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ORIGINAL ARTICLE

Evaluating the Impact of School Meal Policies on Nutritional Outcomes Among Children

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ABSTRACT

The Mid-Day Meal (MDM) and PM POSHAN are the world's most extensive school-based nutrition programmes implemented in India, which have demonstrated an impact on both educational outcomes, in terms of academic achievement, as well as specific nutritional indices among children. However, ongoing stunting, micronutrient deficiencies, and regional disparities suggest that school meal policies and practices, although excellent in nature, require further enhancement in terms of quality, reach, and coherence with broader health strategies to realize their potential fully. Utilization of school meal policies is a key element in strategies to enhance child nutrition worldwide. The purpose of this paper is to estimate the impact of school meal interventions on nutrition-related outcomes by examining the policy design and implementation processes, as well as the effectiveness of the program. It focuses primarily on anthropometric measurements and food consumption, drawing on recent literature from systematic reviews and program evaluations. There is evidence that effectively administered school meal policies can lead to improved dietary quality, greater participation in meals, and modest improvements in child growth measures, including lower levels of obesity. Nonetheless, not all settings are equally served by policies, and challenges with the quality of meals and equity in access remain.

KEYWORDS

• Mid-Day Meal • PM POSHAN • Child Nutrition • School Meal Interventions • School Feeding Programs

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INTRODUCTION

Malnutrition and diet-related non-communicable diseases are still significant global health burdens for children. Many countries, including Brazil, have adopted school meal programs as policy instruments to combat nutrient deficiencies and alleviate hunger, thereby improving educational and health outcomes. The impact of these policies is continuously monitored to inform public health decisions and policy development. In this narrative review, we synthesize the latest evidence on the effects of school meal policy interventions to inform child nutrition in both global and Indian contexts.[1]

Background and Policy Rationale

School meal programs serve free or reduced-price meals during the school day with the goals of enhancing dietary quality, addressing food insecurity, and promoting learning. For example, in the US, millions of children, mostly from low-income households, are fed through the National School Lunch Program each year. In India, the Mid-Day Meal Scheme (MDMS) is one of the largest central government programs, designed to mitigate undernutrition, stunting, increase children's enrollment in primary schooling, provide employment opportunities, and empower women. In addition to hunger relief, modern nutrition policy frameworks have been centered on meal quality, diversity, and adherence to dietary recommendations key for addressing not only undernutrition but also the growing burden of childhood obesity. Cross-cutting approaches are becoming more common, for example, by incorporating school meal policies into food supply, agriculture, and social protection. Children's malnutrition is a significant public health problem in India, which has traditionally reported high levels of stunting (low height-for-age), wasting (low weight-for-height), underweight, and anaemia among children < 5 years. Recently renamed as PM POSHAN, the Mid-Day Meal (MDM) serves as the cornerstone of India's school-based nutrition intervention, providing millions of children with daily meals while also contributing to nutritional standards, community health initiatives, and child-centric educational objectives.[1,2]

1. Historical and Policy Context

The path of the Indian school meal policy reflects these major dimensions:[2-4]

a. **Launch & Scale:** The national launch of the MDM Programme was in 1995 and currently covers over 110 million children with a school touchpoint of over 1.12 million schools. The continued changes have influenced its path in food norms, quality regulations, and inclusion criteria.[20]

b. **Nutritional standards:** Meals deliver 450–700 kcal and 12–20 g protein, based on age-specific recipes designed to meet minimum dietary requirements.[22]

