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Anthropometrical Aspects and Nutritional Status of Minority Children (6–10 Years) of Purba Medinipur District, West Bengal, India

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Abstract

Introduction: Nutritional status during childhood plays a crucial role in physical growth, cognitive development, and overall health. In India, despite the implementation of large-scale school feeding programmes such as the Mid-Day Meal Scheme (MDMS), undernutrition among primary school children remains a public health concern, particularly in rural and socio-economically vulnerable populations. The present study aimed to assess the socio-demographic characteristics and nutritional status of primary school children aged 6–10 years in Nandigram-I Block of Purba Medinipur District, West Bengal, and to examine age- and sex-specific variations in anthropometric indicators. **Methods:** A cross-sectional study was conducted among 275 children (120 boys and 155 girls) selected from four government-aided primary schools. Socio-demographic information was collected using a structured schedule. Anthropometric measurements with height, weight and mid-upper arm circumference (MUAC) were recorded following standard techniques. Statistical analysis was performed using SPSS (version 16.0), and parametric tests were applied after confirming normality. **Results:** Females constituted a higher proportion of the study population (56.4%). Most children belonged to households with agricultural or daily wage occupations and low to moderate levels of paternal education. Anthropometric results showed a progressive increase in height, weight, and MUAC with age up to nine years in both sexes. Sex-wise differences were minimal, with boys exhibiting slightly higher mean body weight and BMI in most age groups, while girls showed comparable height and MUAC values. BMI values remained relatively stable across age groups, indicating borderline nutritional adequacy. Interpretation of findings for 10-year-old children was limited due to small sample size. **Conclusion:** The study highlights modest growth patterns and persistent nutritional vulnerabilities among rural primary school children. While the Mid-Day Meal Scheme appears to support basic nutritional needs, continued monitoring and strengthening of school-based nutritional interventions are necessary to ensure optimal child growth and development.

Keywords: Nutritional status, Primary school children, Anthropometry, Mid-Day Meal Scheme, West Bengal.

Resumen

Introducción: El estado nutricional durante la infancia desempeña un papel crucial en el crecimiento físico, el desarrollo cognitivo y la salud en general. En India, a pesar de la implementación de programas de alimentación escolar a gran escala, como el Programa de Comida del Mediodía (MDMS), la desnutrición entre los niños de primaria sigue siendo un problema de salud pública, particularmente en las poblaciones rurales y socioeconómicamente vulnerables. El presente estudio tuvo como objetivo evaluar las características sociodemográficas y el estado nutricional de niños de primaria de 6 a 10 años en el bloque Nandigram-I del distrito de Purba Medinipur, Bengala Occidental, y examinar las variaciones por edad y sexo en los indicadores antropométricos. **Métodos:** Se realizó un estudio transversal con 275 niños (120 niños y 155 niñas) seleccionados de cuatro escuelas primarias públicas. La información sociodemográfica se recopiló mediante un cuestionario estructurado. Las mediciones antropométricas de talla, peso y circunferencia del brazo (MUAC) se registraron siguiendo técnicas estándar. El análisis estadístico se realizó utilizando SPSS (versión 16.0) y se aplicaron pruebas paramétricas tras confirmar la normalidad. **Resultados:** Las niñas constituyeron una mayor proporción de la población estudiada (56,4%). La mayoría de los niños pertenecían a hogares con ocupaciones agrícolas o de

jornaleros y con niveles bajos a moderados de educación paterna. Los resultados antropométricos mostraron un aumento progresivo de la talla, el peso y la MUAC con la edad hasta los nueve años en ambos sexos. Las diferencias por sexo fueron mínimas; los niños mostraron un peso corporal y un IMC promedio ligeramente superiores en la mayoría de los grupos de edad, mientras que las niñas mostraron valores de talla y MUAC comparables. Los valores de IMC se mantuvieron relativamente estables en todos los grupos de edad, lo que indica una adecuación nutricional límite. La interpretación de los hallazgos para los niños de 10 años fue limitada debido al pequeño tamaño de la muestra. **Conclusión:** El estudio destaca patrones de crecimiento modestos y vulnerabilidades nutricionales persistentes entre los niños de primaria de zonas rurales. Si bien el Programa de Comida del Mediodía parece cubrir las necesidades nutricionales básicas, es necesario un seguimiento continuo y el fortalecimiento de las intervenciones nutricionales escolares para garantizar un crecimiento y desarrollo infantil óptimos.

