Human Biology Review (ISSN 22774424)
www.HumanBiologyJournal.com

International Peer Reviewed Journal of Biological Anthropology

Volume 13, Number 4, October-December 2024 Issue

Original scientific paper

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Human Biology Review, Volume 13 (4), pp. 324-335.

Revised and accepted on October 2, 2024

Citation: Samsuddin SK, Biswas A and Roy S. 2024. Prevalence and Grades of Thinness among Pre-School Children Aged 2-5 Years in Paschim Medinipur, West Bengal, India. Human Biology Review, 13 (4), 324-335.

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Prevalence and Grades of Thinness among Pre-School Children Aged 2-5 Years in Paschim Medinipur, West Bengal, India

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ABSTRACT

Malnutrition, particularly undernutrition among preschool children, is a critical global health concern with profound implications for child health, growth, and development. This study examines the prevalence and grades of thinness in preschool children aged 2-5 years in the culturally diverse region of Paschim Medinipur, West Bengal, conducted within eight ICDS centers in seven villages under Medinipur Sadar Block, with 215 participants (105 boys and 110 girls). Body mass index (BMI) was calculated, and thinness was classified into Grades I, II, and III for mild, moderate, and severe cases, using age- and sex-specific BMI cutoffs proposed by Cole et al, 2007. The findings highlighted significant trends: boys had higher mean height, weight, and BMI values than girls. Both exhibited an overall pattern of increasing height and weight and decreasing BMI with age, with exceptions among 4-year-olds. Thinness was prevalent, affecting 61.9% of boys and 62.7% of girls, with the lowest prevalence among 5-year-olds and the highest among 3-year-olds. Grade III thinness was the most common category, impacting 28.4% of boys and girls, followed by Grade I (18.6%) and Grade II (15.3%). Notably, no significant association between sex and thinness prevalence was found, underscoring the similar risks boys and girls face regarding undernutrition. The present study revealed that the nutritional status of these villages' preschool children was poor, with a very high rate of thinness present among both sexes. These results indicate that the present food supplementation program of the ICDS centers needs to be improved.

Key Words: *Undernutrition, Socio-economy, BMI for Age, ICDS, Malnutrition*

INTRODUCTION

In recent years, there has been a growing focus on the issue of undernutrition among pre-school children, recognizing its profound impact on child health, growth, and development. Malnutrition is a critical global health concern, especially affecting many children in middle and lower-income nations (Victora *et al*., 1986). According to a study by UNICEF in 2005,

approximately 2.2 million children under the age of 5 died due to malnutrition (Mandal *et al*., 2012). Nearly 70 percent of the world's malnourished children are estimated to reside in Asia, with approximately 800 million individuals suffering from undernourishment globally. Of these, just under one-third, or 258 million individuals, are concentrated in South Asia (Ahmed *et al*., 2012). The high prevalence of thinness among pre-school children aged 2-5 years in West Bengal, India was also been observed (Mahapatra and Bose, 2020). As India undergoes developmental changes, it grapples with a complex health burden, encompassing pre-transition challenges like undernutrition and infectious diseases alongside post-transition lifestyle-related degenerative conditions such as obesity, diabetes, hypertension, cardiovascular diseases, and cancers (Das & Banik, 2011). India is ranked 111th out of 125 countries in the 2023 Global Hunger Index, with a serious hunger level, scoring 28.7 (GHI, 2023). This thinness among pre-school children remains a significant global public health challenge, affecting millions of children and resulting in both immediate and long-term adverse health consequences. Despite notable advancements in child nutrition efforts, disparities persist among different regions and communities, emphasizing the need for localized studies to tailor interventions effectively. India has implemented various nutritional programs, and with continued research and targeted interventions, there is hope for significant improvement in children's nutrition status (Shahnawaz & Singh, 2014).

