SURVEY ON THE ASSESSMENT OF BMI AND ITS ASSOCIATION WITH MALNUTRITION AMONG RURAL PRESCHOOL AND PRIMARY SCHOOL CHILDREN IN DISTRICT HARDOI, UTTAR PRADESH, INDIA

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ABSTRACT

Malnutrition is a major health problem among rural children in developing countries such as India. Nutrition plays a vital role in the growth and development of children in early childhood. The present study aimed to analyze the trends in the growth pattern of both boys and girls among preschool and primary school children groups in rural areas using body mass index (BMI). A total of 486 children (aged 2-8 years) were examined of which 230 were preschool children aged 2-4 years and 256 were primary school children aged 5-8 years. Out of 230 preschool children, 21.74% were underweight, 67.83% normal and 10.43% overweight while obesity was not reported. Out of 256 children of primary school, 33.59% were underweight, 52.35% normal, 11.72% overweight and 2.34% obese. Prevalence of underweight was found the highest 33.59% in primary school children while preschool children were found to be relatively healthier with 67.83%. The average BMI of preschool children exceeded the national standards of the WHO (16.1) while average BMI of primary school children was almost same with WHO norms. Findings of the study also supports the need of proper and honest implementation of Mid-Day Meal Scheme in primary schools.

Key Words: *Body Mass Index, Malnutrition, Underweight, Overweight, Obesity, Preschool, Primary School, Rural.*

INTRODUCTION

The nutritional status of an individual refers to his/her health as indicated by the quality of nutrients consumed and the body's ability to utilize them for its metabolic needs. World Health Organization (WHO) believes that the ultimate objective of nutritional assessment is overall improvement in the quality of human health (Beghin *et al.*, 1988). Malnutrition is widely recognized as a major health problem among rural children in developing countries

such as India. According to FAO Report "The State of Food Insecurity in the World" (2004), India contributes to about 5.6 million child deaths every year due to undernutrition, more than half of the world's total. According to UNICEF data, 90% of developing world's malnourished children live in Asia and Africa; while 40% of the world's malnourished live in India (UNICEF, 2009). Nutrition plays a vital role in the growth and development of children. Inadequate nutrition may lead to malnutrition, growth retardation, reduced work capacity and poor mental and social development (Manna *et al.*, 2011, Bergman *et al.* 2011). Growing children in particular are the most vulnerable to its consequences (Ahmad, *et al.*, 2011). There are several ways of measuring nutritional status. Anthropometry is one of the most useful tools for assessment of the nutritional status of children and adolescents. The anthropometric measurements which are commonly used to assess nutritional status during childhood stages are height-for-age (stunting), weight-for-height (wasting), weight-for-age (underweight) and thinness (Body Mass Index (BMI)-for-age). Body mass index (BMI) is the ratio of an individual's weight to height squared. It is the most commonly used sensitive, specific, reliable screening tool to identify individual who are potentially at risk for weight related health problems. Body mass index (BMI) is commonly used to quantify anthropometrics in identification of children at risk due to its simplicity (Bose *et al.*, 2007). The problem of undernutrition is higher in rural areas compared to urban areas (Smith *et al.*, 2006). The condition of being underweight may have resulted from low dietary intake, excessive workout and chronic infections (Ramzan *et al.*, 2008). Early developmental opportunities establish a critical foundation for children's academic success, health and general well-being (Van Landeghem *et al.*, 2002). Keeping this in view, the present study was conducted under the National Service Scheme, Uttar Pradesh (a) To access the body mass index, (b) To assess the nutritional status of rural preschool and primary school children in terms of body mass index, (c) To compare the body mass index and the nutritional status between preschool and primary school children in rural areas of district Hardoi, Uttar Pradesh.

MATERIAL AND METHODS

Study design and Settings

Anthropometric surveys were conducted under the National Service Scheme, Uttar Pradesh by NSS volunteers of Government Degree College Pihani, Hardoi with the help of ASHA workers. This was a community and school-based, cross-sectional study carried out over a period of six months, from August 2019 to January 2020. Ten primary schools and their neighboring communities (villages) were selected to collect primary data by simple random technique. The present study was carried out among preschool children aged 2-4 years and primary school children aged 5-8 years who were belonging to rural areas under Pihani block of district Hardoi, Uttar Pradesh. Preschool children were watched over under the Integrated Child Development Scheme (ICDS). The ICDS was launched by the Government of India on 2nd of October 1975. This scheme now includes preschool children, pregnant and lactating mothers and women in the age group of 15 years to 44 years and is the largest national program for promotion and development of health of mother and child (Tigga *et al*., 2015). All the children were free from physical deformities and were not suffering from any illness

or diseases at the time of data collection. The objectives of the study were explained to either parent of the children as well as the principals of primary schools and an informed consent was obtained from them. Height and weight were taken to compute the BMI and graded as per WHO guidelines given below.

$$\text{Formula} = \text{weight (kg)}/\text{height (m)}^2$$

Table 1: Classification of BMI.

