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Socio-Economic, Demographic Determinants of Undernutrition among the Midday Meal Beneficiary Adolescents of Darjeeling, West Bengal, India

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ABSTRACT: *To prevent hunger in classroom and to reduce school dropout the midday meal scheme was introduced in India. Present study aims to assess the nutritional status and its associated socio-economic and demographic factors among the midday meal beneficiary adolescents. A cross-sectional study was conducted among 303 Bengali medium government school students (10-14 years) of Siliguri sub-division of Darjeeling, West Bengal. Anthropometric measurements such as height, weight, and one derived variable BMI was considered. T-test and chi-square were performed. For nutritional assessment, WHO 2007 cut offs (Height-for age and BMI-for-age Z-score) was utilized. Overall significant sex difference was observed for height and Height-for-age Z-score (HAZ). Mean height (significant at $p<0.05$ for girls), weight and BMI were found to be higher in case of never/occasionally midday meal eating group for both gender. Also a significant difference was observed in case of girls for height among the regular midday meal eating and never/occasionally eating groups. Prevalence of stunting and wasting found to be higher in case of boys (11.9% and 14.6%). Different factors such as age, number of siblings, mother's occupation, socio-economic class and midday meal were found to be associated with stunting, whereas only age and father's occupation were associated with wasting. Proper nutritional intervention and awareness are necessary to overcome the burden of undernutrition among the school-going adolescents.*

KEYWORDS: *Midday meal, Bengali adolescents, Nutritional status, Socio-economic factors, Darjeeling*

I. INTRODUCTION

Nutrition influences the physical growth of the body, particularly within the rapidly growing period of the student community. The health supervision of school children is critical and might help to spot the magnitude of malnutrition. Malnutrition is generally defined as under- (stunting, wasting, and underweight) and overnutrition (overweight and obesity). Undernutrition is responsible for stunting, a higher risk of infections, and compromised organ development that may affect the physical and social well-being of school-going adolescents (1). Also, different factors such as age, sex, birth order, birth weight, dietary pattern, and history of illness; socio-economic factors and environmental factors (residential place, adequate food, and water availability) were found to affect the nutritional status of school children (2). Socio-economic status has been found to determine an individual's access to basic needs like healthcare facilities, housing as well as education; hence adolescents belonging to the lower socio-economic strata are reported to have malnutrition, poor access to health care, etc. (3). To overcome these socio-economic differences and to prevent hunger in the classroom, raise students' enrolment and retention rates, strengthen social integration, and improve the nutritional status of

school children the National Programme for Nutritional Support to Primary Education (NP-NSPE), called Midday Meal (MDM) Scheme, which is the large school-based nutritional program in the world, was launched on August 15, 1995, in India and the scheme was revised in 2007 to cover students in the upper primary class (4,5). The MDM program is considered a substitute for the home meal.

Several studies in India have been conducted among children and adolescents by many researchers to find the impact of MDM on nutritional status (1,2,3,6,7,8) and the improvements in enrolment, attendance, and retention rates (9,10,11). A recent review paper on the impact of MDM on nutritional status and academic performance reported that there were mixed results related to the effectiveness of the MDM scheme in improving dietary outcomes while, significant improvements in enrolment, attendance, and retention rates among the MDM beneficiaries in comparison to the non-MDM groups (12). Most studies conducted in West Bengal among children and adolescents were about the impact of the MDM program on student's enrolment, retention, and academic achievements (10, 13). Present study will focus on undernutrition as it continues as an economic macro issue related to food entitlements, poverty, and socio-economic structure of the society etc. (14). Our search strategy did not find any study conducted to assess the nutritional status and its association with midday meal consumption as well as with different socio-economic and demographic variables among the MDM beneficiary adolescents in the area selected for the present study as well as in West Bengal.

OBJECTIVES OF THE STUDY

The main objectives of the present study are as follows

1. To compare the anthropometric characteristics and nutritional status of the regular MDM eating and never/occasionally eating groups.
2. To find the socio-economic and demographic correlates of undernutrition (stunting and Wasting) among the midday meal (MDM) beneficiaries.
3. To find if there is any association between midday meal consumption (based on regular and never/occasionally receiving groups) and nutritional status.

