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Original Article

Assessing the Role of Mid-day Meal (MDM) on the Nutritional Profile of School Going Children: Snapshot of a Suburban School

Biswangree A[1], Islam M F[2], Tabassum M N[3], Raha R A[4], Alam S[5], Ismail M[6], Imam M S[7], Banu T[8]*

Abstract

Background: Children's well-being has been a critical public health concern and an essential determinant of a nation's overall growth. Although Government has initiated mid-day meal programs particularly in rural areas to improve school-age children's health and nutrition, data on the nutritional status of sub-urban school children still remain limited.

Objective: The present study investigated the nutritional profile of the children receiving mid-day meal (MDM) in a sub-urban school.

Methodology: A descriptive, cross-sectional study was conducted among 181 school students of a suburban school in Chattogram. Students from Kinder Garten (KG) level to Class 5 (aged 5-16 years) were interviewed. Sociodemographic, anthropometric and data related to mid-day meal (MDM) were recorded and analyzed. Descriptive statistics were performed using Microsoft Excel.

Results: The mean age of the participants was 9.43 ± 2.76 years. Most of them were girls (62.43%). The basal metabolic rates of day shift students (girls: 1154.817 kcal/day; boys: 1083.628 kcal/day) were consistently higher than those of morning shift students (girls: 1025.149 kcal/day; boys: 906.737 kcal/day), indicating age-related physiological differences. Height-for-age Z-scores revealed that 20.54% of girls and 8.68% of boys were stunted. BMI-for-age analysis indicated that 38.24% of boys and 32.77% of girls were underweight. Severe undernutrition (<−3 SD) was observed in 20.59% of boys and 13.27% of girls.

Conclusion: The Mid-day meal (MDM) program in a school contributes to reduce hunger among the students during school period. In this study, 37.68% of boys and 33.04% of girls are underweight, and boys are more likely to suffer from mild to severe malnutrition by height for age and BMI for age metrics, despite getting MDM regularly. It is still insufficient to treat all nutritional issues. In order to determine the efficacy and long-term effects of school feeding programs in Bangladesh, the study emphasizes the necessity for future large scale research.

Key words: Mid-Day Meal (MDM), malnutrition, school children, sub-urban area.

1. Arpita Biswangree
Research Assistant, Chittagong Research Institute for Children Surgery (CRICS), Panchlaish, Chattogram 4203, Bangladesh
Email: arpitaleembiswangree@gmail.com
ORCID ID: https://orcid.org/0009-0009-5502-744X

2. Md. Fahadul Islam
Research Intern, Chittagong Research Institute for Children Surgery (CRICS), Panchlaish, Chattogram 4203, Bangladesh
Email: fahadiw673@gmail.com
ORCID ID: https://orcid.org/009-0001-2664-4475

3. Mustari Nailah Tabassum
Research Intern, Chittagong Research Institute for Children Surgery (CRICS), Panchlaish, Chattogram 4203, Bangladesh
Email: mustarinaila19@gmail.com
ORCID ID: https://orcid.org/0000-0003-2836-1847

4. Rahatil Asyekin Raha
Research Intern, Chittagong Research Institute for Children Surgery (CRICS), Panchlaish, Chattogram 4203, Bangladesh
Email: rahatilraha3@gmail.com
ORCID ID: https://orcid.org/0009-0002-4086-2513

5. Sakibul Alam
Research Assistant, Chittagong Research Institute for Children Surgery (CRICS), Panchlaish, Chattogram 4203, Bangladesh
Email: sakibalam8020@gmail.com
ORCID ID: https://orcid.org/0009-0005-5841-0963

Correspondence to: Professor Tahmina Banu
Director, Chittagong Research Institute for Children Surgery (CRICS), Panchlaish, Chittagong, 4203, Bangladesh
Phone: +8801711720635
Email: proftahmina@gmail.com

6. Mohammad Ismail
Research Assistant, Chittagong Research Institute for Children Surgery (CRICS), Panchlaish, Chattogram 4203, Bangladesh
Email: ismaildoc06@gmail.com
ORCID ID: https://orcid.org/0009-0000-7156-4741

