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Research Article

Assessment of Physical Growth and Nutrition in Indian School-age Children at An Outpatient Department in Sitapur, Uttar Pradesh

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A B S T R A C T

Introduction: A child's physical growth is indicative of his or her nutrition, family finances, health care system's efficacy, community's social health, and environmental factors. The goal of this study was to assess the physical growth and nutrition of Indian school-age children.

Methods: This was a retrospective observational study conducted on school-age children (6 to 12 years) who visited the Outpatient Paediatrics Department of BCM Hospital, Sitapur (UP), India between June 2022 and June 2023. Z-scores for weight-for-age, height-for-age, and BMI-for-age were utilised to characterise nutritional status. Using an unpaired t-test with a 95% confidence interval, differences in the mean weight, height, and BMI between males and females were analysed according to age. Values of $p \leq 0.05$ were considered statistically significant.

Results: During the course of the study, a total of 1399 children (906 male and 493 female) were enrolled. The mean age of the children was 8.6 ± 2.0 years. The mean weight was 25.8 ± 8.7 kg, mean height was 126.6 ± 14.3 cm, and BMI was 15.7 ± 2.8 kg/m^2. Their mean ± SD scores of the weight-for-age, height-for-age, and BMI-for-age were -0.47 ± 1.16, -0.52 ± 1.42, and -0.24 ± 1.15, respectively. Most (83.7%) of the children had normal nutritional status. Wasting (4.7%), stunting (11.2%), underweight (5.7%), overweight (9.2%), and obesity (2.4%) were noted.

Conclusion: Most of the children have normal physical growth and nutrition. Both undernutrition and overnutrition were found in the remaining children.

Keywords: Physical Growth, Nutrition, School-age Children

Introduction

Nutritional status is considered an indicator of the physical and mental development of school-age children. Assessment of physical growth is done to know the child's nutritional status.[1] A child's physical development is an indicator of his/ her family's and community's financial standing, quality of accessible healthcare, and impact of surroundings.[2] Infectious diseases account for more than 70% of under-five mortality. Malnutrition plays a contributory role in more

than 45% of such deaths.[3] Low intelligence, poor academic performance, high school dropout rates, and the onset of chronic health problems later in life are all linked to chronic undernutrition in older children.[2,4] Childhood undernutrition and premature delivery are major contributors to adult-onset diabetes mellitus, high blood pressure, and abnormal lipid profiles. Heart and lung illnesses are among those made more likely by overeating.[5]

In the prevalence of malnutrition, secular and geographical trends have been observed. In both rich and developing nations, the prevalence of childhood overnutrition is rising.[6,7] Food habits have been changed from a balanced diet to energy-dense junk foods. As a consequence of changes in both lifestyle and culture, childhood obesity rates are rising in low- and middle-income countries. The prevalence of undernutrition has reportedly decreased in several nations.[6,8]

This research aims to evaluate the nutrition and physical growth of Indian school children. In order to make strategies to lessen the community's malnutrition burden and to create a foundation for future research, we require an estimate of the prevalence of undernutrition and overnutrition among local school-age children.

Methods

This is a retrospective observational study carried out among 1399 school-age children (6 years to 12 years old) who visited the Outpatient Department of Paediatrics of BCM Hospital, Sitapur (UP), India from June 2022 to June 2023 for routine follow-up, vaccination, or for seeking treatment of a minor illness. The Ethical Committee of the BCM Hospital approved the protocol before the inception of the research. The points and objects of the research were discussed with the parents in an easy local language. Informed consent was taken from the parents in writing.

The age, gender, weight, and height of the studied children were recorded. The Aadhar card issued by the Indian government was used to establish age.