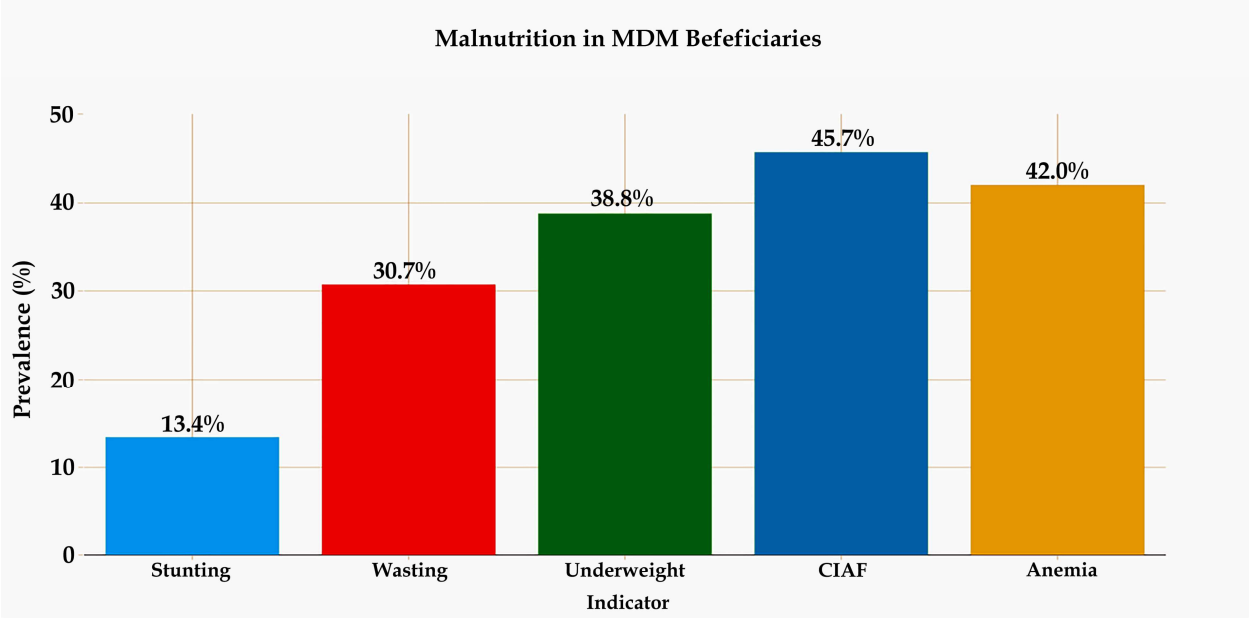
c. **Governance and funding:** Funding by both central and state governments; the implementation and coverage are widely different from one state to another. FY25 allocation is ₹12,467 crore.

d. **Recent enhancements:** Integration of nutrition tracking (POSHAN Tracker), nutritional fortification (Iron & folic acid), field-level activities through increased community participation, and convergence with other health initiatives (Anemia Mukt Bharat, Anganwadi Services).

The high prevalence of malnutrition indicators among schoolchildren receiving the Mid-Day Meal reveals that the disproportionate burden of undernutrition persists despite the program's implementation.

Table 1: Segregation of primary vs upper primary foods and nutrients

School Level	Food Grains (g)	Pulses (g)	Vegetables (g)	Oil/Fat (g)	Energy (kcal)	Protein (g)
Primary (Classes 1-5)	100	20	50	5	450	12
Upper Primary (Classes 6-8)	150	30	75	7.5	700	20