II. MATERIALS AND METHODS

Study Area, Participants and Data collection

The present cross-sectional study was carried out among the Bengali medium government school students (class V to VIII), situated in Shivmandir, Matigara, and Champasari areas under the Siliguri sub-division of Darjeeling (from July 2023 to October 2023). At first, a total of 312 Bengali adolescents of 10-15 years were selected using a stratified random sampling method. But as the number of 15-year-olds was less in number (only 9) they were excluded. Thus the sample size became 303 (151 boys and 152 girls). A total of five schools were selected based on easy road access, but we got permission (either written or verbal consent was taken) from three schools. The participants were also informed about the objective of the study. The date of birth was confirmed from either the birth certificate or school identity cards. A pre-tested, semi-structured schedule was used to collect various socio-economic and demographic data.

Measurements taken

Anthropometric measurements such as Height and weight were taken by first author, using the standard technique and instruments (15). BMI was calculated using the formula BMI= Weight/Height^2 (kg/m^2). Height-for-age Z-score (HAZ) and BMI-for-age Z-score (BAZ) (<-2 SD) were used to assess the prevalence of stunting and wasting (3, 14).

Socio-economic and Demographic Data

Demographic data such as age, gender, birth order (parity) and number of siblings and socio-economic data such as parental education, parental occupation and socio-economic class were collected and categorized into two groups as shown in table 3a and 3b. As per the frequency of midday meal consumption adolescents were divided into two groups (regular, who eat midday meal everyday and never/occasional, who eat midday meal ≤3 days or never in a week). Fig 1 shows the socioeconomic status of the participants according to the modified Kuppuswamy socio economic scale (16). The majority of the participants (53.8%) belonged to the upper lower class (IV).

Statistical Analysis

Statistical analyses were carried out using WHO Anthro Plus and SPSS (v.26). We conducted an independent t-test to examine differences in anthropometric parameters based on sex. We also compared the height, weight, and BMI between regular and never/occasionally MDM-eating groups. Furthermore, we performed a Chi-square test to determine the significant association of stunting and wasting with MDM consumption and various socio-demographic and economic factors. A p-value of less than 0.05 and 0.01 was considered statistically significant.

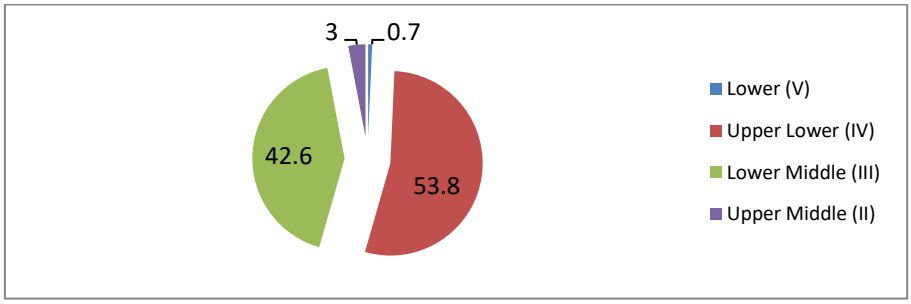

Fig 1: Distribution (%) of the participants based on the Socio-economic Class

III. RESULTS

The percentage of boys and girls were 49.83% and 50.17% respectively in this study and the mean ages of the boys and girls were 12.16±1.37 and 12.14±1.38 years, respectively. Table 1 showed that mean height and weight were more in case of boys than girls but BMI found to higher in case of girls. A significant negative sex-difference in case of height ($p<0.05$) was found among the participants. The values of mean HAZ among boys found to be greater than girls whereas, the case was reversed for BAZ. Again significant negative sex difference was observed for HAZ ($p<0.01$) but the sex-difference was insignificant for other anthropometric and derived variables (Table 1).

Table 1: Showing the mean and standard deviation (sd) of the anthropometric and derived variables among the studied participants (overall)

Variables	Boys (N=151)	Girls (N=152)	t-value
	mean±sd	mean±sd	
Height (cm)	149.27±11.84	146.28±7.65	-2.605*
Weight (kg)	41.05±12.56	39.64±9.36	-1.108
BMI (kg/m^2)	18.11±3.73	18.40±3.53	0.690
HAZ	-0.47±1.22	-0.92±0.96	-3.517**
BAZ	-0.31±1.59	-0.27±1.39	0.690

Table 2 represents the mean difference of the anthropometric and derived parameters between the regular and never/occasionally midday meal receiving groups (for both boys and girls). More boys (55) were preferred to eat midday meal compared to girls (31). It is seen that the mean of height, weight, BMI were higher in case of the adolescents who did not eat midday meal regularly in schools in comparison to their counterparts. No statistical significant difference was observed for any of the anthropometric parameters among the two groups except for height in girls ($p<0.05$). The mean values of HAZ was high among the non-regular midday meal groups for both gender but the mean value of BAZ was found high among the non-regular groups only in case of girls. According to the prevalence (%) of stunting the regularly eating midday meal group are more stunted (18.2% in boys and 16.1% in girls) compared to the non-regular group. But the prevalence of wasting (%) in case boys who never/occasionally eat (16.7%) midday meal was more than the regular eating group. Figure 2. represents the overall prevalence of stunting and wasting among the adolescents.