7. Md Sharif Imam
Assistant Professor, Department of Paediatric Surgery, Chattogram Maa-O-Shishu Hospital Medical College, Agrabad, Chattogram, Bangladesh
Email: sharifimam58@gmail.com
ORCID ID: https://orcid.org/0000-0002-3973-6133

8. Tahmina Banu
Director, Chittagong Research Institute for Children Surgery (CRICS), Panchlaish, Chattogram 4203, Bangladesh
Email: proftahmina@gmail.com

Introduction:

Children are an indispensable part of a nation's development. Ensuring their well-being is a critical public health concern and a barometer of a society's overall growth [1]. The World Health Organization (WHO) states that the health status of school-aged children is closely connected to their social and environmental situations, such as socioeconomic factors, education, nutrition, and sanitation [2]. Poor child health and nutrition affect badly on long-term economic and human development, especially on the low-and middle-income countries (LMICs) [3]. Because in such countries, structural inequities in health care access, parental literacy, and living conditions disproportionately affect children in their most formative years [4].

Over 1.9 billion children are thought to reside in developing nations worldwide, and many of them suffer from avoidable illnesses that include malnutrition too [5]. Children of school age, usually those aged 5 to 15, spend a large amount of their time in learning environments. According to Langford et al. (2015), schools offer a vital venue for health interventions and disease prevention initiatives [6]. But the schools of low-income countries lack in coordinated and effective health initiatives for their students [7]. School-age children mainly suffer from many health conditions including stunting, underweight, anemia, iodine deficiency disorders, and vitamin A deficiency [3]. These issues are made worse in South Asia, notably Bangladesh, by systemic disregard for child-specific health infrastructure and sociocultural norms [8]. A scoping review in South Asia reported that diets are not sufficient to meet nutritional requirements [9].

A multicenter study involving low income countries (Ghana, Tanzania, Indonesia, Vietnam and India) assessed the anthropometric status of rural school children and found the overall prevalence of stunting and underweight to be high in all countries. The nutritional status of boys in the study was worse than girls [3]. Another study conducted comparing rural and urban areas of west bengal found that malnutrition was quite prevalent among rural girls [10].

Malnutrition is still a serious public health issue that has an impact on children's general well-being and also cognitive development. It affects a child's long-term health in addition to their ability to focus on study, and normal physical activities [11]. Several studies repeatedly show that childhood eating habits can affect individual's growth pattern, developmental outcomes, and illness vulnerability throughout life. Because of this, it is often acknowledged that developing appropriate eating habits at a young age is essential to promote long-term health [12]. However, changes in healthy eating is linked to inconsistent dietary choices and decreased intake of vital nutrients, increasing the likelihood of present and future health issues [13]. As a result, school-based nutrition programs have been put into place in several nations; the majority of these programs concentrate on preventing obesity and encouraging the intake of fruits and vegetables as part of a balanced diet [12].

Due to its preparation for the fast physical growth that characterizes adolescence, the school-age era itself is a window of nutritional sensitivity. During these years, it is crucial to consume enough protein and calories to avoid undernutrition, which can cause underweight, wasting, stunting, weakened immunity, and poor cognitive and academic performance [14]. The mid-day meal program in Bangladesh attempts to avoid these consequences by giving school-age children extra food, which serves as a significant supplement to the home diet rather than an alternative. In order to address frequent nutritional deficiencies during school hours and promote development and learning, the program is designed to provide around one-third of the child's daily energy requirements.

The lack of a nationwide school health surveillance system in Bangladesh has resulted in data gaps, especially in suburban areas that are underrepresented. Although previous study has examined the differences in child health between rural and urban areas [15], suburban populations who are frequently trapped between urbanization and infrastructure neglect remain the subject of a significant lack of research. Since 2011, Government of Bangladesh and the United Nations World Food Program (WFP) have been implementing 'School Feeding Program in Poverty-prone Areas' to provide nutritional support to school going children [16].