To the closest half kilograms (kg), weight was determined using a mechanical scale (Suvarna, D R Bansal Consumer Products Pvt. Ltd., Jalandhar, Punjab, India). The participants stood on the apparatus wearing minimal clothing and no shoes. Before taking a reading, the machine would reset itself to zero automatically. To verify its accuracy and reliability, it underwent daily quality control testing using a standard item of known mass. The body mass index (BMI) was calculated by dividing weight in kilograms by height in metres squared.[9]

Height was measured in centimetres (cm) with a wall-mounted stadiometer (Rilekh, RLK-65, India Rilekh, India) to the nearest 0.1 cm. The subject was asked to stand tall when his or her height was taken. The weight was distributed equally between the two feet. There was little separation between the heels. The back of his head, his shoulders, his hips, and his heels all touched the wall. The child's head was tilted such that the biauricular plane was horizontal and the Frankfort plane pointed directly ahead. The hair was compressed by maintaining a tight fit of the headpiece. Before each measurement, the instrument was verified to make sure the headpiece and floor were still at 90° to the vertical wall.

Characteristics including weight-for-age, height-for-age, as well as body mass index-for-age were evaluated using the AIIMS 'AnthroCal' smartphone software (based on IAP growth charts 2015). Z-scores were used to quantify these variables. Table 1 provides details regarding the interpretation of these growth parameters.

The statistical work was done using JASP v0.17.2 developed by Jeffreys, who are known for their Amazing Statistics Programme. Quantitative data were described using mean and standard deviation, whereas qualitative data were described using percentages and proportions. Using an unpaired t-test with a 95% confidence interval, we compared the average height, weight, and body mass index of boys and girls of different ages. Values of $p \leq 0.05$ were deemed statistically significant.

Table 1.Interpretation of Growth Parameters

Z-score	Weight-for-age	Height-for-age	BMI-for-age
> 3	-	-	Severely obese
2 < score ≤ 3	-	-	Obese
-2 ≤ score ≤ 2	Normal		
-3 ≤ score < -2	Underweight (for ≤ 10 years old)	Stunted	Wasted
< -3	Severely underweight	Severely stunted	Severely wasted

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Results

During the course of the study, a total of 1399 children (6-12 years old), 906 of whom were male and 493 of whom were female, visited the Paediatric Outpatient Department of BCM Hospital. Male: female ratio was 1.8:1. The mean age was 8.6 ± 2.0 years. The mean weight of the children was 25.8 ± 8.7 kg; mean height was 126.6 ± 14.3 cm; and BMI was 15.7 ± 2.8 kg/m^2. The anthropometric parameters among the various age groups and gender have been depicted in Table 2. For males, the mean weight was 25.7 ± 8.6 kg; the mean height was 126.6 ± 14.2 cm; and BMI was 15.7 ± 2.8 kg/m^2, while for females, these parameters were 26.0 ± 8.9 kg, 126.8 ± 14.3 cm, and 15.7 ± 2.7 kg/m^2, respectively. Males and females of all ages ≤ 11 years had similar body mass indices, heights, and weights. At the age of 12 years, there were noticeable variations in weight and BMI, with girls having higher values than boys.

The average Z-score for weight in relation to age was -0.47 ± 1.16. The average weight-for-age Z-score for males was -0.51 ± 1.18 and for girls, it was -0.39 ± 1.12. The average height-for-age Z-score was -0.52 ± 1.42, while the corresponding scores for boys and girls were -0.52 ± 1.42 and -0.42 ± 1.29, respectively. The mean BMI-for-age Z-score was -0.24 ± 1.15; the corresponding values for males and females were -0.26 ± 1.15 and -0.21 ± 1.13, respectively (Table 3).

