Original Article

# Nutritional Status of Mid-Day Meal Programme Beneficiaries: A Cross-sectional Study among Primary Schoolchildren in Kottayam District, Kerala, India

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## Abstract

**Background:** The efficiency of Mid-Day Meal (MDM) Programme in India to ensure the optimum nutritional status of its beneficiaries is rarely studied. **Objective:** This study assessed the nutritional status of 6–10-year-old schoolchildren who were the beneficiaries of MDM and the child-related factors affecting their nutritional status. **Methods:** A cross-sectional study was performed among 322 children from 12 randomly selected primary schools in one block panchayat of Kerala state. The background information was collected from children and their parents, and anthropometric measurements of the children were observed. The prevalence of undernutrition was estimated using conventional indices (stunting, underweight, and wasting) and composite index of anthropometric failure (CIAF). Logistic regression analysis was used to estimate odds ratios (ORs) and 95% confidence intervals (CIs). **Results:** The prevalence of CIAF was 45.7% (95% CI: 40.3%–51.1%) and that of stunting, underweight, and wasting were 13.4% (9.7%–17.1%), 38.8% (33.5%–44.1%), and 30.7% (25.7%–35.7%), respectively. The prevalence of wasting (42.6% vs. 28.4%, $P = 0.039$) and severe underweight (20.4% vs. 7.1%, $P = 0.002$) was statistically significantly high among occasional/never users compared to regular users of MDM Programme. Children born with <2.5 kg showed an OR of 1.76 (95% CI: 0.99–3.11) for being undernourished compared to children born with normal weight (≥2.5 kg) when adjusted for age, sex, birth order, and illness in the past 2 weeks. **Conclusion:** This study showed a higher prevalence of undernutrition among school-age children who were the beneficiaries of MDM Programme, and this indicates the need for continuous nutritional interventions and surveillance among these children.

**Key words:** Composite index of anthropometric failure, Mid-Day Meal Programme, nutritional status, primary schoolchildren

## Introduction

School age, also known as middle childhood (6–10 years of age), is the fourth developmental stage in one's life span after infancy, toddler, and preschool stages.[1,2] It is the transition phase between childhood and adolescence marked by the active growth and development.[2,3] Moreover, school age acts as the preparatory period with adequate nutritional reserves for the rapid growth and development in adolescence.[4] Nutritional imbalance in school-age children can have serious health implications for their lifetime.[3-6] However, most of the health and nutritional surveys and interventions focus on children <5 years of age and/or adolescents, considering them as the most vulnerable groups and school-age children are usually get neglected.[7]

There are many factors affecting the nutritional status of school-age children, including child-related factors such as age, sex, birth order, birth weight, dietary pattern, and history of any illness; socioeconomic factors such as family income, education, and occupation of parents; and environmental factors such as place of residence, availability of adequate food and safe water, and environmental hygiene.[8-14]

The National Programme for Nutritional Support to Primary Education, popularly known as Mid-Day Meal (MDM) Programme in India started on August 15, 1995, is the largest school-based nutritional program in the world.[15,16] In Kerala,

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school nutritional program was first implemented in 1960, and from 1995 onward, it came under central government sponsored MDM Programme.[17] This programme is intended to eliminate the classroom hunger, improve the nutritional status of the upper and lower primary schoolchildren (first to eighth standards), increase enrollment and retention of students, enhance social integration, and inculcate good food habits in children.[15,18,19]

Studies on MDM Programme found that it was successful in terms of increasing the enrollment and retention rates in schools as well as to address classroom hunger particularly in tribal areas with endemic poverty and hunger.[18,20,21] In this paper, we assessed the nutritional status of 6–10-year-old children who are the beneficiaries of MDM Programme, and the child-related factors affecting their nutritional status.

## Materials and Methods

### Study design and sampling procedure

This study was a cross-sectional survey carried out from June 15 to August 31, 2014, in 12 primary schools coming under MDM Programme, randomly selected from a block panchayat (local administrative units) in Kottayam district, Kerala. One block panchayat was randomly selected from a total of 11 block panchayats in Kottayam district. With the prevalence of undernutrition among 6–10-year-old children as 27% (Kerala, National Nutrition Monitoring Bureau [NNMB] report-2012),[22] 95% confidence interval (CI) having a precision of 7%, design effect of two, and a nonresponse rate of 25%, the sample size was estimated to be 388 and it was rounded to 400 as the final sample size. The Institute Ethical Committee permission was obtained before conducting the study.

There were 21 government (746 students) and 33 aided (4137 students) primary schools in the selected block panchayat with a total of 4883 students in a 1:5.5 ratio. To maintain the proportion of children from government and aided schools in the sample, we decided to take 64 students from the government and 336 students from the aided schools. We randomly selected four government schools and eight aided schools to recruit the target number of children. Class-wise (1st to 4th standard) list of students was obtained from each school register, and the participants were randomly selected keeping almost equal number of children from the 1st to 4th standards.