Pre-school years mark a pivotal period of rapid growth and cognitive development, making adequate nutrition paramount in establishing a solid foundation for lifelong health. Despite considerable strides in improving child nutrition globally, the persistence of thinness highlights the need for targeted interventions to address this multifaceted challenge. Poor nutrition of children affects children's cognitive development and is likely to reduce work capacity in the future (Elizabeth *et al*., 2009). Body mass index (BMI) has been widely used for assessing the nutritional status of adults and thinness in adolescents and, more recently, in children aged 0-5 years (WHO, 2006).

This paper seeks to contribute to the existing body of knowledge by investigating the extent of thinness, a key indicator of undernutrition, among pre-school children aged 2-5 in Paschim Medinipur, a West Bengal, India district. Due to its diverse socio-economic and cultural landscape, Paschim Medinipur presents a unique context. The study aimed to evaluate levels of thinness in pre-school children using age- and sex-specific international cut-off values based on Body Mass Index (BMI) as defined by Cole et al. in 2007.

MATERIAL AND METHODS

Study Area

This cross-sectional study was conducted in different Integrated Child Development Service (ICDS) centers, commonly known as "Anganwadi," of the villages of Medinipur Sadar Block in Paschim Midnapur district, West Bengal, India. ICDS was launched on 2 October 1975 to improve the nutritional and health status of pre-school children (Ministry of Women and Child Development, 2023). The study area was rural, and the villages were remotely located, approximately 131 km from Kolkata, the state's capital. The data was collected in April 2022.

Study Participants

The survey was carried out in eight ICDS centers in seven Medinipur Sadar Block villages. Participants are selected following the total enumeration procedure, resulting in a total sample size of 215 children (Absent/unavailable children were excluded). Among these children were 105 boys and 110 girls, all falling within the age group of 2 to 5 years (Table 1).

Table 1: Age and sex-specific distribution of study participants.

Age (years)	Sex				Total	
	Boys		Girls			
	N	%	N	%	N	%
2	18	17.1	20	18.2	38	17.67
3	37	35.2	40	36.4	77	35.81
4	26	24.8	30	27.3	56	26.05
5	24	22.9	20	18.2	44	20.46
Total	105	100.0	110	100.0	215	100.0

Measurements and Assessment of Thinness

The present study, which focuses on the Measurements and Assessment of Thinness, was conducted with a strong emphasis on reliability and validity. Official approval was obtained from the ICDS centers before commencing data collection, and parents were fully informed about the study's purpose and their consent was obtained prior to initiating measurements. The information collected, including age, ethnicity, height, and weight, was systematically gathered using a pretested schedule. Subject measurements were collected using Martin's Anthropometer for height (in cm) and a Standard Weighing Machine for weight (in kg), following established WHO (1995) guidelines. Body mass index (BMI) was calculated using the standard formula: BMI = weight (kg) / height (m^2). To assess nutritional status (thinness),

the present study follows age and sex-specific BMI cut-offs as defined by Cole *et al*.,2007 with Grades III, II, and I representing severe, moderate, and mild undernutrition, respectively (Table 2). A one-way ANOVA (F-test) was conducted to evaluate age-related differences in weight, height, and BMI means. This study compiles a comprehensive dataset comprising demographic information such as age, sex, and birth order of preschool children, details about the educational and occupational statuses of mothers and fathers, type of house, sanitation facilities, and socio-economic status by collecting data on total family members education, occupation, and monthly family income through a structured pretested interview schedule. Pearson's Chi-square was performed to find out the significance of differences among the studied children based on socio-demographic factors. Socio-economic status of the family was categorised as per the modified Kuppuswamy's socio-economic scale updated for March, 2019 (Wani, 2019). All statistical analyses were performed using the SPSS version 25, with statistical significance set at $P < 0.05$.