Table 2: Showing the mean (±SD) of the anthropometric parameters of the regular and never/occasionally midday meal eating groups.

Variables	Boys (N=151)		t-test	Girls (N=152)		t-test
	Regular (N=55)	Never/occasionally (N=96)		Regular (N=31)	Never/occasionally (N=121)	
Height (cm)	146.89±10.16	150.63±12.55	1.884	143.77±5.88	146.93±7.93	2.007 *
Weight (kg)	38.90±9.47	42.28±13.93	1.601	36.86±9.27	40.35±9.29	1.868
BMI (kg/m^2)	17.81±2.89	18.29±4.15	0.749	17.68±3.56	18.58±3.51	1.269
HAZ (stunting%)	-0.56±1.28 (18.2)	-0.42±1.20 (8.3)	0.676	-1.07±0.88 (16.1)	-0.88±0.98 (9.9)	0.950
BAZ (Wasting %)	-0.25±1.39 (10.9)	-0.35±1.70 (16.7)	-0.365	-0.48±1.42 (9.7)	-0.21±1.38 (8.3)	0.932

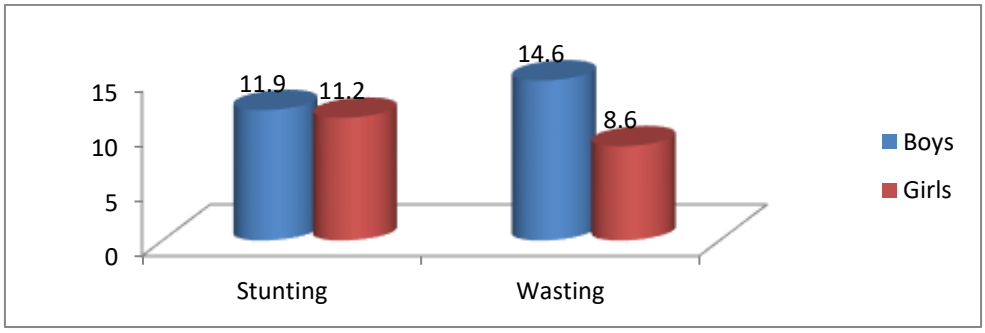

Figure 2: Gender-wise prevalence (%) of stunting and wasting among the studied participants

Table 3a represents that the prevalence (%) of stunted adolescents were more in 12-14 years age group, among boys, having 1st order of birth, those who have ≥2 sibs, parental education level is upto secondary (10th standard), whose fathers were associated with manual or other works, having working mothers, belongs to lower socio-economic class and who eat midday meal regularly. Chi square revealed that age, number of siblings,

mother's occupation, socio-economic class and midday meal consumption were the factors that were found to be associated with stunting.

Table 3a: Association (Chi-square) between Stunting and different socio-economic, demographic, and midday meal consumption among the studied participants

Variables	Categories	Frequency of stunted adolescents (%)	χ^2	p-value
Age	10-11 years	10 (7.0)	5.507*	0.019
	12-14 years	25 (15.6)		
Gender	Boys	18 (11.9)	0.040	0.841
	Girls	17 (11.2)		
Birth order/Parity	1st	21 (12.1)	0.136	0.712
	≥2	14 (10.8)		
Number of Siblings	Having no or one sib	22 (9.3)	5.191*	0.023
	≥2	13 (19.4)		
Father's Education	Secondary	28 (12.6)	0.835	0.361
	Higher Secondary & above	7 (8.8)		
Mother's Education	Secondary	32 (12.4)	1.129	0.288
	Higher Secondary & above	3 (6.8)		
Father's occupation	Manual & others	29 (11.4)	0.028	0.868
	Business & Professionals	6 (12.2)		
Mother's occupation	Housewife	15 (7.5)	9.769**	0.002
	Working	20 (19.6)		
Socio-economic class	Middle	9 (6.5)	6.274*	0.012
	Lower	26 (15.8)		
Midday meal consumption	Never/occasional	20 (9.2)	4.078*	0.043
	Regular	15 (17.4)		

The prevalence of wasting (%) was high among 12-14 years of age group, among boys, those having 1st order of birth, having ≥2 siblings, whose parental education was upto secondary level, whose fathers were businessman and professionals, working mothers, who were from lower socio-economic class and who never/occasionally eat midday meal. Only age and father's occupation was found to be associated with wasting among the studied participants (Table 3b).

