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B.M.I VARIATIONS IN ADOLESCENT CHILDREN URBAN VERSUS RURAL &MALE VERSUS FEMALE

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ABSTRACT
Achievement of optimum growth during this period is of utmost importance in maintaining good health thereafter. WHO recommends the use of BMI for growth monitoring in adolescents in the community setup. Reports of nutritional status of adolescents from different parts of India are published periodically by different authors. Present study is undertaken to enrich the scanty information that is available about the nutritional status of children in our surrounding areas.

OBJECTIVES:
1. To study the nutritional status of school children in urban and rural schools in coastal Andhra Pradesh.
2. To identify prevalence of under-nutrition and obesity based on BMI status of children
3. To observe any differences based on urban or rural setups and sex differences.

MATERIAL AND METHODS:
Study Design: A cross sectional observational study
Study Period: From October 2018 to June 2019
Study Area: Urban and rural schools in West Godavari District of Andhra Pradesh
RESULTS:
1. The prevalence of under-nutrition is more in rural areas compared to the urban areas and the difference is found to be statistically significant
2. The prevalence of under-nutrition significantly higher in males in both urban and rural areas
3. The prevalence of severe under-nutrition is seen males, both in rural and urban areas though the difference is not statistically significant.
4. More girls in both rural and urban areas are found to have BMI >18.5 compared to males, but the difference is found to not be statistically significant

CONCLUSION: The prevalence of under nutrition (BMI value of <18.5) is found to be more in rural areas compared to urban areas from our study and the difference is found to be statistically significant. Urban adolescents of Coastal Andhra have moderate rates of under-nutrition (42%). There is a clear pattern found where urban boys are more prone for under-nutrition than urban girls (56% vs 44%). The prevalence of under nutrition as defined as a BMI value of < 18.5 is found to be significantly higher in males in both urban and rural setups. (p < 0.005). The prevalence of obesity (BMI above 25) is found to be of 5.8% with equal sex distribution.

KEYWORDS : Body Mass Index (BMI), Malnutrition, Under-nutrition, Obesity, Urban, Rural, Severe malnutrition

INTRODUCTION

The period of adolescence is a crucial phase of growth and offers the last chance of catch-up growth. Achievement of optimum growth during this period is of utmost importance in maintaining good health thereafter. Growth monitoring by anthropometric measurement during this period is an important health indicator and predictor of various morbidity conditions in the community.

Body mass index (BMI) is a measure of nutritional status. A WHO Expert Committee recommends the use of BMI in the community and the use of the 'National Center for Health Statistics' (NCHS) references till local references are developed. BMI centiles lines rise from 6 years onwards and continue through adolescence. Malnutrition 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 effect on the growth, development and physical fitness of a person. It is well recognized worldwide that anthropometric measurements are indispensable in diagnosing undernutrition.[12] Several recent studies have investigated nutritional status of adolescents from different parts of India. However, there is scanty information on the nutritional status of adolescents from semi urban coastal Andhra Pradesh. The present investigation was attempted to evaluate the overall prevalence of under nutrition and to assess age-sex trends in the level of under nutrition among 11-14yearold adolescents of coastal Andhra and also to find the trend of malnutrition in children of rural and urban backgrounds.

REVIEW OF LITERATURE:

In a study in Varanasi by Seema Chowdary, C.P. Mishra and K.P. Shukla in 2003 68.52% girls are undernourished as per WHO and Asian criteria (BMI <18.5)[1]

Benefits of various nutrition programmes have not been so profound particularly in case of girl child. It is now realized that nutritional insult at earlier ages leaves their mark during adolescence. Pubertal spurt, rapid physical growth do take place during this period and therefore nutritional requirements are quite different. In adolescent girls psychosocial and emotional problems are of considerable magnitude and they may exert significant influence on their nutritional status. Although genetic codes set the upper limit of optimum growth, the environment in which they thrive can help or hinder realization of that goal. During adolescence, gender based discrimination prevails in various ways viz. selective nutritional neglect of girls, differential investment or expenditure on health care, educational opportunities and work force participation. Unfortunately, assessment of nutritional status of adolescent girls has been the least explored area of research particularly in rural India. The findings of studies on school children (girls) cannot be extrapolated to adolescent girls, as their school enrollment as well as sustenance are less than that of boys. It is likely that girls not attending schools belonged to disadvantaged section of society and contribute significantly in domestic and peri-domestic activities, there by jeopardizing their health. With this background this community-based study was undertaken to assess the nutritional status of adolescent rural girls of Varanasi district.[14]

Prevalence of malnutrition in rural adolescent girls ranged from 50-72% and thus taking a middle course a prevalence rate of 60% was assumed. A considerable proportion of adolescent girls had clinically obvious nutritional deficiency diseases. Two third of study subjects were undernourished (BMI <18.5 kg/m^2); nearly one third experiencing Chronic Energy Deficit (CED) grade III (BMI < 16).