Classification	BMI (kg/m2)
Underweight	< 18.50
Normal weight	18.50 - 24.99
Overweight	25.00 - 29.99
Obese	≥ 30.00

Source: BMI chart adopted from the WHO report, 2006.

Variables

Age group: 2-4 years (Preschool Children) and 5-8 years (Primary School Children)
Gender: Male and female.

Statistical tools

Percentage and ANOVA have been computed. The software used to compute the statistical data is SPSS, Windows version 21.0.

RESULTS

A total of 486 children (aged 2-8 years) were examined of which 230 were preschool children aged 2-4 years and 256 were primary school children aged 5-8 years. Out of 230 preschool children, 122 were boys and 108 were girls. On the other hand, out of 256 primary school children, 135 were boys and 121 were girls as given in table 2.

Table 2: Gender and age wise distribution of sample.

Group (Age)	Gender	N	%
Preschool Children	Boys	**122**	**53.04 %**
(2-4 years)	**Girls**	108	46.96%
Primary school children	**Boys**	135	52.73%
(5-8 years)	**Girls**	121	47.27%

Preschool Children:

The age and gender-specific nutritional status among preschool children are shown in Table 3. Among boys, overall mean ± SD of age, height, weight, and BMI were 3.56 ± 1.02 years, 85.91 ± 9.37 cm, 14.12 ± 3.46 kg and 21.16 ± 1.62 kg/m^2, while, among girls, these respective values were 3.24 ± 0.95 years, 78.18 ± 8.41 cm, 12.59 ± 2.85 kg and 19.86 ± 1.37 kg/m^2. Among preschool girls, mean height, weight and BMI exhibited a decreasing trend which was lower than that shown by boys. According to BMI for age, out of 108 girls 28.70% were underweight, 62.96% normal and 8.34% overweight, while out of 122 boys 15.57% were underweight, 72.13% normal and 12.30% overweight. Overall out of 230 preschool children, 21.74% were underweight, 67.83% normal and 10.43% overweight while

obesity was not reported among boys and girls in rural areas. The study clearly showed that malnutrition was higher among girls in compare with boys of same group.

Table 3: Descriptive statistics (mean ± SD) of age, gender and anthropometric variables related to nutritional status of preschool children.

Variables	N	Boys	Girls	Total
Age	230	3.56 ± 1.02	3.24 ± 0.95	3.40 ± 0.99
Height	230	85.91 ± 9.37	78.18 ± 8.41	82.05 ± 8.89
Weight	230	14.12 ± 3.46	12.59 ± 2.85	13.34 ± 3.16
BMI	230	21.16 ± 1.62	19.86 ± 1.37	20.51 ± 1.50

Primary School Children:

The age and gender-specific nutritional status among primary school children are shown in Table 4. Among boys, overall mean ± SD of age, height, weight, and BMI were 6.24 ± 1.35 years, 112.34 ± 10.23 cm, 24.03 ± 4.14 kg and 19.26 ± 1.45 kg/m^2, while, among girls, these respective values were 6.52 ± 1.26 years, 114.15 ± 9.67 cm, 25.58 ± 4.65 kg and 18.36 ± 2.12 kg/m^2. Among girls of primary school, mean height and weight exhibited an increasing trend except in case of BMI which was lower than that shown by boys. According to BMI for age, out of 121 girls 38.02% were underweight, 50.42% normal, 9.91% overweight and 1.65% obese, while out of 135 boys 29.62% were underweight, 54.08% normal, 13.34% overweight and 2.96% obese. Overall out of 256 children of primary school, 33.59% were underweight, 52.35% normal, 11.72% overweight and 2.34% obese. Results of the study showed a mark of concern to note that malnutrition was a bigger problem among girls of primary school in compare with boys.

Table 4: Descriptive statistics (mean ± SD) of age, gender and anthropometric variables related to nutritional status of primary school children.

Variables	N	Boys	Girls	Total
Age	256	6.24 ± 1.35	6.52 ± 1.26	6.38 ± 1.31
Height	256	112.34 ± 10.23	114.15 ± 9.67	113.25 ± 9.95
Weight	256	24.03 ± 4.14	25.58 ± 4.65	24.81 ± 4.40
BMI	256	19.26 ± 1.45	18.36 ± 2.12	18.81 ± 1.79

Table 5: Age wise comparison of BMI grades.

BMI grades (kg/m^2)	Preschool Children (2-4 years) N=230 %	Primary school children (5-8 years) N=256 %	Total N=486 %
Underweight < 18.50	21.74	**33.59**	27.98
Normal weight 18.50 - 24.99	**67.83**	52.35	59.67
Overweight 25.00 - 29.99	10.43	11.72	11.11
Obese > 30.00	-	2.34	1.24

Table 5 shows 33.59% children of primary school were underweight that was higher than preschool children (21.74%) while negligible percentages of children were overweight and obese in both groups.

Table 9: Gender wise comparison of mean BMI between boys and girls using ANOVA.