Table 3b: Association (Chi-square) between Wasting and different socio-demographic, socio-economic factors and midday meal consumption among the studied participants

Variables	Categories	Frequency of wasted adolescents (%)	χ^2	p-value
Age	10-11 years	10 (7.0)	5.507*	0.019
	12-14 years	25 (15.6)		
Gender	Boys	22 (14.6)	2.684	0.101
	Girls	13 (8.6)		
Birth order/Parity	1st	21 (12.1)	0.136	0.712
	≥2	14 (10.8)		

Number of Siblings	Having no or one sib	25 (10.6)	0.959	0.328
	≥2	10 (14.9)		
Father's Education	Secondary	26 (11.7)	0.010	0.922
	Higher Secondary & above	9 (11.3)		
Mother's Education	Secondary	33 (12.7)	2.473	0.116
	Higher Secondary & above	2 (4.5)		
Father's occupation	Manual & others	25 (9.8)	4.488*	0.034
	Business & Professionals	10 (20.4)		
Mother's occupation	Housewife	20 (10.0)	1.498	0.221
	Working	15 (14.7)		
Socio-economic class	Middle	14 (10.1)	0.490	0.484
	Lower	21 (12.7)		
Midday meal consumption	Never/occasional	26 (12.0)	0.139	0.710
	Regular	9 (10.5)		

IV. DISCUSSION

The boys were found to be taller and heavier than the girls. It was also observed that among the genders, height, weight, and BMI were found to be higher in the never/occasionally received MDM group (Table 2). There was a significant difference in terms of height for girls among the MDM groups, which is consistent with the study of Patel et al. 2016 (3). Study conducted by Udgata et al. (2022) (5) among the early adolescent girls under the midday meal scheme reported very high prevalence of underweight (56.66%). Findings from a longitudinal study (1) among children and adolescents under midday meal scheme for a long time revealed that the MDM programme had a significant impact on lowering the prevalence of underweight. It was also found from the same study that MDM were more effective for those children to fight with underweight if consumed only at younger ages. Kaur et al. (2024) found the prevalence of stunting and wasting was to be higher in case of girls (30% & 25%) than boys (23% & 23%) (2) which are opposite to our study findings. Another study among the early adolescents to know the impact of midday meal on the health and nutritional status in Mumbai found 5% boys were stunted and 3% of them was severely stunted whereas, 6% of the girls were stunted (7). It was found that MDM has an effect on nutritional status and one meal gives a calorific value of 357.6. The same study also found a significant difference between the distribution of MUAC during the pre and post nutritious period in government school students (getting MDM) and BMI showed a significant difference between government school students (at $p<0.005$) (8). But the study did not find any significant difference between other anthropometric measurements such as height, weight and triceps thickness. This study also reported greater anthropometric measurements among the private school students who did not get the midday meal but bring their own tiffin from home. Similar findings were observed from present study that the regular MDM eating groups had lower anthropometric measurements compared to the never/occasionally eating group. Prevalence of stunting (boys 24% and girls 19%) and wasting (boys 17% and girls 18%) was significantly higher in adolescents receiving MDM among the Gujarati adolescents (3). This study also observed a greater mean of the anthropometric measurements (Height, weight and BMI) among the MDM non-receiving group.

Hence, it can be said that, though the midday meal scheme is successful to reduce classroom hunger and retention rate of the school students but somehow the meal is not enough to combat malnutrition specially stunting. Present study also found a significant association between stunting and MDM among the school-going adolescents but not with wasting. The previous comparative studies generally undertook between the

government and private school students whereas, the present study considered the government schools where the socio-economic background of the participants were same for the two comparative groups (based on the frequency of MDM consumption). Again present study not only considers the MDM consumption frequency rather it also showed how different socio-economic and demographic factors are related to undernutrition among the school-going midday meal beneficiaries. The study may add some knowledge to the existing literature regarding the midday meal consumption and its impact on nutritional status of the midday meal beneficiary adolescents. However, this study also had some limitations, such as its cross-sectional design, the small sample size and the lack of data regarding the menu/food items provided in midday meal to the children.

V. CONCLUSION

Boys were found to vulnerable than the girls. Present findings reported a significant association between stunting and midday meal consumption but not with wasting. Age, number of sibs, mother's occupation, father's occupation and socio-economic class were the most significant factors found to be associated with undernutrition among the studied participants. Proper nutritional interventions and awareness through school and/or different NGOs can reduce the prevalence of undernutriton among the school-going adolescents.

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