RESULTS

In this study, Table 2 provides a comprehensive overview of the mean values and their corresponding standard deviations (in parentheses) for the height, weight, and BMI of pre-school children aged 2-5 years. Among boys, the mean values are 95.29 (9.19), 12.86 (2.71), and 14.11 (1.74) for height, weight, and BMI, respectively. Among girls, these values are 92.84 (7.15), 11.95 (2.11), and 13.85 (1.82), respectively. It is evident that, on average, boys exhibit higher mean values for height, weight, and BMI than girls. Statistical analyses revealed significant mean differences between age groups for boys in both height ($F=27.53$; $p<0.001$) and weight ($F=19.67$; $p<0.001$), mirroring similar trends observed among girls concerning height ($F=16.62$; $p<0.001$) and weight ($F=13.34$; $p<0.001$). In both boys and girls, there is a general trend of increasing height and weight and decreasing BMI with age, except for 4-year-olds, where this trend deviates.

Table 3 of the study assesses the sex and age-specific prevalence of thinness among pre-school children aged 2-5. The combined prevalence of thinness reveals that 61.9% of boys and 62.7% of girls experience thinness. Among boys, the lowest prevalence is observed among 5-year-olds (45.8%), while the highest is among 3-year-olds (72.9%). A similar prevalence range is observed among girls, with 5-year-olds experiencing a minimum prevalence of 45.0% and 3-year-olds having the highest prevalence at 75.0%. When

considering both age and sex combined, the overall prevalence of thinness is 62.3%, and importantly, there is no significant association between sex and thinness prevalence. Further analysis highlights the distribution of thinness grades, with Grade III thinness being the most pervasive (28.4%) among both boys and girls, followed by Grade I (18.6%) and Grade II (15.3%).

Table 2: Mean and standard deviation of height, weight and BMI of study children

Age (years)	Height (cm)		Weight (kg)		BMI (kg/m^2)	
	Boys (N=105)	Girls (N=110)	Boys (N=105)	Girls (N=110)	Boys (N=105)	Girls (N=110)
2	85.84 (9.42)	85.28 (7.78)	10.49 (1.61)	10.22 (1.61)	14.41 (2.15)	14.15 (2.07)
3	92.22 (5.60)	92.62 (4.31)	11.92 (1.92)	11.47 (1.62)	14.02 (1.91)	13.36 (1.53)
4	98.34 (6.12)	94.78 (5.75)	13.73 (2.07)	12.70 (1.72)	14.18 (1.64)	14.19 (1.94)
5	103.83 (7.39)	97.97 (7.09)	15.17 (2.92)	13.50 (2.50)	13.94 (1.24)	14.00 (1.82)
ANOVA	**F=27.529*** **	**F=16.618*** **	**F=19.672*** **	**F=13.342*** **	$F=0.297^{NS}$	$F=1.554^{NS}$

****means p<0.001, N.S= Not significant.* *Standard deviation is shown in parentheses.*

Table 3: Prevalence of age and sex wise thinness among study children

Age (years)	Sex	Prevalence of thinness				Sex differences (χ^2)
		Grade- III (%)	Grade- II (%)	Grade- I (%)	Overall (%)	
2	Boys	4 (22.2%)	3 (16.7%)	5 (27.8%)	12 (66.6%)	1.08^{NS}
	Girls	6 (30.0%)	3 (15.0%)	3 (15.0%)	12 (60.0%)	
3	Boys	11 (29.7%)	8 (21.6%)	8 (21.6%)	27 (72.9%)	2.99^{NS}
	Girls	19 (47.5%)	6 (15.0%)	5 (12.5%)	30 (75.0%)	
4	Boys	4 (15.4%)	7 (26.9%)	4 (15.4%)	15 (57.7%)	2.22^{NS}
	Girls	7 (23.3%)	4 (13.3%)	7 (23.3%)	18 (60.0%)	
5	Boys	5 (20.8%)	2 (8.3%)	4 (16.7%)	11 (45.8%)	1.81^{NS}
	Girls	5 (25.0%)	0 (00.0%)	4 (20.0%)	9 (45.0%)	
Age Combined	Boys	24 (22.8%)	20 (19.0%)	21 (20.0%)	65 (61.9%)	4.25^{NS}
	Girls	37 (33.6%)	13 (11.8%)	19 (17.3%)	69 (62.7%)	
Age & Sex Combined		61 (28.4%)	33 (15.3%)	40 (18.6%)	134(62.3%)	