Group (Age)	Gender	BMI (mean ± SD)	P
Preschool Children (2-4 years)	Boys	21.16 ± 1.6	0.0001 S*
	Girls	19.86 ± 1.37	
Primary school children (5-8 years)	Boys	19.26 ± 1.45	0.0001 S*
	Girls	18.36 ± 2.12	

S*-Significant

The mean BMI value of 21.16 and 19.86 shows that the boys average BMI value exceeds that of girls in preschool children aged 2-4 years. Similarly the mean BMI value of 19.26 and 18.36 shows same result in primary school children aged 5-8 years. The p value 0.0001 of both age groups indicates that there is a significant difference between boys and girls in their mean BMI values. The p value (0.0025) of preschool vs primary school children shows that there is a significant relationship between age and BMI in the age range of 2-4 vs 5-8 years.

DISCUSSION

An anthropometric study was carried out among 230 preschool children and 256 primary school children with age groups 2-4 years and 5-8 years respectively to understand the BMI profile in rural area of district Hardoi, Uttar Pradesh.

Prevalence of underweight was found highest 33.59% in primary school children. Preschool children were found to be relatively healthier with 67.83% due to proper and regular health camps by ASHA workers under the Integrated Child Development Scheme (ICDS). The results reported overweight to be prevalent among 10.43% of preschool and 11.72% of primary school children while obesity among 2.34% of only primary school children. Previous study carried out in Kochi, Kerala and Chennai, Adyar, Tamil Nadu in India, also validates present finding for the prevalence of obesity as 2.96% among boys and 1.65% among girls. The gender difference in BMI was found to be significant as denoted by the p value 0.0001 likewise the p value 0.0025 indicated a significant relation between age and BMI. Age was more significantly related within the age group of 2-4 vs 5-8. This indicates that BMI progresses as a continuum form childhood. Another interesting finding from present study was that the average BMI of preschool children (20.51± 1.50) exceeded the national standards of the WHO (16.1) while average BMI of primary school children (18.81 ± 1.79) was almost same with the national standards of the WHO (19.0). But it is a concern to note that the prevalence of malnutrition is higher among primary school children.

CONCLUSION

The present study revealed some new findings which are valuable in understanding the factors related to health during preschool and primary school age of children. High prevalence of underweight in the years of primary school education needs to be looked into, in terms of nutritional spooning. It also indicated that the age and gender has a strong impact on BMI and hence dietary practices need to be tailored accordingly. Malnutrition is thus

found to be a major factor in the child's growth during earlier period of education. The study also supports the need of proper and honest implementation of Mid-Day Meal in primary schools.

LIMITATIONS

The children were screened only through physical examination and not through any clinical investigation during survey. BMI (Body Mass Index) as a screening tool is only an indicator and not a definite report of growth and development analysis.

REFERENCES

- Ahmad, E., Khalil, S. & Khan, Z. (2011): Nutritional status in children (1-5 years): A Rural Study. *Indian Journal of Community Health*, **23(2)**: 84-86.
- Beghin, M. Cap & Dujardin, B. (1988): A Guide to Nutritional Assessment, World Health Organization, Geneva, Switzerland, 1988.
- Bergman, R.N., Stefanovski, D. and Buchanan, T.A. (2011): A better index of body adiposity. *Obesity (Silver Spring)*, **19**: 1083- 1089.
- Bose, K., Bisai, S. and Mukherjee, S. (2007): Anthropometric characteristics and nutritional status of rural school children. *Internet J Biol Anthropol*, **2**: 11-7.
- Food and Agriculture Organization of the United Nation Economic and Social Department, "The State of Food Insecurity in the World, (2004): Monitoring Progress towards the World Food Summit and Millennium Development Goals". Food and Agriculture Organization of the United Nations, p. 8.
- Manna, P.K., De, D., Bera, T.K., Chatterjee, K. and Ghosh, D. (2011): Anthropometric assessment of physical growth and nutritional status among school children of North Bengal. A*nthropologist*, **13**: 299-305.
- Ramzan, M., Ali, I. and Khan, A.S. (2008): Body mass status of school children of Dera Ismail Khan, Pakistan. *J Ayub Med Coll Abbottabad*, **20**: 119-21.
- Smith, L.C., Ruel, M.T. and Ndiaye, A. (2006): Why is child malnutrition lower in urban than rural areas? Evidence from 36 developing countries. *World Dev*, **33**: 1285-305.
- Tigga, P., Sen, J. and Mondal, N. (2015): Association of some socio-economic and socio-demographic variables with wasting among pre-school children of north Bengal, India. *Ethiopian Journal of Health Sciences*, **25(1)**: 63–72.
- United Nations Children's Fund (UNICEF) (2009): Tracking Progress on Child and Maternal Nutrition. A Survival and Development Priority. New York: United Nations Children's Fund (UNICEF).
- Van Landeghem, K., Curgins, D. and Abrams, M. (2002): Reasons and strategies for strengthening childhood development services in the healthcare system. Portland, ME: National Academy for State Health Policy.
- WHO 2010 WHO, The WHO child growth standards, 2006, http://www.who.int/childgrowth/en/.