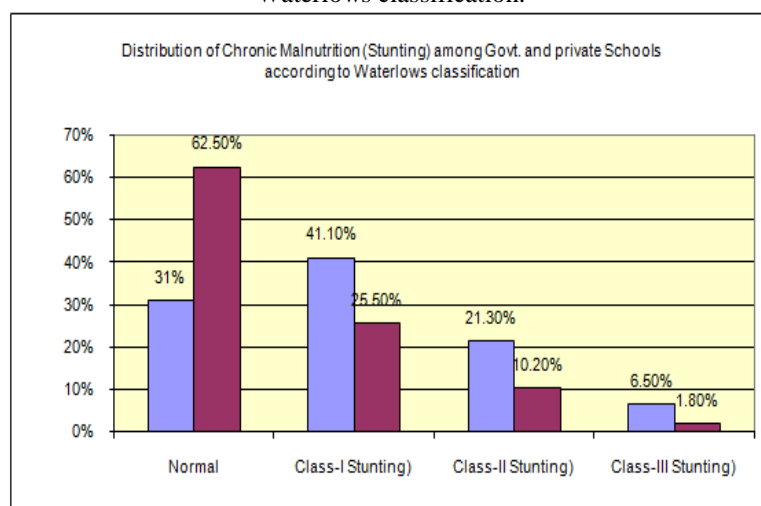
In Government school normal = 281 (31%), chronic malnutrition (overall class I,II,III) 624 (68.95%), & in Private schools normal = 385 (62.5%), chronic malnutrition(class I, II, III)231 (37.5%) (Figure 3).

Chronic malnutrition is more among government schools (68.95%) when compared to private schools (37.5%) indicating poor nutritional status among both government and private schools which is more in government schools with Chi-square value 147.29,p<0.001,df=1 significant.

Figure 4: Distribution of Chronic Malnutrition (Stunting) in various Socio-Economic Status.
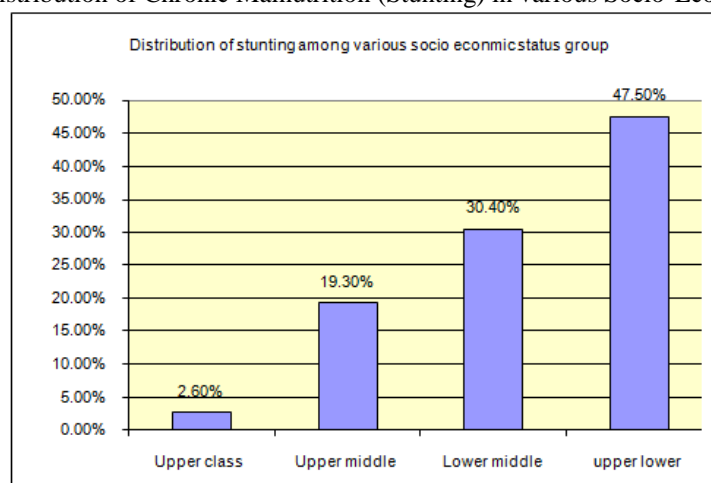
Chronic malnutrition in upper class (I) normal is 27 (54%) chronic malnutrition overall Class I, II and III of stunting 23 (46%) in upper middle class (II) normal is 249 (60.1%), chronic malnutrition overall Class I, II and III of stunting 165 (39.85%) in lower middle class (III) normal is 193 (42.6%), overall Class I, II and III of stunting 260 (57.39%), in upper lower class (IV) normal is 196 (32.6%) overall Class I, II, III of stunting is 406 (67.49%) (Figure 4). Lower class (V) students were not present. Chronic malnutrition is increasing from upper class to lower class with Chi-square value 237.14,p<0.0001,df=3 significant.

Table 3: Distribution of Under weight, overweight and obesity as per (EHPA) Eliz health path BMI chart among Boys and Girls

	Normal	Under weight	Over weight	Obesity
Boys	358 (65.66%)	136 (24.9%)	32 (5.86%)	20 (3.63%)
Girls	690 (70.84%)	190 (19.50%)	64 (6.56%)	30 (3.07%)

According to Eliz Health path for adolescents boys BMI chart (Table 3) normal is 358 (65.56%), underweight < 5th percentile is 136 (24.9%), among over weight (> 85th percentile) is 32 (5.86%) and obesity (> 95th percentile) is 20 (3.63%). Under weight (chronic energy deficiency) is more among early male adolescents (26.54%) when compared to (22.22%) in middle adolescents. Overweight and obesity are more among middle adolescents as 7.7% and 4.83% when compared to early adolescents as 4.7% and 2.9%. Chi-square value 0.14, p>0.7, df=1, not significant.