N.S= Not significant. *Percentages are shown in parentheses.*

Table 4 in the present paper summarizes the findings of this study of preschool children's background characteristics and the percentage of thin children within each group. Among the factors investigated, birth order exhibited a significant association ($\chi 2$ =17.607, p<0.001) with child nutrition, with first-born children having a higher percentage of thinness (45.5%) compared to second-born (39.6%) and subsequent siblings. The proportion of people in multidimensional poverty in India decreased from 24.85% (NFHS-4) to 14.96% (NFHS-5) between 2015-16 and 2019-21, while in West Bengal it dropped from 21.29% (NFHS-4) to

11.89% (NFHS-5) (NMPI, 2023). This may be linked to earlier-born children showing increased concern for health issues during a period of higher poverty levels in both India and West Bengal.

Table 4: Association of thinness and socio-economic factors

Background Characteristics	Normal n = 81	Thinness n= 134
Kuppuswami Socio-Economic Status		
Upper Class	3 (3.7)	2 (1.5)
Upper Middle	7 (8.6)	9 (6.7)
Lower Middle	32 (39.5)	37 (27.6)
Upper Lower	39 (48.1)	86 (64.2)
Chi Square (χ^2)	5.770^{NS}	
Type of Family		
Joint	14 (17.3)	21 (15.7)
Neuclear	38 (46.9)	67 (50.0)
Extended	29 (35.8)	46 (34.3)
Chi Square (χ^2)	0.211^{NS}	
Size of Family		
2 To 4	35 (43.2)	51 (38.1)
5 To 8	36 (44.4)	72 (53.7)
≥ 9	10 (12.3)	11 (8.2)
Chi Square (χ^2)	2.086^{NS}	
House Type		
Pucca	36 (44.4)	59 (44.0)
Semi Pucca	18 (22.2)	25 (18.7)
Kancha	27 (33.3)	50 (37.3)
Chi Square (χ^2)	0.546^{NS}	
Toilet Facilities		
No	7 (8.6)	8 (6.0)
Yes	74 (91.4)	126 (94.0)
Chi Square (χ^2)	0.555^{NS}	
Birth Order		
First	44 (54.3)	61 (45.5)
Second	28 (34.6)	53 (39.6)
Third	2 (2.5)	18 (13.4)
Fourth	6 (7.4)	0 (0.0)
Fifth	1 (1.2)	2 (1.5)
Chi Square (χ^2)	**17.607*** **	
Type of Delivery		
Normal	55 (67.9)	104 (77.6)
Caesarean	26 (32.1)	30 (22.4)
Chi Square (χ^2)	2.471^{NS}	

****means p<0.001, N.S= Not significant.* *Percentages are shown in parentheses.*

Children born through normal delivery had a higher prevalence of thinness (77.6%) compared to those born via cesarean section (22.4%). Other background characteristics, including modified Kuppuswami Socio-Economic Status, Type of Family, Size of Family,

House Type, Toilet Facilities, did not demonstrate significant differences in the prevalence of thin children. However, it's noteworthy that children in the "Upper Lower" socio-economic class had the highest prevalence of thinness at 64.2%, while those in the "Lower Middle" class had a substantial percentage of thin children at 27.6%. These findings suggest that lower socio-economic status may be linked to a higher risk of thinness among preschool children. The results underscore the relevance of birth order in understanding and addressing child nutrition disparities, suggesting the need for targeted interventions to support the well-being of first-born children.

DISCUSSION

Childhood and adolescent undernutrition are a critical global public health concern, particularly prevalent in middle and lower-income nations (Pelletier & Frongillo, 2003; UNICEF, 2006). Deviations in nutrient intake from requirements can adversely affect growth and life expectancy, especially in the later stages of development (Mishra & Mishra, 2007).

Table 5: Comparison of the prevalence of thinness of present study with other studies from India (Thinness evaluation method as per Cole *et al*., 2007 cut-offs).