The dramatic rise in the prevalence of obesity in European countries and the USA has become a major health concern. Childhood obesity is linked to obesity in adulthood and furthermore it is associated with increased mortality, coronary heart disease, hypertension, dyslipidemia and diabetes mellitus. Thus, the importance of achieving a reliable and accurate estimate of body fatness is essential not only for the prevention but also for the treatment of overweight in children and adolescents. Hence we included the study of high BMI also in our project to detect not only the under nutrition but also the prevalence of over nutrition.

A study was conducted from Dayanand Medical College, Ludhiana to determine the prevalence of obesity among adolescents belonging to well-to-do families there. They reported the prevalence of obesity and overweight as 3.4% and 12.7%, respectively in affluent adolescents from Ludhiana, Punjab.[2] Punjab is an economically advanced State of the country with high per capita income and Ludhiana, an industrial city has a large population of affluent families who are exposed to a modern life style.[2] Children belonging to High schools / Senior Secondary classes are particularly vulnerable to external factors owing to newfound independence and the influence through peer pressure and exposure to media.

In a study conducted by Department of Community Medicine, Mahatma Gandhi Institute of Medical Sciences, Sewagram, Wardha, India the researchers reported a majority (53.8%) of the adolescents in this study area are thin and only 2.2% were overweight.[3]

The prevalence of overweight among US children and adolescents increased between 1980 and 2004.[4]

In a study conducted by Kamla-Raj 2005 J. Hum. Ecolamong adolescents of Kolkata, more than one third (36.49%) of the urban Bengali adolescents were found to be undernourished.[5]

AIMS AND OBJECTIVES:
To study the nutritional status of school children, a high school based cross sectional study covering 1258 students from different schools, from both urban and rural background from coastal Andhra Pradesh.

An observational study is planned. The nutritional status is evaluated based on BMI estimation.

MATERIALS AND METHODS
The present study was carried out during the period **from October 2018 to June 2019**

Selection of study subjects:
[A] Two Rural Blocks were selected from nearby villages District by simple random sampling;
[B] Cities of Eluru and Vijayawada –were selected as urban sources.

Necessary approvals were obtained from the school authorities prior to the commencement of the study. Authentication of age and ethnicity were prepared from the school records. The students belonged to mixed socioeconomic strata.

A total of 1258 students (716 boys and 542 girls) aged between 11 and 14 years participated in the present study. The study was cross-sectional in nature and the subjects were selected through random sampling procedure.

Then using the standard techniques recommended, weight and height of all the children were noted with same instruments for uniformity. The medical students helped in the process of taking measurements of the children.

Body mass index (BMI)[8] was computed using the standard equation: $BMI\,(kg/m^2) = Weight\,(kg)/Height^2\,(m)$.

Nutritional status was evaluated using the World Health Organization (WHO, 1995) recommended age and sex specific cut-off points of BMI based on the National Health and Nutrition Examination Survey (NHANES I)percentile values (WHO, 1985).[11]

Under nutrition was defined as BMI < 5th percentile values of NHANES I. This cut-off point has been utilized by several recent studies worldwide on under nutrition among adolescents. The measurement of height and body weight of each student was recorded by following the standard techniques and body mass index calculated.

The international cuts off points for the body mass index were used; BMI ≥95th percentile for age and sex was considered as obese BMI ≥85th percentile was considered as overweight.

Data, thus generated, were analyzed with the help of personal computer using *MS Excel* and *MS Access* software.

Nutritional status of study subjects was assessed by using various parameters viz. weight for age, height for age, and Body Mass Index

(BMI). Relevance of these parameters was examined against available reference values viz. 50th Centile of NCHS[7] for weight for age and height for age. BMI of each study subject was computed by using the formula weight (kg)/ height[2] (m).

OBSERVATIONS AND RESULTS: -
The study population comprised of 534 students from urban and 724 from rural area respectively. These students were selected from total of nearly 3200 students using random sampling method.

Here are the details of the analysis.