According to BMI (Table 3) in girls normal is 677 (69.50%), underweight is 203 (20.84%), overweight 64(6.56%), obesity is 30 (3.07%). Chronic energy deficiency is more among early adolescent girls (23.76%) when compared to middle adolescents (11.8%). Overweight and obesity are also more among early adolescent girls as 7% and 3.1% when compared to middle adolescents 5.76% and 2.88%. Chi-square value 19.74, p<0.000008, df=1 significant.

Chronic energy deficiency (underweight) is more among boys 24.9%, when compared to girls (19.50%). Overweight is more among girls 6.56% when compared to boys 5.86%. Obesity is almost similar in both boys and girls ad 3.63% and 3.07%. Chi-square value 4.55, p < 0.33,df=1 significant.

Table4: Distribution of BMI in adolescents among Govt. and Private Schools.

Type of School	BMI			
	Normal	**Under weight**	**Over weight**	**Obesity**
Govt. School	620 (68.6%)	228 (25.22%)	42(4.6%)	13 (1.4%)
Private School	428(69.3%)	98 (15.9%)	54 (8.8%)	37 (6%)
Total:	**1047 (68%)**	**326 (21.44%)**	**96 (6.3%)**	**50 3.3%**

Study shows under weight is more among government schools 228 (25.22%) when compared to private schools 98 (15.9%) as per Eliz Health Path BMI and overweight and obesity are more among private schools 96 (6.3%), 50 (3.3%) when compared to government schools 42(4.6%) and 13 (1.4%) (Table 4). Chi-Sq.43.73 p=000 which is statistically significant.

Table 5: Distribution of BMI in Adolescents of various Socio-economic Statuses

Socio-economic Status	BMI			
	Normal	**Under weight**	**Over weight**	**Obesity**
I.	27 (67.5%)	2 (5%)	7 (17.5%)	4 (10%)
II.	266 (75.3%)	23 (6.5%)	38 (10.76%)	26 (7.36%)
III.	357 (74.53%)	85 (17.74%)	27 (5.63%)	10 (2.08%)
IV.	398	216 (33.33%)	24 (3.7%)	10 (1.5%)
Total:	1048 (68.94%)	326 (21.44%)	96 (6.3%)	50 (3.3%)

Underweight is more among lower classes, in class IV it is 33.33% when compared to higher class in Class I it is 5%, overall underweight among various socioeconomic status is 21.44%. Overweight and obesity are more among class I and Class II , 17.5%, 10% and 10.70% and 7.36% and the average overweight and obesity among various socio economic status are 6.3% and 3.3% respectively (Table 5)

Table 6: Distribution of Underweight, overweight, obesity as per IAP BMI growth chart 2007 for BMI among boys and girls

	Normal BMI	Under weight	Over weight	Obesity
Boys	316 (57.8%)	172 (31.50%)	36 (6.59%)	22 (4.62%)
Girls	643 (66%)	232 (23.81%)	68 (6.9%)	31 (3.1%)
Total	959 (63.09%)	404 (26.5%)	104 (6.8%)	53 (3.4%)

As per IAP BMI growth chart 2007, underweight is 26.5%, overweight is 6.8% and obesity is 3.4%, underweight is more among boys 31.50% when compared to girls 23.81%. overweight and obesity are almost similar among boys and girls as 6.59%, 4.62% and 6.9% and 3.1% with Chi-square value 9.96,p<0.001,df=1 significant (Table 6).

Table 7: Distribution of Underweight, overweight, obesity as per IAP BMI growth chart 2007 for BMI among Government and Private Schools

	Normal BMI	Under weight	Over weight	Obesity
Govt School	572 (63.3%)	272 (30.12%)	44 (4.8%)	15 (1.6%)
Private school	387 (62.72%)	132 (21.39%)	60 (9.7%)	38 (6.15%)

Table shows underweight is more among government schools (30.12%) when compared to private schools (21.39%). Overweight and obesity are more among private schools (9.7%) and 6.1% when compared to government schools 4.8% and 1.6%. Chi-square value 166.38,p < 0.000001, df=3 significant (Table 7).