But little attention was given to the schools of low income communities of urban areas. Therefore, using the results of a recent school health screening program in a suburban area of Chattogram, the present study aimed to investigate the nutritional profile of the children receiving mid-day meal in a sub-urban school.

Methodology:

Study design: This was a single-day cross-sectional study conducted among 181 students at a school of sub-urban area on 9th April, 2025 in the district of Chattogram. The school was established by A.K. Khan Foundation, a non-profit social welfare organization in Chattogram. Since its establishment (1991), the foundation is actively contributing to different types of philanthropic activities including health, education, social welfare and more in Chattogram city and across the country. There are two shifts in the school- the morning shift operates from 9:00 AM to 11:15 AM and the day shift runs from 11:45 AM to 3:40 PM.

The study team consisted of 30 dedicated members. There were ten physicians, eight medical students and two CRICS members. The students and their parents were informed about the health camp by the school authority. The entire program was led by the expertise of pediatric surgeon and director of CRICS.

Survey administration: A comprehensive program schedule was sent to the A.K. Khan foundation two weeks before the visit to ensure that the program was properly organized. A questionnaire was developed to record the relevant information of the students. All the data collectors were briefed on the procedure of the data collection. Students who agreed to participate in the study with consent from their parents were included. Each student was given with a questionnaire and they were asked to carry the form at every station and return the forms after completing the survey. However, some information was collected from their parents as some students were unable to give accurate answer. ABO blood grouping and hemoglobin measurement were done at first and then clinical assessments of the students were performed by the panel of specialists at every station.

Study instrument: The questionnaire contained socio-demographic profile, information about Mid-Day-Meal (MDM) and health practice-related information. Socio-demographic questions included age, gender, religion, residence, and occupation of parents, housing condition, source and treatment of drinking water, hand washing habit, height, weight, BMI, immunization status, and deworming status. Dietary pattern was studied by interviewing the patients regarding MDM. The school authority provides MDM to all of their students. Rice, lentil and green vegetables are the main ingredients of the MDM. According to the school authority, they provide The school authority provides MDM to all of their students. Rice, lentil and green vegetables are the main ingredients of the MDM. According to the school authority, they provide approximately 13600 kcal (3kg rice, 2kg potato,300gm lentis,1L oil,500gm spice) to their students weekly. All the data was consolidated on an excel sheet. The students were asked to report any present illnesses and any known congenital anomalies, as well as their regular health checkup history. These data were recorded in the general health section. ABO Blood grouping, Rh typing, and the measurement of hemoglobin level were also performed and noted as general health-related data. Only the students who completed the survey were considered for the analysis.

Statistical Analysis: Data were analyzed using Microsoft Excel. Categorical data were presented as frequencies and percentages, while continuous data were reported as means and standard deviations. The dietary intake of the subjects was evaluated against Recommended Dietary Allowances (RDA) and calorie percentage contribution of MDM was analyzed. BMI for age and height for age were calculated and compared with World Health Organization (WHO) reference. This study maintained data confidentiality by omitting names from the case record forms. Data were collected and processed anonymously, with access restricted to authorized personnel only.

Results:

A descriptive analysis was conducted on a sample of 181 school-age children to understand the demographic and nutritional status receiving MDM. The age of the participants ranged from 5 to 16 years with a mean of 9.43 (± 2.76) years. Maximum students were girls (n=113, 62.43%). Number of students from Kinder Garten (KG), class 1, class 2, class 3, class 4, class 5 and above class 5 were respectively 27 (14.92%), 22 (12.16%), 25 (13.81%), 36 (19.89%), 26 (14.36%), 37 (20.44%) and 8 (4.42%). A good number of students were Muslim (n= 167, 92.27%), followed by Hindu (n= 11, 6.07%) and Buddhist (n= 3, 1.66%). In the present study, it was found that majority of the fathers were manual worker (n= 95, 52.49%), followed by professional/managerial/technical employee (n= 44, 24.31%) and self-employed (n= 12, 6.63%). Most of the mothers were housewives (n= 119, 65.74%), followed by manual laborers (n=35, 19.33%) and 7.73% (n= 14) in professional or technical roles.