Palabras Clave: Estado nutricional, Niños de primaria, Antropometría, Programa de Comida del Mediodía, Bengala Occidental.

Introduction

In the 1970s, Nutritional Anthropology was emerged as sub discipline of Biological Anthropology. According to Freedman (1976), nutritional anthropology is the 'study of the interrelationship between diet and culture and their mutual influence upon one another'.

Biological anthropologists have long observed nutrition as an important dimension of the complex human–environment relationship. For both biological anthropologists and nutritionists, food serves as the primary source of energy and essential nutrients required for survival, growth, and maintenance of health (Scrimshaw, 1964; Pelto & Pelto, 1983). Nutritional anthropology is a synthetic and interdisciplinary field that examines the interaction between economic systems, nutritional status, and food security, and analyzes how changes in one dimension influence the others (Pelto *et al ,* 2000).

Economic and environmental transformations within a community often affect access to food, food security, and dietary quality. These changes reflect the dynamic interaction between culture and biology, which is further shaped by broader historical, political, and economic processes associated with globalization (Messer, 1997; Dufour, 2013). Nutritional status plays a crucial role in determining overall health status, work capacity, and productivity, thereby influencing the potential for social and economic development, whether assessed through human development indicators or conventional Western economic models (FAO, 2008; WHO, 2013).

India is the 2nd most populated country in the world and the literacy rate is very low we rank 172th position among 208 countries (World Population Review 2022). Literacy directly affects the economic status of any country; it helps to create job opportunities, and other options to earn money, respect, position in social hierarchy and also in administrations etc. As we all know children are the future of any developing country and it is very essential to improve the nutritional status of children and asper the Indian constitution, it is the right to get primary education for every child. Although it was not hundred percent successes, it has shown up a constant tremendous developing (Kumari and Sinha 2020). To fulfil this objective government has launched a scheme called Mid-Day Meal (MDM) in year 1995, by P.V. Narasimha Rao. Under the National Program of Nutritional support to Primary Education, the mid-day meal program was started with a view to enhance enrolment, retention and attendance and also to improve the nutritional status of children (Kabra and Azeem, 2018). Several international development organizations and foundations are partnering with the Indian government through public-private partnerships schemes to achieve the objectives of this program (Assan, 2020). It is centrally governed program with the help of 75% of the cost and free food grains to states (Tiwari, 2017). Lunch programme in the school which is not a existing phenomenon. The idea of providing organized meals to school-going children has existed for more than a century. One of the earliest initiatives was introduced in France in the late nineteenth century under the influence of Victor Hugo. Over time, school-based nutrition programmes expanded gradually across different regions of the world. Several countries, including the United Kingdom and the United States, adopted such programmes during the mid-twentieth century, followed by Japan, China, Australia, Switzerland, and Singapore in later decades. Although introduced at different historical moments, these initiatives shared a common goal of improving children's nutritional well-being and supporting educational participation (Menezes, 2015). The school lunch programme also received attention in some of the developing countries like Indonesia 1967, Thailand 1970, and Korea 1973 (Menezes, 2015). Under nutrition during any period of childhood, even for relatively short-term episodes, can have negative effects on the cognitive development thus leads to poor school performance among children (Alim, *et al.,* 2012). The nutritional status of a population determines the overall health status which affects the growth and development of a society. As per the present nutritional norms under this scheme 450 calorie and 12g of protein is to be provided per day to primary school children and 700 calorie and 20g of protein are to be provided to children belonging to upper primary classes that is