Table 8: Distribution of Underweight, overweight, obesity as per IAP BMI growth chart 2007 among various socio economic status children

	Normal	Under weight	Over weight	Obesity
I	23 (57.5%)	4 (10%)	8 (20%)	5 (12.5%)
II	256 (72.52%)	30 (8.4%)	40 (11.3%)	27 (7.6%)
III	33 (69.72%)	102 (21.21%)	31 (6.47%)	12 (2.5%)
IV	346 (53.39%)	268 (53.3%)	25 (3.8%)	9 (1.3%)
Total	959 (63.09%)	404 (26.57%)	104 (6.8%)	53 (3.4%)

It shows that underweight is more among lower class (IV) 53.3% when compared to higher class (I) i.e., 10% and overweight and obesity are more among class I as 20%, 12.5% when compared to lower class 3.8% and 1.3%. The overall underweight among various socio economic status is 26.57%, overweight 6.8% and obesity is 3.4% (Table 8).Chi- square value 136.14,p < 0.00001, df=3 significant.

IV. Discussion
The present study is undertaken to study the nutritional status among local higher secondary school adolescents of various socioeconomic status. This study was taken up mainly because adolescents form a major proportion of population and the future generations both in terms of physical and mental health as well as health of future families and society are decided based on the health status of the present day teenagers. In India only few studies have been undertaken on adolescents to determine the causes of illness and even far less is known about the local adolescent population, hence the present study has been conducted.

Our study is similar to Dambhare DG et al 2010 (10), study is conducted among school going peri urban adolescents in Wardha, wasting and stunting were assessed as per WHO criteria. Wasting in boys and girls 75%, 25% and in early adolescents and late adolescents 73.3% and 26.7%, boys are having more wasting compared to girls and early adolescents are having more wasting. Our study shows among boys and girls wasting is 47.42%, 41.09% and among early and middle adolescents 41.06% and 38.2%, boys are having more

wasting compared to girls and early adolescents are having more wasting then late adolescents. Wasting is less in our study compared to the Dambhare DG et al may be due to they have used WHO criteria and we have used IAP 2007 criteria. Stunting among boys and girls 72.5%, 27.5% among early and late adolescents 67.5% and 32.5% compared to our study boys and girls 48.9%, 60.30% and early and middle adolescents 61.05% and 48.09%. Stunting is more in boys compared to girls in Dhamber DG (10), study but in our study girls are having more stunting compared to boys. Early adolescents are having more stunting compared to middle and late in both studies.

In comparison to our study Sanjay Mandot et al 2009 (11) – Nutritional status of Tribal (Garasiah) school children of Sirohi District, Rajasthan, study conducted in schools of tribal children, 5-16yrs of age, study shows height for age (stunting) 44% among boys and 46.9% among girls (WHO reference value), underweight among boys 69.7% and girls 59.3% (BMI 50th percentile of WHO). In our study stunting among boys is 48.9% and girls 60.30% (IAP BMI Chart 2007) and underweight is 24.9% in girls and 19.50%. The higher incidence of under nutrition in the above study might be due to Tribal children with poor nutrition and different criteria in assessing the stunting.

The study comparable to Pande P et al 2000 (12), CMC, Luthiana, Punjab, study among school children of 5-16yrs of age shows wasting of 52.2%, stunting 26.3%. Both boys and girls are equally affected. In our study wasting in boys is 47.42%, girls 41.09% and overall 44.925% and stunting boys 48.9%, girls 60.30% and overall 54.6% in our study girls are more affected than boys in stunting.

In comparison to K Anand et al 1998 (13), a study was conducted on Nutritional status of adolescent school children in Rural North India. Study was conducted in Govt senior secondary schools in Village, Chandawli of Faridabad District in Harayana among students of class VI to XII, total children were taken into consideration were 494 students and 60% of total children were from village Chandwli and rest from nearby villages. In boys – prevalence of stunting shows a declining trend from 56% at 12yrs of age to 25% at 17yrs. If Indian norms are used the prevalence of stunting comes down from 33% at 12yrs to 20% at 18yrs. The prevalence of stunting drops down sharply at 14yrs of age. Prevalence of thinness as per NCHS in boys it varies between 31 – 52% and in girls 40-59%. Prevalence of stunting among 12-18yrs – 37.2% among girls, 41% among boys with overall prevalence of 38.5%. our study shows stunting among boys 48.9% and girls 60.30% and underweight boys 31.50% and girls 23.81% with overall 26.5% (IAP BMI Chart 2007). The results are comparable to the above study.