Study Group	Region	Age (Year)	Sample	Prevalence of Thinness (%)			References
				Boys	Girls	Overall	
ICDS children	Vadodara, Gujrat.	<5	3157	58.0	68.2	63.0	Bhalani & Kotecha, 2002.
Bauri children	Purulia, W.B.	2-6	219	61.5	70.8	65.3	Das & Bose, 2009.
Santal children	Purulia, W.B.	2-6	251	59.5	53.3	56.4	Das & Bose, 2011.
ICDS children	Patashpur, W.B.	3-6	225	61.8	56.5	59.1	Mandal *et al*., 2012.
ICDS children	South 24 Pargana, W.B.	3-5.5	656	81.9	80.6	81.25	Giri *et al*., 2017.
Tribal children	Jhargram & Medinipur,W.B.	2-5	643	69.5	69.2	69.4	Mahapatra & Bose, 2020.
ICDS children	**Paschim Medinipur,W.B.**	**2-5**	**215**	**61.9**	**62.7**	**62.3**	**Present Study**

Assessing undernutrition through BMI is challenging for pre-school children due to a lack of appropriate cut-off points. To address this, Cole and colleagues established suitable thinness cut-off points for children aged 2-18 using data from various countries, including Brazil (a middle—and lower-income country). These cut-off points apply to Indian children, including those in Paschim Medinipur (Table 2).

According to these cut-offs, the present study found that 62.3% of ICDS children aged 2-5 in Paschim Medinipur were classified as thin. This prevalence was slightly higher than pre-school children in Patashpur, Purba Medinipur (59.10%) (Mandal *et al*., 2012) and Santal children in Purulia, West Bengal (56.4%) (Das and Bose, 2011). However, it was lower than thinness rates among tribal (Santal & Bhumij) children in Paschim Medinipur and Jhargram district (69.4%) (Mahapatra & Bose, 2020), ICDS children in Vadodara, Gujarat (63.0%) (Bhalani & Kotecha, 2002), and Bauri scheduled caste pre-school children in Purulia, West Bengal (65.3%) (Das & Bose, 2009). Compared to the present study, ICDS children in the Sagar block of South 24 Pargana District, West Bengal, had a significantly higher thinness rate of 81.25% (Giri *et al*., 2017). Table 6 compares undernutrition prevalence (%) as assessed through thinness (BMI) in different regions.

Thin children are at risk of becoming thin adults with low BMI, which impacts their productivity and increases morbidity and mortality rates (Das and Bose, 2010). The present study highlights the poor nutritional status of pre-school children in the villages under Medinipur Sadar Block, Paschim Medinipur, with a very high thinness rate of 61.9% for boys and 62.7% for girls. Urgent measures are needed to improve the nutritional status of these children in Paschim Medinipur, including the initiation of nutritional supplementation programs.

Limitation of the Study

The current study's drawback lies in its limited sample size, which merely reflects a segment of the community rather than the entire Paschim Medinipur district or the state of West Bengal. Therefore, it cannot provide a comprehensive overview of the prevalence of thinness among pre-school children in Paschim Medinipur and West Bengal as a whole.

Conclusions

In conclusion, this study brings to light the high prevalence of undernutrition, specifically thinness, among pre-school children in Paschim Medinipur, West Bengal. This problem is not unique to the region but is a pervasive issue across middle and lower-income nations, as highlighted by previous studies. The high thinness rates of 61.9% for boys and 62.7% for girls in the present study underscore the immediate need for intervention to address the nutritional well-being of these vulnerable children. In light of these findings, we stress the urgent need for the immediate initiation of comprehensive nutritional intervention programs

in the studied villages under Medinipur Sadar Block, Paschim Medinipur. These programs should be designed to combat childhood undernutrition and its adverse consequences, and should be implemented without delay.

Acknowledgment

We gratefully acknowledge all the participants, their parents, and the authorities of the ICDS centers who participated in the study. We extend special thanks to the faculties of the Department of Anthropology at Vidyasagar University, Midnapore, for their guidance and for providing the necessary instruments.

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