Table 2.Mean Weight, Height, and BMI among the Various Age Groups and Gender

Age (Years)	Gender	Number of Children	Mean Weight (± SD) in kg	p Value	Mean Height (± SD) in cm	p Value	Mean BMI (± SD) in kg/m^2	p Value
6	Male	194	19.2 (± 4.5)	0.36	112.4 (± 8.4)	0.92	15.0 (± 2.5)	0.21
	Female	101	18.7 (± 4.4)		112.3 (± 7.4)		14.6 (± 2.7)	
7	Male	108	21.5 (± 5.2)	0.79	117.9 (± 8.4)	0.74	15.3 (± 2.8)	1.00
	Female	77	21.7 (± 4.6)		118.3 (± 7.3)		15.3 (± 2.9)	
8	Male	138	23.0 (± 5.1)	0.40	123.0 (± 9.2)	0.35	15.0 (± 2.4)	0.57
	Female	73	22.4 (± 4.4)		121.8 (± 8.3)		14.8 (± 2.5)	
9	Male	133	26.8 (± 7.2)	0.16	128.6 (± 9.6)	0.68	15.9 (± 2.9)	0.07
	Female	62	25.3 (± 6.0)		128 (± 9.6)		15.1 (± 2.7)	
10	Male	152	28.7 (± 8.1)	0.56	133.5 (± 10.2)	0.89	15.8 (± 3.2)	0.53
	Female	67	29.4 (± 8.2)		133.3 (± 9.5)		16.1 (± 3.3)	
11	Male	89	33.5 (± 9.3)	0.29	141.0 (± 10.3)	0.11	16.6 (± 4.7)	1.00
	Female	56	35.1 (± 8.1)		143.7 (± 8.8)		16.6 (± 3.5)	
12	Male	92	34.1 (± 8.9)	0.04	143.5 (± 11.3)	0.42	16.2 (± 3.0)	0.04
	Female	57	37.1 (± 8.1)		144.9 (± 8.2)		17.3 (± 3.4)	

Table 3.Mean Weight-for-age, Height-for-age and BMI-for-age Z-scores of Children

Age (years)	Weight-for-age Z-score		Height-for-age Z-score		BMI-for-age Z-score	
	Male	Female	Male	Female	Male	Female
6	-0.37 (± 1.33)	-0.34 (± 1.27)	-0.56 (± 1.53)	-0.32 (± 1.27)	-0.07 (± 1.31)	-0.19 (± 1.49)
7	-0.42 (± 1.25)	-0.09 (± 0.99)	-0.59 (± 1.44)	-0.28 (± 1.20)	-0.08 (± 1.39)	0.09 (± 1.06)
8	-0.63 (± 1.08)	-0.55 (± 1.04)	-0.64 (± 1.50)	-0.64 (± 1.29)	-0.34 (± 1.06)	-0.28 (± 0.99)
9	-0.46 (± 1.17)	-0.57 (± 1.12)	-0.59 (± 1.47)	-0.56 (± 1.42)	-0.16 (± 1.02)	-0.38 (± 0.96)
10	-0.61 (± 1.12)	-0.51 (± 1.19)	-0.62 (± 1.47)	-0.63 (± 1.35)	-0.41 (± 1.05)	-0.25 (± 1.04)
11	-0.40 (± 1.09)	-0.23 (± 1.10)	-0.30 (± 1.41)	0.02 (± 1.25)	-0.37 (± 1.13)	-0.28 (± 1.10)
12	-0.78 (± 1.03)	-0.48 (± 0.96)	-0.70 (± 1.48)	-0.53 (± 1.15)	-0.59 (± 0.87)	-0.26 (± 0.91)

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Table 4.Comparison of Nutritional Status of Children on the Basis of Their Gender

Nutritional Status	Number of Children		Total (N = 1399)
	Male n (%)	Female n (%)	
Wasted	43 (65.2)	23 (34.8)	66
Stunted	108 (68.8)	49 (31.2)	157
Underweight	57 (71.3)	23 (28.7)	80
Normal weight	757 (64.6)	414 (35.4)	1171
Overweight	83 (64.3)	46 (35.7)	129
Obese	23 (69.7)	10 (30.3)	33

Table 5.Categorisation of Nutritional Status of Children According to Age and Gender