Sample Size: **1258**
Urban: 534 (57.55%) ,
Rural: 727 (42.0%)

Sex Ratio of the sample children:
Male: 726 (57%)
Female: 542 (43%)
Total: 1258

Sex Ratio of the sample children – with reference to Urban and Rural School background:
Table 1)

	Sex	Nos.	%
Urban	Male	300	43.8
	Female	234	56.2
Rural	Male	308	57.5
	Female	416	42.5

BMI Status of all the students: -
Above 18.5: 547 (43.48%)
Less than 18.5 : 711 (56.52%)

BMI < 18.5: Male / Female ratio:
Males: 430 (60.5%)
Females: 281 (39.5%)

BMI < 18.5: Urban / Rural ratio:
Urban: 226 (32%)
Rural: 485 (68%)

Table II) BMI Status by Urban / Rural: -

BMI	Urban	Rural	Total
<18.5	226	485	711
>18.5	308	239	547
	534	724	1258

$(\chi2 = 76.09, p < 0.0001)$

The prevalence of under nutrition (BMI <18.5) is found to be more in rural areas compared to the urban areas and the difference is found to be statistically significant

Table III) BMI Status by Urban / Rural and Male /Female:-

BMI <18.5	Urban	Rural	Total
Male	154	276	430
Female	72	209	281
	226	485	711

$(\chi2 = 7.677, p < 0.005)$

The prevalence of under nutrition (BMI <18.5) significantly higher in males in both urban and rural areas

BMI above 18.5: Total = 547
Males: 286 (52.29%)
Females: 261 (47.71%)

Table. IV) BMI Status evaluation: -

BMI <18.5	Urban	Rural	Total
Male	286	140	426
Female	261	99	360
	547	239	786

$(\chi2 = 2.65, p > 0.05)$

More girls in both rural and urban areas are found to have BMI >18.5

compared to males, but the difference is found to not be statistically significant

BMI above 25:
Total no. of students with BMI above 25 = 73 (5.8 %) and their distribution sex wise is almost equal. i.e. 2. 9 % each in male and female categories.

BMI Status of 534 students from Urban Schools: -
Total Urban Students = 534
Urban students with BMI < 18.5 = 226 (42.32%)
Urban students with BMI > 18.5 = 308 (57.68%)

BMI Status of 724 students from Rural Schools:
Total Rural Students = 724
Rural students with BMI < 18.5 = 485 (67%)
Rural students with BMI > 18.5 = 239 (33%)

Urban School Students with BMI < 18.5:
Total Urban students with BMI < 18.5 = 226
Urban Male students with BMI < 18.5 = 154 (68.14%)
Urban Female students with BMI < 18.5 = 72 (31.86%)

Rural School Students with BMI Above 18.5:-
Total Rural students with BMI > 18.5 = 239
Rural Male students with BMI > 18.5 = 140 (59.86%)
Rural Female students with BMI > 18.5 = 99 (40.14%)

Rural School Students with BMI below 18.5: -
Total Rural students with BMI < 18.5 = 485
Rural Male students with BMI < 18.5 = 276 (56.58%)
Rural Female students with BMI < 18.5 = 209 (43.42%)

**Obesity :- BMI above 95th Percentile Urban - Rural Distribution**
Total students with BMI above 95th percentile = 73
Urban students with BMI above 95th percentile = 42 (57.53%)
Rural students with BMI above 95th percentile = 31 (42.47%)

Obesity: - BMI above 95th Percentile – Sex Distribution
Total students with BMI above 95th percentile = 73
Male students with BMI above 95th percentile = 37 (50.68%)
Female students with BMI above 95th percentile = 36 (49.32%)

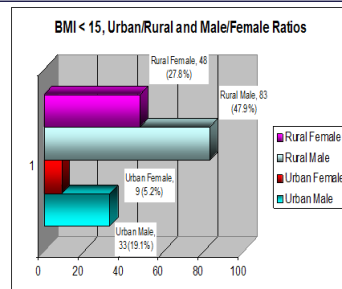**Table V. Extreme Malnutrition: (BMI <15) by Residence and Sex:**

BMI < 5th Percentile	(N=173)	N	%
	Male	116	66%
	Female	57	33%
	Urban	42	24.3%
	Rural	131	75.7%
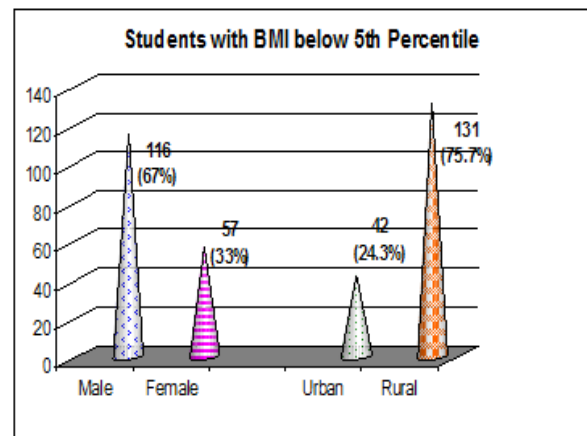
Fig 1