to the adolescent children (Arya and Bisht, 2019). Initially the scheme was for lower primary school, In October 2007, the scope of the programme was expanded to include students enrolled in upper primary grades, specifically from Class VI to Class VIII, thereby extending nutritional support to older school-age children (Ministry of Human Resource Development [MHRD], 2007). Basic infrastructure is crucial for the implementation of MDMS. Infrastructure includes water supply, separate kitchen, cooking utensils, plates, fuel, storage facility, adequate staff, monitoring and supervision authorities all these facilities are needed to improve education and nutrition status of children (Sinha, 2019). In India, malnutrition continues to affect a substantial proportion of the child population. National survey data indicate that a significant number of children experience various forms of nutritional deprivation. Approximately one-third of children are affected by stunted growth due to chronic undernutrition, while a notable proportion suffer from wasting and low body weight. At the same time, a small but growing percentage of children are classified as overweight, reflecting emerging nutritional challenges alongside persistent undernutrition (International Institute for Population Sciences [IIPS & ICF, 2021). In Chhattisgarh almost 77% of population lives in rural areas and we all know that that in rural area, the basic need of nutrition level is not sufficiently filled due to poverty and lack of knowledge. According to government figures, stunting and wasting among children in the country has reduced by 3.7 per cent and the number of underweight children have reduced by 2.3 per cent from 2016 to 2018 (UNICEF, 2019). The introduction of the Mid-Day Meal Programme has contributed significantly to improved student retention in schools. By providing a regular nutritious meal, the programme supports children's daily dietary requirements and plays an important role in improving their nutritional intake and school participation (Afridi, 2010). One balanced meal everyday has reduced deficiencies of vital nutrients like vitamins and calcium, making them less susceptible to diseases (Singh, 2019).

Materials and Methods

Study Area

The present cross-sectional study was undertaken among primary school children of Nandigram-1 Block of Purba Medinipur District, West Bengal, India. Purba Medinipur District of West Bengal which contain four subdivisions namely, Tamluk, Haldia, Contai and Egra. According to the 2011 Population Census, Purba Medinipur district recorded a literacy rate of 87.02 percent, making it the most literate district in West Bengal at that time (Office of the Registrar General & Census Commissioner, India, 2011). Purba Medinipur District contains twenty six Blocks and out of this Nandigram-1 Block is selected as present study area.

Study people:

Study participants were selected from four Government aided primary schools of Nandigram-1 Block of Purba Medinipur District. Name of the schools are 1. Soudkhali Vajahori Board Primary school 2. Nandigram Brojamahon Tiwari Girls' Primary school 3. Nandigram Brojamahon Primary school 4. Godaibalbher Haronarayan Primary school. This four schools were purposively selected for the convenience of conducting fieldwork. Schools were chosen by opportunity sampling on the basis of easy accessibility of road connectivity to the schools and convenience of data collection. All the minority students of both sexes from 6 to 10 years old were eligible for this study. Students from 1st standard to 4th standard were selected for this investigation because of the inclusion criterion of this study. Mother tongue of all study participants was Bengali. All children were Bengalees and Other Backward Classes.

Ethical guideline

Necessary approval was obtained from the higher school authorities before the commencement of data collection. Objectives of the present investigation were explained clearly to the Head Teacher, others teacher of the schools prior to the collection of data. Permission was taken from the Head of the Department, Dept. of Anthropology, Sitananda College, Nandigram. The present study was carried out in accordance with the ethical guidelines for human experiments, as laid down by the Helsinki Declaration of 2000 (Touitou *et al.,* 2004).

Anthropometric Measurements

There were several methods to evaluate the nutritional status in a population namely dietary methods, biochemical examinations, clinical examinations, immunological examinations etc. Among the various assessment techniques, anthropometry is considered one of the most practical and widely applicable methods for evaluating body size, proportions, and composition in both children and adults. It is cost-effective, non-invasive, and easily adaptable across different populations and field settings (WHO, 1995). All anthropometric measurements were measured

following the standard techniques (ISAK 2019). For height and weight, participants were requested to remove their shoes before taking measurements.