Age (Years)	Gender	Number of Children (n)	Normal n (%)	Wasted n (%)	Stunted n (%)	Underweight n (%)	Overweight n (%)	Obese n (%)
6	Male	194	153 (78.9)	11 (5.7)	24 (12.4)	14 (7.2)	22 (11.3)	8 (4.1)
	Female	101	78 (77.2)	9 (8.9)	10 (9.9)	2 (1.9)	10 (9.9)	4 (3.9)
7	Male	108	80 (74.1)	5 (4.6)	12 (11.1)	11 (10.2)	19 (17.6)	4 (3.7)
	Female	77	62 (80.5)	2 (2.6)	4 (5.2)	3 (3.9)	9 (11.7)	4 (5.2)
8	Male	138	117 (84.8)	9 (6.5)	17 (12.3)	12 (8.7)	9 (6.5)	3 (2.2)
	Female	73	65 (89)	3 (4.1)	8 (10.6)	7 (9.6)	5 (6.8)	0 (0)
9	Male	133	113 (84.9)	3 (2.3)	17 (12.8)	9 (6.8)	14 (10.5)	3 (2.3)
	Female	62	55 (88.7)	3 (4.8)	8 (12.9)	6 (9.7)	4 (6.5)	0 (0)
10	Male	152	132 (86.8)	9 (5.9)	17 (11.2)	11 (7.2)	8 (5.3)	3 (1.9)
	Female	67	54 (80.6)	2 (2.9)	11 (16.4)	5 (7.5)	10 (14.9)	1 (1.5)
11	Male	89	78 (87.6)	3 (3.4)	6 (6.7)	NA	6 (6.7)	2 (2.2)
	Female	56	48 (85.7)	3 (5.4)	3 (5.4)	NA	5 (8.9)	0 (0)
12	Male	92	84 (91.3)	3 (3.3)	15 (16.3)	NA	5 (5.4)	0 (0)
	Female	57	52 (91.2)	1 (1.8)	5 (8.8)	NA	3 (5.3)	1 (1.8)

Assessment of the Z-scores showed that 83.7% (1171/1399) of children had a normal nutritional status, 4.7% (66/1399) were wasted, 11.2% (157/1399) were stunted, 5.7% (80/1399) were underweight, 9.2% (129/1399) were overweight, and 2.4% (33/1399) were obese. Severe obesity was noted in 9.1% (3/33) of the obese children (Table 4).

Table 5 shows the nutritional status of school-age children according to age and gender categories.

Discussion

The vast majority of the school-age children (83.7%) in this single-centre, retrospective observational research had normal nutritional status, but different forms of malnutrition were also present. Wasting was seen in 4.7%, stunting in 11.2%, and underweight in 5.7% of participants. 9.2% of subjects were found to be overweight and 2.4% were obese. Among the obese participants, 9.1% were severely obese. In our study, a total of 1399 children (906 male and 493 female) were enrolled. Male: female ratio was 1.8:1. This ratio pointed towards gender bias in Indian society i.e., parental preferences for boys to visit the outpatient department for routine follow-up, vaccination, and for seeking treatment of a minor illness. Boys and girls belonging to the age group of 6-11 years had comparable weight, height, and BMI, while in the 12-year-old age group, considerable differences were observed. These results indicated that the parents who brought their girls to the outpatient department were giving them equal food, attention and care as their boys.

Eze et al.[10] portrayed the average height (136 ± 10.2 cm), weight (29.7 ± 7.7 kg), and body mass index (BMI) (15.7

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± 2.4 kg/m^2) of school-age children in their research from Enugu, Nigeria. The average body mass index (BMI) was quite close to that observed in our study (15.7 ± 2.8 kg/m^2). Weight-for-age Z-scores averaged 0.33 ± 1.20, height-for-age Z-scores averaged 0.78 ± 1.17, and BMI-for-age Z-scores averaged -0.51 ± 1.27. In their study, the majority (78.9%) of children were also in the normal nutritional category. Wasting (9.3%) and obesity (4.4%) were more than that seen in our study, but overweight (6.3%), underweight (0.9%), and stunting (0.4%) were less.

Akor et al.[11] in their study on primary school children in Jos Plateau, Nigeria, reported 11.1% stunting, 10.3% underweight, and 2.4% wasting. Wasting (4.7%) obtained in our study was lower than Ghana's school-age children (19.4%) and Ethiopia's school-age children (14%).[12] These differences in results may be due to the reference indices used, secular trends, or sociocultural factors. The World Health Organisation reference values were utilised by Akor et al.[11]

Using three distinct reference indices (CDC centile charts, International Obesity Task Force charts, and WHO AnthroPlus based on Z-scores), Kovalskys et al.[7] found varying rates of wasting (3.5%, 2.1%, and 2.1%) in the same cohort.