The children were randomly selected on the 1st day of visit to each school. The children who were severely sick or differently abled (e.g., children with autism) were excluded from the study. Furthermore, children from the 1st to 4th standards who were <6 years or more than 10 years of age and who were absent on the 1st day of school visit were excluded from the study. The age of the children was ascertained from the school register, which was based on birth certificate.

Informed consent form was given to the children to get consent from their parents/guardians. A questionnaire was sent along with the consent form to get information on children's birth order, birth weight, history of any acute illness in the past 2 weeks (fever, cough, diarrhea, or any such illnesses) and the pattern of taking MDM from school if the parent consented to participate. The schools were again visited after 3 to 5 days and collected the signed informed consent and questionnaire from students.

Anthropometric measurements (height and weight) of the children were taken using standardized instruments (SECA: 813 Electronic Flat weighing scale and SECA: 213 stadiometer) by strictly following the WHO guidelines.[23] The measurements were taken in a closed room with adequate lighting and under the supervision of a teacher in the school to make children comfortable The measurements were taken without wearing footwear, and the children were supposed to wear minimal clothing while weighing.

Principal investigator alone took the measurements and checked the measurements thrice for the first few students each day to check the instrument's validity. The stadiometer reading was taken at the eye level and ensured that pointer of the weighing scale was at zero before weighing each child. Same instruments were used throughout data collection.

### Statistical analysis

The data entry and analysis were performed using statistical software SPSS (IBM Corp, Released 2012, IBM SPSS Statistics for Windows, Version 21.0, Armonk, NY: IBM Corp). The Z-score interpretation recommended by the WHO was used to estimate the prevalence of undernutrition in terms of conventional indices such as stunting (low height for age), underweight (low weight for age), and wasting (low body mass index for age).[23] To get a single aggregate prevalence of undernutrition (prevalence of any form of anthropometric failure), the composite index of anthropometric failure (CIAF) was used.[12] According to CIAF classification, the nutritional status was divided into seven categories such as Group A – No failure; Group B – Wasting only; Group C – Wasting and underweight; Group D – Wasting, stunting, and underweight; Group E – Stunting and underweight; Group F – Stunting only; and Group Y – Underweight only. The sum of Group B to Group Y constitutes the aggregate value of CIAF. Those who come under Groups C, D, and E are said to have multiple anthropometric failures, and those in B, F, and Y Groups are said to have a single anthropometric failure. Another theoretical combination would be "wasted and stunted" but this is not physically possible since a child cannot simultaneously experience stunting and wasting but not be underweight.[12] If the value of CIAF is high, it indicates a higher prevalence of any form of anthropometric failure.

The relationship between CIAF and factors such as age, sex, birth order (first, second and third, or higher), birth weight (<2.5 kg, ≥2.5 kg), and history of any acute illness in the past 2 weeks (present or not present) was assessed. The associations were tested using Chi-squared test and odds ratios, and CIs were estimated using binary logistic regression analysis.

## Results

Out of 400, only 338 children brought the consent form and completed questionnaire back to school. Reasons for nonparticipation in the study were parents did not give consent (16), children forgot to bring the consent form and questionnaire (46), and absent on the days of data collection (16). The final response rate was 80.5% with a sample size of 322.

The prevalence of undernutrition using conventional indices and the CIAF is described in Table 1. Overall 54.3% (175) of students did not show any form of anthropometric failure. The prevalence of CIAF according to the frequency of having MDM on all/most of the school days (regular users) and occasionally/never is also shown [Table 1]. The prevalence of stunting and underweight did not vary much with the frequency of MDM intake, but wasting was very high among children who take MDM occasionally/never compared to those having MDM regularly (42.6% vs. 28.4%; $P = 0.039$). Similarly, severe underweight was statistically significantly high among children who take MDM occasionally/never compared to regular users (20.4% vs. 7.1%; $P = 0.002$). The CIAF among children who take MDM on regular basis was 5.2% lesser than those who take MDM occasionally/never. Similarly, multiple anthropometric failures also showed a decrease of 7.0% among regular users though the results were not statistically significant.

Table 2 describes the prevalence of CIAF with respect to child-related factors. Birth weight was found to be the most important factor associated with CIAF when adjusted for other factors such as sex, age, birth order, and history of acute illness in the past 2 weeks. Children of low birth weight (<2.5 kg) showed 1.76 times higher odds for having CIAF during school age compared to children born with normal weight (≥2.5 kilograms). Further, we analyzed the prevalence of single or multiple anthropometric failures in accordance with birth weight of the children and found that multiple anthropometric failures were 44.1% among children with low birth weight compared to 28.5% among children with normal birth weight ($P = 0.047$). However, single anthropometric failure did not vary greatly [Figure 1].