Out of 181 students, more than half (53.04%) lived in semi-pucca houses. Among 70.17% (n= 127) had history of complete immunizations, with only 33.15% (n= 60) having dewormed. 12.16% (n=9) of morning shift students brought food from home, compared with a higher value in the day shift (n=42, 40%) [Table 1].

Table 1: Characteristics of the participants (N= 181)

Variables	N	%
Age (mean ± SD)	9.43 ± 2.76	
Gender		
Girls	113	62.43
Boys	68	37.57
Class		
KG	27	14.92
Class 1	22	12.16
Class 2	25	13.81
Class 3	36	19.89
Class 4	26	14.36
Class 5	37	20.44
Above class 5	8	4.42
School Shifts		
Morning shift	74	40.88
Day Shift	107	59.12
Religion		
Islam	167	92.27
Hinduism	11	6.07
Buddhism	3	1.66
Father's Occupation		
Not alive	5	2.76
Manual worker	95	52.49
Professional/Technical/Managerial	44	24.31
Non Resident Bangladeshi (NRB)	2	1.1
Self-employed	12	6.63
Unknown	23	12.71
Mother's Occupation		
Not alive	2	1.1
Manual worker	35	19.33
Professional/Technical/Managerial	14	7.73
Housewives	119	65.74
Unknown	11	6.1
Housing Facility		
Semi pacca	96	53.04
Pacca	52	28.73

N= Number of participants, SD= Standard Deviation

Below, table 2 presents the distribution of Mid□ Day Meal (MDM) uptake across the two shifts. In the morning shift comprising the younger students (KG to class 2), 67 out of 74 students consumed the MDM, representing a strong uptake rate of 90.54%. In contrast, the day shift, consisting of students from classes 3 to 5, recorded an uptake rate of 80.37% (n=86), out of 107 students participating. The difference may be attributed to variations in appetite, parental preferences, or the tendency for older children to bring their own food.

Table 2: MDM Uptake distribution in both shifts

MDM in Both Shift		
	N	**%**
Morning Shift	67 (74)	90.54
Day Shift	86 (107)	80.37

Table 3 summarizes BMR values (kcal/day) for students in morning (N=74) and day (N=107) shifts, grouped by gender. The morning shift consists of younger children, specifically those in class KG to class 2, while the day shift includes older students from class 3 to class 5. Among female students, 44 girls in the morning shift (59.46%) recorded a mean BMR of 1025.149 kcal/day, whereas 69 girls in the day shift (64.48%) showed a higher average BMR of 1154.817 kcal/day. A similar pattern was observed among male students: 30 boys in the morning shift (40.54%) had a mean BMR of 906.737 kcal/day, while 38 boys in the day shift (35.51%) demonstrated a notably higher mean BMR of 1083.628 kcal/day. In addition to this, the students get on average 1942 Kcal/day from their MDM, calculated from total weekly calories 13600 Kcal/day.

Table 3: Basal Metabolic Rate (BMR) for students according to the shifts and gender

BMR in Both Shift	**Morning Shift (74)**			**Day Shift (107)**		
	N	**%**	**Average (Mean) – (Kcal/day)**	**N**	**%**	**Average (Mean)- (Kcal/day)**
Female	44	59.46	1025.149	69	64.48	1154.817
Male	30	40.54	906.737	38	35.51	1083.628

However, Table 4 represents the distribution of height-for-age Z scores of the study subjects following the WHO children growth chart (2007). In our study,

stunting was slightly more in girls than boys. More than 40% of girls had height for age below Z score of -1 SD. Almost 17.70% of girls were moderately stunted, while only 5.88% of boys fell in this category. Then, 2.65% of girls were severely stunted. However, mild stunting was found in 22.12% of girls. Similarly, among boys, 25% were mildly stunted and 2.94% were severely stunted.