Statistical Analysis

The data was analysed using Statistical Package for Social Sciences (SPSS, version 16.0). The figures and tables were constructed by using Microsoft Excel. Parametric tests were performed to analyze the data. To evaluate whether age-related differences existed between male and female participants, statistical comparisons were carried out using independent *t*-tests. These analyses focused on variations in both physical body measurements and calculated anthropometric indicators.

Results

Table 1. Socio-demographic characteristics of minority children aged 6–10 years in Nandigram (n = 275).

Variable	Category	Male	Female	Total
Father's Occupation	Agriculture	68	66	134
	Day labour	37	67	104
	Business	15	22	37
Father's Education	Literate	46	64	110
	Primary	55	70	125
	Upper primary	19	21	40
House Type	Pucca	78	99	177
	Kachha	42	56	98
Social Category	General	50	53	103
	OBC-A	41	66	107
	OBC-B	29	36	65
Total		120	155	275

Table 2. Mean and Standard deviation of the various anthropometric variables by age group and sex

Age group (years)	Sex	N	Height(cm)	Weight(kg)	BMI (kg /m²)	MUAC (cm)
			Mean±SD	Mean±SD	Mean±SD	Mean±SD
6	Boys	30	1.21 ± 6.72	23.02±3.84	15.76 ± 2.72	17.70 ± 1.54
	Girls	38	1.24 ± 6.87	22.47± 4.21	14.45 ± 2.74	17.58 ± 1.56
7	Boys	27	1.23 ± 5.21	22.49 ± 5.34	14.85 ± 3.58	17.37 ± 1.77
	Girls	37	1.24 ± 4.88	22.80 ± 3.71	14.86 ± 2.57	17.59 ± 2.26
8	Boys	35	1.24 ± 4.96	23.35 ± 3.73	15.02 ± 2.59	17.55 ± 1.92
	Girls	50	1.24 ± 4.55	23.10 ± 3.86	14.91 ± 2.90	18.30 ± 2.02
9	Boys	25	1.23 ± 4.24	23.28 ±10.33	15.29 ± 2.29	17.71 ± 1.87
	Girls	24	1.22 ± 7.63	22.12 ± 2.70	14.83 ± 2.64	17.69 ± 2.11
10	Boys	3	1.25 ± 1.67	18.90 ± 3.68	11.98 ± 2.50	16.06 ± 1.36
	Girls	6	1.24 ± 2.58	14.11 ± 3.73	15.62 ± 2.87	15.85 ± 1.85

Discussion

Table-1 presents the socio-demographic characteristics of the participants by sex (n = 275). Females constituted a higher proportion of the sample (56.4%) than males (43.6%). Agriculture was the predominant paternal occupation, followed by day labour and business, with day labour more common among females. Primary education was the most frequent level of father's education, and female participants were more represented across all educational categories.

Most households lived in pucca houses, with a higher proportion of females compared to males. Regarding social category, OBC-A formed the largest group, followed by General and OBC-B, with females outnumbering males in all categories. Overall, female participants showed greater representation across most socio-demographic indicators, highlighting the need to account for sex-based socio-economic differences in further analyses.

Table-2 presents the mean and standard deviation of anthropometric variables by age group and sex among children aged 6–10 years. A progressive increase in mean height and weight with advancing age was observed in both boys and girls up to 9 years. Girls showed comparable or marginally higher mean height than boys at 6–8 years, while boys were slightly taller at 9 and 10 years. Mean body weight was generally higher among boys across most age groups, although sex differences were small. Body mass index (BMI) values remained relatively stable across age groups, with boys demonstrating marginally higher mean BMI than girls at 6, 8, and 9 years, whereas girls showed higher mean BMI at 10 years. Mid-upper arm circumference (MUAC) increased with age in both sexes up to 9 years, with girls exhibiting higher MUAC values at 7 and 8 years, while values were comparable between sexes at other ages. Anthropometric measurements at 10 years should be interpreted cautiously due to the small sample size in this age group.