## Discussion

There are many health and nutritional programs to monitor the growth and development of under-five children, but school age is the period when children are just out of such surveillance. Therefore, it is important to know whether

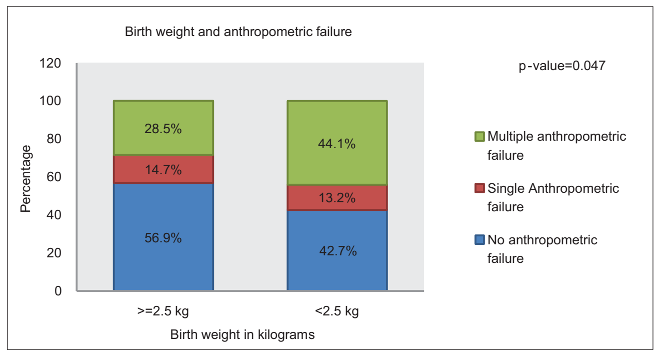


**Figure 1:** The prevalence of single or multiple anthropometric failures with respect to birth weight.

**Table 1: The prevalence of undernutrition among 6-10-year-old schoolchildren**

| Indicators | All children ($n$=322) | Children who take MDM on all/ most of the school days ($n$=268) | Children who take MDM occasionally/never ($n$=54) | $P$ |
|---|---|---|---|---|
| Conventional indices | | | | |
| Stunting | 43 (13.4) | 35 (13.1) | 8 (14.8) | 0.729 |
| Underweight | 125 (38.8) | 103 (38.4) | 22 (40.7) | 0.751 |
| Wasting | 99 (30.7) | 76 (28.4) | 23 (42.6) | 0.039 |
| Severe | | | | |
| Stunting | 3 (0.9) | 2 (0.7) | 1 (1.9) | 0.427* |
| Underweight | 30 (9.3) | 19 (7.1) | 11 (20.4) | 0.002 |
| Wasting | 29 (9.0) | 21 (7.8) | 8 (14.8) | 0.102 |
| CIAF | | | | |
| No failure (A) | 175 (54.3) | 148 (55.2) | 27 (50.0) | |
| Wasting only (B) | 21 (6.5) | 16 (6.0) | 5 (9.3) | |
| Wasting and underweight (C) | 58 (18.0) | 46 (17.2) | 12 (22.2) | |
| Wasting, stunting, and underweight (D) | 20 (6.2) | 14 (5.2) | 6 (11.1) | |
| Stunting and underweight (E) | 22 (6.8) | 20 (7.5) | 2 (3.7) | |
| Stunting only (F) | 1 (0.3) | 1 (0.4) | 0 | |
| Underweight only (Y) | 25 (7.8) | 23 (8.6) | 2 (3.7) | |
| CIAF=B + C+D + E+F + Y | 147 (45.7) | 120 (44.8) | 27 (50.0) | 0.482 |
| Single anthropometric failure | 47 (14.6) | 40 (14.9) | 7 (13.0) | 0.709 |
| Multiple anthropometric failure | 100 (31.1) | 80 (29.9) | 20 (37.0) | 0.298 |

Figures in the parentheses indicate percentages. $P$ values derived using Chi-squared test. *Fisher's exact test used to derive $P$ value. CIAF: Composite index of anthropometric failure, MDM: Mid-Day Meal Programme

**Table 2: Child-related factors associated with the prevalence of composite index of anthropometric failure**

| Category | Number of children (*n*) | Prevalence of CIAF, *n* (%) | ORs and 95% CIs | |
|---|---|---|---|---|
| | | | Unadjusted | Adjusted† |
| Age in completed years | | | | |
| 6 | 102 | 42 (41.2) | 1 | 1 |
| 7 | 90 | 51 (56.7) | 1.87 (1.05-3.32) | 1.58 (0.87-2.89) |
| 8 | 81 | 28 (34.6) | 0.76 (0.41-1.38) | 0.78 (0.41-1.47) |
| 9 | 49 | 26 (53.1) | 1.61 (0.81-3.21) | 1.61 (0.77-3.37) |
| Sex of the child | | | | |
| Male | 171 | 80 (46.8) | 1 | 1 |
| Female | 151 | 67 (44.4) | 0.91 (0.58-1.41) | 0.77 (0.48-1.25) |
| Birth order of the child | | | | |
| First | 137 | 59 (43.1) | 1 | 1 |
| Second | 130 | 68 (52.7) | 1.47 (0.91-2.39) | 1.42 (0.85-2.39) |
| Third or higher | 55 | 20 (35.7) | 0.73 (0.39-1.40) | 0.78 (0.39-1.54) |
| Birth weight of the child (*n*=300)* | | | | |
| Normal (≥2.5 kg) | 232 | 100 (43.1) | 1 | 1 |
| Low (<2.5 kg) | 68 | 39 (57.4) | 1.77 (1.03-3.07) | 1.76 (0.99-3.11) |
| History of any acute illness in the past 2 weeks | | | | |
| No | 139 | 68 (48.9) | 1 | 1 |
| Yes | 183 | 79 (43.2) | 1.26 (0.81-1.96) | 1.201 (0.75-1.93) |