Our study is comparable with Muni Sushmitha et al (2009) (14), this study in girls in Social welfare hostels of Nellore, AP shows stunting 13.3%, underweight 46.7%. In comparison to our study stunting is 62.45% and underweight is 33.33% in middle and low class. The lower incidence of underweight in the study group might be due to social welfare hostel girls belong to very poor in socio economic status and poor nutrition in hostels.

Our study is comparable to G.K.Medhi et al (15), Assam 2006, Nutritional status of adolescents among Tea garden workers of boys and girls aged 10-18yrs, study is conducted by house to house visit. Study shows stunting among boys 47.4% (NCHS ref) girls 51.9%. This is reduced to 30.92% in boys and 29.12% in girls with Agarwal et al chart (16). Our study shows stunting of 48.9% among boys and among girls 60.30%. Underweight in boys is 59.54% and girls 41.3%, our study shows underweight in boys and girls 24.9%, 19.50% (EHPA), 30.12% and 21.39% according to IAP BMI 2007. In our study in lower class IV underweight is 33.3% as per EHPA and 53.3% as per IAP BMI 2007. Thinness is more among boys compared to girls in that study as 59.5% vs 41.3%. in our study also similar way boys 31% and girls 23.8%. Overweight was detected only in 0.33% but in our study overweight in lower class is 3.7%.

The results of the study are comparable to the study conducted by M. Premnath et al 2009 (17), a mysore childhood study, a study was conducted on the prevalence of obesity, overweight and underweight in the school children aged 5-16yrs from mysore.In this study 139 schools are taken (Private 111, Govt 28). – total 43,152 school children (Boys – 23,527, girls 19,625). In the study 84.2% children are from private schools and 15.8% were from government schools. The prevalence of obesity, overweight and under nutrition were 3.4%, 8.5%, 17.2% when compared to our study 3.3%, 6.3% and 21.44% (EHPA), 3.4%,6.8% and 26.57% (IAP). Prevalence of obesity in boys 3.7%, girls 3.3% and overall 3.4% comparison to our study boys 4.62%, girls 3.1% and overall 3.4% (IAP). Overweight boys – 8.8%, 8.2% and average 8.5% in comparison to our study boys 6.59%, girls 6.9% and average (6.9%) (IAP). Underweight boys 17.1%, girls 16.2%, average 17.2% in comparison to our study underweight in boys is 31.50%, girls 23.8%, average 26.50% (IAP). This difference of less underweight in the above study shows might be due to 84.2% children is from private schools in mysore study and in our study adolescents of various socio-economic status present from both Government and Private schools.

Our study is comparable to Shah C et al (2008) (18) bhavnagar, assessment of obesity in school children, the study group of 12yrs old school going students of a sample 54, male – 24, female – 30. BMI is assessed by Agarwal KN et al (16), IAP 2001, the study shows underweight among boys and girls 70.83%,

70.00% total 70.37%, overweight among boys and girls 4.16%, 13.33% total 9.25%, obesity among boys and girls 8.32% and 3.33% and total 5.55%. In comparison to our study which is done by IAP BMI Modified 2007 chart shows underweight among 12yrs aged shows boys and girls 34%, 24.2% total 29%, overweight among boys and girls 4% and 4.1% total 4.05%, obesity among boys and girls 2% and 3.7%, overall 2.85%. The cause for underweight which is more in Shah C et al is might be due to pubertal spurt and more number of working mothers in that study group (affluent) but in our study it is done among various socioeconomic status school going children among Government and Private schools. Similar study Bidhan Kanti das et al 2009 (19), a study conducted on prevalence of under nutrition among Telega adolescents cross sectional study conducted among Telegas, an endogenous population of Kharagpur town, West Bengal, Telugu speaking migrant population from East Godavari, Vishakapatnam and Srikakulam etc., Study group is 5-20yrs. Prevalence of under nutrition based on BMI, overall prevalence of under nutrition is 28.60%, boys – 37.59%, girls 19.43%. In our study boys 31.50%, girls 23.81% (IAP 2007) which is comparable with the other study. In both the studies underweight is more among boys than girls.

In comparison to our study Kaushik Bose et al 2004 (20), Nutritional status of adolescents Bengali boys of Urban area – study done among 10-16yrs school going children in urban area within the north dum dum municipality. Study shows underweight as per BMI (WHO) – 37.65%, under nutrition at 16yrs is 19.3% at 14yrs 53.4%, there was consistent increase in the rate of under nutrition for 10 (36.5%) to 14yrs (53.4%). Thereafter, there was a study decline at age 16yrs (19.3%). In our study as per IAP BMI Chart underweight is 21.44%, in our study also there was consistent increase in the rate of under nutrition from 10 to 14yrs and later decreased. The difference in underweight is due to the study used WHO charts and belong to urban area, whereas in our study, study group belong to various socioeconomic status and used Indian reference charts.