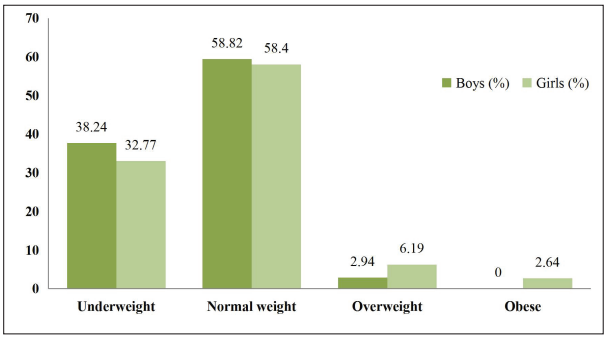
Table 4: Height for age of the participants using Z scores (n= 181)

Z score	Boys (68)		Girls (113)	
	N	%	N	%
<-3 SD	2	2.94	3	2.65
<-2 SD to -3 SD	4	5.88	20	17.70
<-1 SD to -2 SD	17	25.00	25	22.12
>-1 SD to Median	26	38.24	40	35.40
Median to +1 SD	12	17.65	14	12.5
> +1 SD to +2 SD	4	5.88	8	7.14
> +2 SD to +3 SD	3	4.41	1	.89
> +3 SD	0	0	2	.89

The BMI for age was calculated for the participants and burden of under nutrition and over nutrition was assessed by using WHO (2007) reference. According to the Table 5, approximately 38.24% of the boys and 32.77% of the girls were in different categories of underweight. On the other hand, 8.83% of the girls and 2.94% of the boys were overweight. Although most of the participants were in the category of undernourished, severe under nutrition (<-3 SD) was observed among 20.59% of the boys and 13.27% of the girls respectively. Moderate under nutrition was more prevalent among boys (16.18%) than girls (14.16%). Similarly, boys were more (26.46%) in the mild under nutrition category than girls (25.66%). The differences of nutrition status between boys and girls are illustrated in Figure 1. Therefore, it can be concluded that there is a high prevalence of stunting and underweight among the sub-urban school children instead of providing sufficient calories through MDM.

Table 5: BMI for Age of the study participants Using Z scores (n=181)

Z score	Boys (68)		Girls (113)	
	N	%	N	%
<-3 SD	14	20.59	15	13.27
<-2 SD to -3 SD	12	17.65	22	19.50
<-1 SD to -2 SD	11	16.18	16	14.16
> -1 SD to Median	18	26.46	29	25.66
Median to +1 SD	11	16.18	21	18.58
> +1 SD to +2 SD	2	2.94	7	6.19
> +2 SD to +3 SD	0	0	3	2.64
> +3 SD	0	0	0	0



Discussion:

The current study evaluated the nutritional status of 181 children of a sub-urban school who received MDM. The results provide crucial information about the prevalence of malnutrition in the students, which should be compared to the existing literatures already available on children health and nutrition. Long-term nutritional status and growth are reflected in height-for-age Z scores. Of the boys, 2.94% were severely stunted and 8.72% were stunted (< -2 SD). On the other hand, 20.35% of females had stunting, with 17.70% being moderately stunted and 2.65% being severely stunted. These results are consistent with national data showing that sociocultural gender differences in some rural areas lead to a higher prevalence of chronic undernutrition among girls [17,18].

This degree of stunting is a sign of chronic malnutrition and a high rate of sickness in early life. It is consistent with research from rural India that shows school-age children, particularly females, have unequal access to healthcare and nutrition [19]. Concerns about intra-household food distribution and long-term health consequences are raised by the increased percentage of females in the moderate stunting category.

We discovered that 32.77% of girls and 38.24% of boys were

thin (BMI-for-age < −2 SD). 81.5% of girls and 83% of boys in West Bengal's rural areas are alarmingly thin, according to comparable research [10]. Stunting rates were roughly 17–18% and thinness rates were 15–16% among tribal people, according to another study [20]. These consistent findings suggest that without addressing dietary diversity and quality, MDM coverage alone may not be sufficient to reduce acute undernutrition. Furthermore, only 2.64% of females were found to be obese, and only 2.94% of boys and 6.19% of girls were overweight. These numbers fall short of metropolitan trends, which show an increase in childhood obesity and overweight, especially in private school environments [21]. Although the dual burden of malnutrition may yet manifest in the future as dietary patterns change, the low levels of obesity indicate that the midday meal intervention has not contributed to over nutrition.