*For 22 children, birth weight was not given by parents, †All factors were adjusted for each other. CIAF: Composite index of anthropometric failure, ORs: Odds ratio, CIs: Confidence intervals

the children are gaining or losing optimum growth and development during this period. Our results showed a higher prevalence of undernutrition in terms of CIAF (45.7%, 95% CI: 40.3%–51.1%). The prevalence of underweight in the present study was also high with 38.8% (95% CI: 33.5%–44.1%), and it was 38.0% for boys and 39.7% for girls. About 9.3% children were of severe underweight in our study. These results are higher than the national and the state level values reported by the NNMB in 2012. According to the NNMB report, the prevalence of undernutrition among children of age 5–9 years was 36.6% and 31% for boys and girls, respectively, in rural areas of India, and the prevalence of undernutrition in Kerala was 26.6% and 22% for boys and girls (5–9 years), respectively.[22]

Stunting is the result of chronic deprivation, and the estimated prevalence of stunting in this study was 13.4% similar to a study conducted in Kannur about 10 years ago.[24] This reveals the inadequacies of the existing system to deal with undernutrition even after a decade. However, when compared to studies conducted in other parts of the country using CIAF as the indicator, the present study shows a lower prevalence, which may be because of the better nutritional outcomes of children in Kerala compared to other states of India.[25-28]

Birth weight showed a strong association with the present nutritional status of the children similar to a study conducted among schoolchildren in Nigeria.[29] This finding gives evidence for the continuous effect of low birth weight in a deprived social scenario. We observed that only 43% of children with low birth weight had optimum nutritional status, and 43% of the children with normal birth weight had any form of anthropometric failure. The socioeconomic and environmental circumstances of the children may have an association with this change. Birth weight also found to be strongly associated with multiple anthropometric failures, which is a major concern requiring special attention from all stakeholders who address the problem of undernutrition.

This study did not show any variation in undernutrition between boys and girls similar to findings from a study conducted in Kannur district.[24] However, a higher prevalence of CIAF observed among children of 7 years followed by 9 years. Two studies conducted, respectively, in West Bengal and Uttar Pradesh also reported a higher prevalence of undernutrition among 9-year-old children.[27,30] The exact reason for these variations across each age group is unknown; however, the difference in the dietary intake and intensity of physical activities may be the reasons.[31,32]

The prevalence of acute illnesses (illnesses such as fever, vomiting, and diarrhea) reported by parents (49%) was very high in this study compared to 8% in the NNMB report (2012).[22] In addition, we observed from our data that the prevalence of CIAF among children with low birth weight and any acute illness in the past 2 weeks was 71.4% compared to 44.1% among children with normal birth weight and no illness in the past 2 weeks. This supports the fact that childhood morbidities and malnutrition mutually contribute each other.[33]

The prevalence of wasting and severe underweight was significantly high among children who take MDM occasionally/never, and we found that it is not associated with birth weight of the children since 85% of the children who take MDM occasionally/never had normal birth weight. However, a valid conclusion may not be possible because the number of occasional/never users among the study participants was very less (48) and we included only MDM beneficiary schools in our study.

To keep a proportionate sample of MDM beneficiaries, we selected 84% of the children from aided schools and 16% from government schools since the ratio of students in government and government-aided private schools in this area was 1:5.5. In addition, the response rate was more than expected (80.5%). We excluded overnutrition as the prevalence of overweight and obesity was very less (1.6% and 0.4%, respectively) among the participants. We did not survey the complete dietary pattern and micronutrient deficiencies of children as these were beyond the scope of this study. In addition, the information on birth weight of the children was given by the parents, and we did not cross check it with any birth record or registers to ensure the validity of the information as the questionnaire was sent to the parents through the children.

## Conclusion

The results of this study revealed the extent of anthropometric failure among 6–10-year-old primary schoolchildren who were the beneficiaries of MDM Programme. In brief, their nutritional status was not satisfactory and birth weight turned to be the important factor affecting the nutritional status of these children. The results indicate the need for continuous nutritional interventions and surveillance among these children.

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### Conflicts of interest

There are no conflicts of interest.

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