In comparison to our study Supreet Kaur et al (2008) (21), prevalence of underweight, overweight and obesity in school children in Delhi India, study is among 5-18yrs school going children belong to lower, middle and high income group. This study shows obesity and overweight among lower socioeconomic group is 0.1% and 2.7% in comparison to our study 1.5 and 3.7% (EHPA). Obesity and overweight among middle socio economic group is 0.6%, 6.5% in comparison to our study 4.72 and 8.1%. Obesity and overweight in higher socio economic group 6.8%, 15.3% in comparison to our study 10% and 17.5%, Overweight is comparable in both the studies but obesity is comparatively high in our study. This shows that overweight and obesity are more in higher socioeconomic class children and shows the increasing trend of obesity in adolescents.

In Comparison to our study B Mohanty et al 2008 (22), Pondicherry in a study, the prevalence of overweight and obesity in children of pondicherry. This study shows overweight and obesity among urban area 7.4% and in rural area 0.4%. In our study overweight and obesity is 9.6%, among government schools it is 6% and private schools 9.6% it shows increasing trend of overweight and obesity in adolescents.

Our study is comparable to MKC Nair et al 2009 (23), Nutrition foundation of India, Thiruvanathapuram District. A study is conducted by child development centre on 3339 adolescent school going girls between 13-15yrs of age in Thiruvanathapuram district have shown overweight prevalence of 7.5% (NCHS) and 9.2% as per Indian Standards KN Agarwal, our study shows overweight as per EHPA – 6.3% and IAP BMI - 6.8%.

The results are in comparison to A.N. Kanade et al (1999) (24), A study was conducted under nutrition and adolescent growth among rural Indian boys in Pune study group is 8 – 18yrs of age, adolescent boys in 7 different villages, 30-40kms from the pune (Rural community). In this study under nutrition is more than 70% (NCHS criteria) much higher than our study (24.9%) , this difference might be due to that, they have done the study in& around slums of Pune & the difference in in usage of charts(our study IAP 2007)

Our study is comparable to Ramachandran et al 2000 (25), Chennai, this study was conducted among school going children (affluent and non affluent children in Chennai) overweight and obesity in affluent children is 22% and in non affluent 4.5%. In our study in class I socioeconomic group children, overweight and obesity are 27.5% (EHPA) and in class IV (lower socioeconomic group) overweight and obesity are 5.2%. the results are comparable and shows the increasing trend of overweight an obesity in higher class.

In comparison to Kapil U et al 2002 (26), a study was conducted in Delhi affluent children, showed a prevalence of overweight 31%, obesity 7.5%, in our study in upper class overweight is 17.5% (EHPA), obesity 10%. In private schools overweight is 8.8% and obesity 6% the above study shows much higher results of overweight and obesity.

In comparison to Y Kaniria et al (2006) (27) study was conducted in school aged children 12-17yrs in Rajasthan Udaypur City. Among two groups, group I (affluent) overweight and obesity are 4.85% and 3.73% among non affluent group overweight and obesity are 1.6% and 0%. In our study in Private schools overweight and obesity are 8.8% and 4.6% (EHPA) and in Government Schools overweight and obesity 4.6% and 1.4% (EHPA). In our study in both classes the incidence of overweight and obesity are in increasing trend.

In comparison to Aparajitha Das Gupta et al (2010) (28) – a study was conducted among 10-19yrs old adolescents in Kolkatta urban slums study shows underweight of 47.93%, our study shows underweight of 26.47% (IAP) but in lower class (Class IV) shows underweight of 53.3%, so it correlates with the above study.

V. Conclusion

Adolescence is a flexible period when interventional programmes have maximal effectiveness. The major causes of morbidity during adolescence are more due to preventable causes. Most of the studies show high incidence of malnutrition in adolescents. Significant proportions are affected by medical conditions, nutritional deficiencies and substance abuse and the need for remedial measures in openly evident. Hence, regular health surveillance, accessible adolescent's health services should be provided by upgrading school / college health care system as well as establishing adolescent clinics at community level. Health education should be a part of these programmes for awareness in matters of healthy eating habits, life style, sexuality issues and substance abuse.

Investing in young people will yield large return for generation to come. Failing to act on other hand, may result in tremendous costs to individuals, society and the world.

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