Srivastava et al.[2] in their study on school-age children in Bareilly (UP), India obtained higher rates of wasting (33.3%) and stunting (18.5%). However, it should be noted that they used a different method of assessment. The nutrition of school-age children is influenced by a number of social factors. According to Srivastava et al.[2], poor dietary practises, low healthcare utilisation and a lack of hygiene knowledge were associated with low levels of education and challenging living situations such as overcrowding, poor quality drinking water, and sanitation. As a result, children living in such situations are more vulnerable to health and nutritional problems.

The aim of this study was to assess the physical growth and nutrition of Indian school-age children at our community's outpatient department. Our study was successful in achieving the aim. In the prevalence of malnutrition, secular and geographical trends have been observed. Over time, there have been remarkable changes in the infrastructure and technology in India. We appreciate the effect of these changes on the physical growth and nutrition of local school-age children, but more awareness and facilities are required in the rural population to ensure that the socioeconomic indices of the rural population get better which will definitely reflect the overall good physical growth and nutrition of school-age children. We recommend that healthcare providers should give more nutritional education to parents and children to prevent malnutrition among school-age children.

The limitation of our study was that the sample had been taken from an outpatient department record which may not be representative of the community's sample.

Conclusion

Most of the school-age children have normal physical growth and nutrition. Both undernutrition and overnutrition were found in the remaining children. We recommend more awareness and facilities for the rural population and more nutritional education to parents as well as children by healthcare providers to reduce malnutrition in school-age children.

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References

1. Physical status: the use and interpretation of anthropometry. Report of a WHO Expert Committee. World Health Organ Tech Rep Ser. 1995;854:1-452. [PubMed] [Google Scholar]
2. Srivastava A, Mahmood SE, Srivastava PM, Shrotriya VP, Kumar B. Nutritional status of school-age children - a scenario of urban slums in India. Arch Public Health. 2012 Apr 17;70(1):8. [PubMed] [Google Scholar]
3. Alkema L, New JR, Pedersen J, You D; UN Inter-agency Group for Child Mortality Estimation; Technical Advisory Group. Child mortality estimation 2013: an overview of updates in estimation methods by the United Nations Inter-agency Group for Child Mortality Estimation. PLoS One. 2014 Jul 11;9(7):e101112. [PubMed] [Google Scholar]
4. Olusanya JO. Assessment of the food habits and school feeding programme of pupils in a rural community in Odogbolu local government area of Ogun state, Nigeria. Pak J Nutr. 2010;9:198-204. [Google Scholar]
5. Tauman R, Gozal D. Obesity and obstructive sleep apnea in children. Paediatr Respir Rev. 2006 Dec;7(4):247-59. [PubMed] [Google Scholar]
6. Popkin BM, Richards MK, Montiero CA. Stunting is associated with overweight in children of four nations that are undergoing the nutrition transition. J Nutr. 1996 Dec;126(12):3009-16. [PubMed] [Google Scholar]
7. Kovalskys I, Herscovici CR, De Gregorio MJ. Nutritional status of school-aged children of Buenos Aires, Argentina: data using three references. J Public Health (Oxf). 2011 Sep;33(3):403-11. [PubMed] [Google Scholar]
8. Popkin BM. The nutrition transition and obesity in the

developing world. J Nutr. 2001 Mar;131(3):871S-3S. [PubMed] [Google Scholar]
9. de Onis M, Onyango AW, Borghi E, Siyam A, Nishida C, Siekmann J. Development of a WHO growth reference for school-aged children and adolescents. Bull World Health Organ. 2007 Sep;85(9):660-7. [PubMed] [Google Scholar]
10. Eze JN, Oguonu T, Ojinnaka NC, Ibe BC. Physical growth and nutritional status assessment of school children in Enugu, Nigeria. Niger J Clin Pract. 2017 Jan;20(1):64-70. [PubMed] [Google Scholar]
11. Akor F, Okolo S, OkoloA. Nutritional status of newly enrolled primary school children in Jos Plateau, Nigeria. Pak J Nutr. 2010;9:1166-70.
12. Wolde M, Berhan Y, Chala A. Determinants of underweight, stunting and wasting among schoolchildren. BMC Public Health. 2015 Jan 17;15:8. [PubMed] [Google Scholar]

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