BMI z-scores were found to be strongly correlated with changes in blood pressure and muscle strength in a recent study by Mirandra et al. (2024), suggesting the significance of a healthy BMI for school-aged children's cardiovascular health and physical performance [22].

A summary of the Mid Day Meal (MDM) related findings from the current study reveals several important insights into children's dietary patterns and the functioning of the school feeding program. More than 80% students consumed the MDM every school day, indicating strong acceptance and dependence on the meal. Although the study did not document the exact number of meals that children consumed at home, it did highlight that older students in the day shift (39.25%) and younger students (12.16%) in the morning shift supplemented the MDM with food brought from home primarily. This difference may reflect varying appetites, eating practices at home, or timing of school hours for older students. Overall, these observations underscore the importance of MDM in ensuring immediate energy adequacy for school□ aged children while highlighting the need for future studies to explore meal quality, dietary practices at home, and functional outcomes such as behaviour, attention, and learning.

Calorie adequacy from the MDM was determined to be satisfactory in our study. The students get on average 1942 Kcal/day from their MDM, calculated from total weekly calories 13600 Kcal/day. According to analysis, the younger girls need 1025.149 kcal/day and the older girls need 1154.817 kcal/day on average. Similarly, the younger boys need 906.737 kcal/day and the older boys need 1083.628 kcal/day on average. This demonstrates how well the midday meal program meets people's immediate energy demands. Moreover, 1942 kcal per kid per day was the average ration, which is in close accordance with the dietary allowances advised for school-age children who participate in moderate physical activity [23].

Food insecurity or a lack of health literacy may be linked to limited maternal work, which could have an impact on children's development. In our study, about 66% mothers were housewives. Maternal education and work play a significant role in determining the nutritional outcomes of children. Additionally, according to Humphrey (2009), 53% of students lived in semi-pacca households, indicating small living quarters that would not have proper sanitation, which would exacerbate nutritional losses brought on by infections [24].

The continuation of undernutrition, especially stunting and thinness, despite high levels of caloric coverage through the midday meal program suggests deficiencies in dietary diversity and nutrient density. Future initiatives should concentrate on enhancing meal quality by utilizing foods that are high in protein and micronutrients, in addition to addressing calorie sufficiency. Therefore, to evaluate the long-term effects of nutrition on functional outcomes, ongoing monitoring is necessary.

Strength and Limitation

To our best knowledge, ours is the first study to investigate the nutritional status of the students of a low income area school of Chattogram city that provides Mid-day meal to their students. The inclusion of both anthropometric measures (height-for-age, BMR, and BMI-for-age) and dietary pattern assessment gives a comprehensive picture of nutritional health. However, the study has some limitations. Due to the nature of the study design, it cannot establish relationship between dietary intake, socioeconomic factors, and nutritional outcomes. Moreover, the study did not include student or parental perceptions of meal quality, hygiene, or preparation standards, nor did it report complaints about undercooked or stale food. Similarly, the study could not assess whether children felt hungry after consuming the meal or whether the program improved behaviour, concentration, or school performance. As all children in the school received MDM, no comparison could be made between children enrolled and not enrolled in the program. Nevertheless, the high uptake rate suggests general satisfaction with the high caloric adequacy and regular consumption. The MDM likely plays an essential role in preventing mid□ day hunger and supporting classroom engagement.

Conclusion

The Mid-day meal (MDM) program in a school contributes to reduce hunger among the students during school period. This study highlights the role of Mid-Day Meal (MDM) program in school children's nutrition in Bangladesh by meeting required caloric demands for both girls and boys. Despite the MDM, 38.24% of boys and 32.77% of girls are underweight, and boys are more likely to suffer from mild to severe malnutrition. Therefore, although the MDM program is beneficial, it is still insufficient to treat all nutritional issues. To achieve better results, it will be crucial to study children's eating

habits outside of school and to improve the variety and quality of school meals. In order to improve the efficacy and long-term effects of school feeding programs in Bangladesh, the study emphasizes the necessity for future large□scale research.

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