Table VI) BMI <15: Urban / Rural and Male / Female Ratios:

BMI < 15 (N = 173)		Nos	%
	Urban Male	33	19.1
	Urban Female	9	5.2
	Rural Male	83	47.9
	Rural Female	48	27.8

Fig 2

Table VII) Distribution of Extreme Malnutrition: -

BMI <15	Urban	Rural	Total
Male	33	83	116
Female	9	48	57
	42	131	173

$(\chi2 = 3.33, p > 0.0)$

The prevalence of severe under nutrition (BMI <15) is found to be more in males in Both rural and urban areas though the difference is not statistically significant

DISCUSSION:
Adolescence is a period of increased nutritional requirements and adolescent anthropometry varies significantly worldwide (WHO, 1995; Himes and Bouchard,1989)[23]. Under nutrition is a documented public health problem contributing substantially to children's survival (Rahmathullahet al., 1990)[22].Therefore, there is a need to develop a database of adolescent under nutrition from different parts of the country. As per Proposed Asian and Previous WHO criteria, 68.52% adolescent girls were under weight (BMI < 18.5)[1].There is scanty information on the nutritional status of adolescents of Andhra Pradesh. The mean height, weight and BMI of the Andhra boys and girls of this study were higher than those reported among rural adolescents in a recent study from India (Venkaiah et al., 2002)[15].In the present investigation we found that 56.5% of children studied come under the category of under nutrition. This figure of nearly 57% (BMI < 18.5) is higher to those among Nepali refugees reported by Woodruff et al. 1999 (34%)[19] and markedly higher than those observed among rural African adolescents reported by Kurz 1996 (23%)[21]. However, the rate of under nutrition of the present study is quite similar to those of rural Nepalese (36%, Kurz1996)[21] but similar to those reported in one Indian study (53%, Kurz 1996)[21] and two Kenyan investigations, i.e. 61% (Cookson et al., 1998) and 57% (Woodruff et al., 1998).[20]Considering sex variation, the rate of under nutrition among adolescent boys of the present study(60.5%) is distinctively higher than the Indian study of urban boys of Kolkata (50.50%) studied by de Onis et al. (2001)[7]and lower than another study among rural boys of nine provinces of India (67%) reported by Venkaiah et al. (2002)[15]. The same is remarkably lower than those of Kenyan refugees (75%) reported by International Rescue Committee (1997). On the other hand, the rate of under nutrition among adolescent girls of the present sample (39.5%) demonstrated a significantly higher rate of under nutrition compared to Bangladeshi girls (16%) studied by Ahmed et al. (1998), but lower than Kenyan refugee girls (55%) and equal to the rural Indian girls (40%) reported by IRC (1997) and Venkaiah et al. (2002) respectively[15].

OBESITY in childhood is associated with an increased incidence of hypertension, diabetes, coronary artery disease, osteoarthritis and overall increase in morbidity and mortality during adult life[13]. There is increasing evidence that children and adolescents of affluent families are overweight; possibly because of decreased physical activities, sedentary lifestyles, altered eating patterns and increased fat content of the diet. BMI is used widely as an indicator of the risk of overweight and of presence of overweight, because of the relative ease and accuracy of the basic measurement.

Overweight and obesity together constitute 4.3 per cent in the study conducted by D.R. Bharati, P.R. Deshmukh & B.S. Garg in Wardha[16]whereas in our study we found that prevalence of obesity to the tune of 5.8 %.Ramchandran et al[14] reported it to be 4.5 per cent in low income schools and 22 per cent in better-off schools of Chennai.[17] Prevalence of overweight and obesity in affluent adolescent school girls in Bangalore according to CDC BMI-for-age criteria was found to be 13.1% and 5.0% respectively.[18]

CONCLUSIONS:

The following are the conclusions from the present study:

1. The prevalence of under nutrition as defined as a BMI value of < 18.5 is found to be more in rural areas compared to urban areas from our study and the difference is found to be statistically significant (p< 0.0001)

2. Urban adolescents of coastal Andhra have moderate rates of under nutrition that is around 42 %

3. There is a clear pattern found where urban boys are more prone for under nutrition than urban girls. (56 % *vs* 44%). The prevalence of under nutrition as defined as a BMI value of < 18.5 is found to be significantly higher in males in both urban and rural setups. (p< 0.005)

4. These rates of under nutrition of the present study are higher than some of the studies from other developing countries in case of boys but equivocal in girls with reference to earlier findings.

5. The prevalence of obesity (BMI above 25) is found to be of 5.8% with equal sex distribution.

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