The present study assessed the socio-demographic profile and anthropometric status of minority primary school children aged 6–10 years in Nandigram-I Block of Purba Medinipur District, West Bengal. The higher proportion of female participants observed in the study is consistent with school enrolment patterns reported in rural West Bengal, where recent initiatives have improved female participation in primary education.

Agriculture and day labour constituted the major paternal occupations, indicating the predominance of low- to middle-income households. Similar occupational patterns have been reported in rural eastern India and are often associated with economic instability and limited access to diversified diets. The predominance of primary-level paternal education further reflects modest socio-economic conditions, which may influence household food security and child nutrition. Housing type and social category distribution also indicate that a considerable proportion of children belonged to socio-economically vulnerable groups, particularly OBC-A households.

Anthropometric findings revealed a progressive increase in height, weight, and MUAC with age in both sexes up to nine years, reflecting normal growth trends. However, sex-wise differences were modest, with boys showing slightly higher body weight and BMI in most age groups, while girls demonstrated comparable or marginally better height and MUAC in early ages. These patterns suggest relatively similar growth conditions for both sexes, possibly reflecting the equalizing effect of school-based nutritional interventions such as the Mid-Day Meal Scheme.

The relatively stable BMI values across age groups indicate the persistence of borderline nutritional adequacy, which has been reported in earlier studies among rural schoolchildren in India. The observed variations in MUAC and BMI may reflect differences in dietary intake, physical activity, and household socio-economic conditions. The small sample size in the 10-year age group limits robust interpretation, emphasizing the need for cautious analysis.

Overall, the findings highlight the role of socio-economic background and institutional feeding programmes in shaping child growth outcomes. While the Mid-Day Meal Scheme appears to support basic nutritional needs, residual growth disparities suggest the continued presence of underlying nutritional vulnerabilities.

Limitations

A key limitation of this investigation lies in the limited number of participants, as the sample reflects only a small segment of the local population and does not encompass the full demographic diversity of Purba Medinipur district or the broader state of West Bengal. The study was confined to a limited sample of 275 children from four schools which may not represent the entire district or state. Rapport establishment (which play a vital role) could have been much better if time span of study could be increased. Only anthropometric indicators were used, excluding detailed dietary and health data.

Conclusion

The present study provides insight into the socio-demographic background and nutritional status of minority primary school children aged 6–10 years in Nandigram-I Block of Purba Medinipur District, West Bengal. The findings indicate that most children belonged to households with modest socio-economic conditions, characterized by agricultural and daily wage occupations and low to moderate levels of parental education. Anthropometric assessment revealed an age-related increase in height, weight, and MUAC among both sexes up to nine years, reflecting expected growth patterns during middle childhood.

Sex differences in anthropometric indicators were minimal, with boys exhibiting slightly higher body weight and BMI in most age groups, while girls showed comparable height and MUAC values, particularly in early ages. The relatively stable BMI across age groups suggests borderline nutritional adequacy among the study population. Despite the presence of the Mid-Day Meal Scheme, the persistence of marginal anthropometric indicators indicates that nutritional challenges continue to exist among rural school-going children. These findings emphasize the need for continuous monitoring and strengthening of school-based nutritional interventions to ensure optimal growth and development.

Recommendation

Strengthening the Mid-Day Meal Scheme; Nutritional quality, dietary diversity, and micronutrient supplementation should be enhanced to address hidden hunger and improve overall growth outcomes. Regular Growth Monitoring: Periodic anthropometric screening in schools should be implemented to identify children at risk of undernutrition at an early stage. Parental Awareness Programs: Nutrition education for parents, particularly in low-literacy households, should be promoted to improve household-level dietary practices. Integration with Health Services: School health programmes should be linked with primary healthcare systems to provide deworming, anemia control, and nutrition counselling. Further Research: Longitudinal and larger-sample studies incorporating dietary intake and biochemical indicators are recommended to better understand the long-term impact of school feeding programmes on child nutrition**.**

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Informed Consent Statement

All the athletes included in the study provided written informed consent.

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