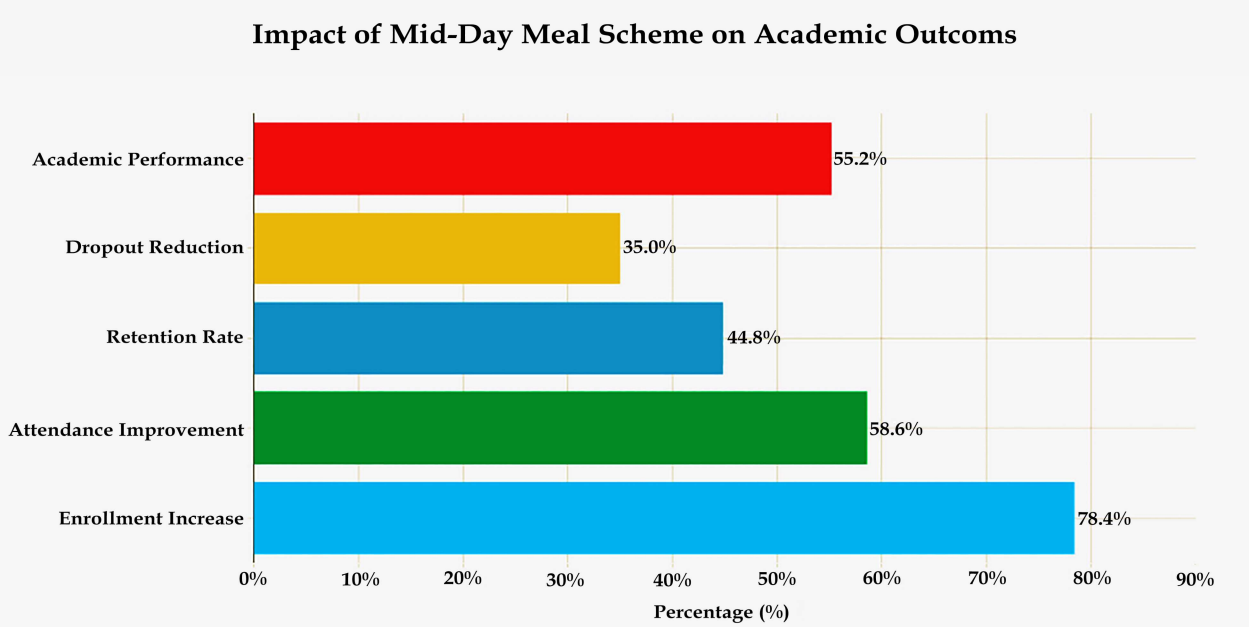


Graph 1: Malnutrition indicators among school children

2. Comparative Academic and Nutritional Impact

Meta-analyses and systematic reviews of 31 studies in 13 states show: Academic Outcomes:

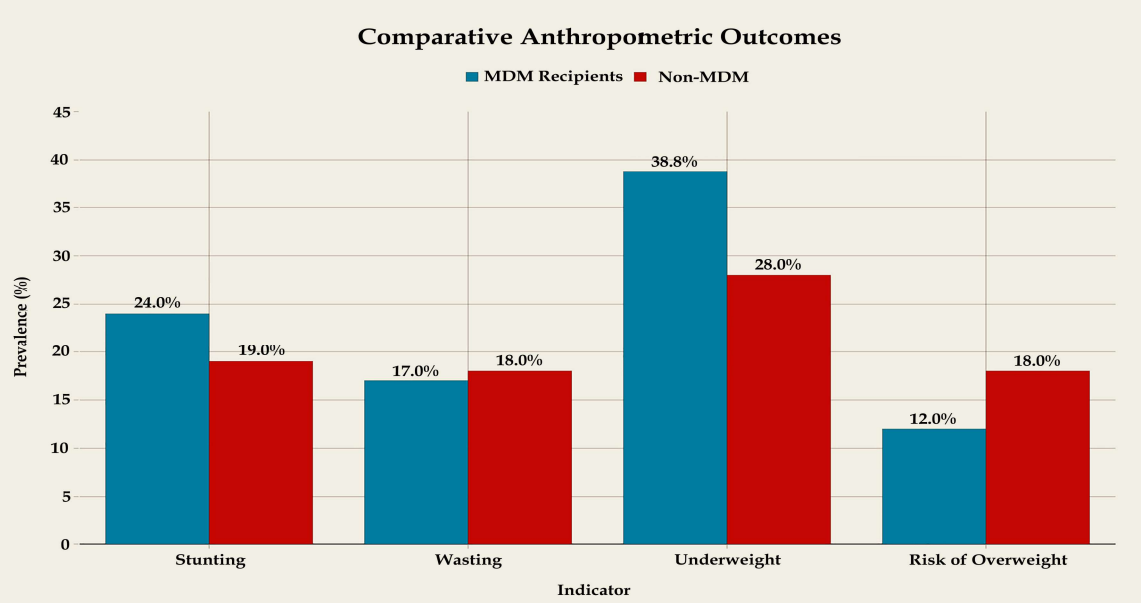
i. Admissions: Increase of up to 78%
ii. Attendance: Improved by 59%
iii. Retention and Dropout: Significant improvement.
iv. Academic performance/test results: Increased 10-20% some studies



Graph 2: Positive impact of the Mid-Day Meal Scheme on various academic outcomes, with enrollment showing the highest improvement at 78.4%.

3. Anthropometric Comparisons (MDM vs. Non-MDM Recipients):

Mixed results: MDM beneficiaries sometimes show similar or lower anthropometric measures compared to non-MDM peers in private schools. The quality and quantity of home meals, socioeconomic context, and implementation fidelity all affect the impact.[4,5]



Graph 3: Comparative Anthropometric Outcomes (MDM vs Non-MDM Recipients

A comparison of anthropometric results between MDM and non-MDM recipients reveals greater undernutrition among MDM beneficiaries, but a lower risk of overweight.[6]

4. Micronutrient Deficiency and Anaemia

I. School meal iron fortification: However, iron-fortified MDM resulted in hemoglobin increase by 0.185 g/dL and decreased anemia prevalence by 22%.

II. There is still a high prevalence of anemia in school children at the national level, which includes those among MDM beneficiaries.

5. Intergenerational and Long-term Impact

New research (Chakrabarti *et al.*, 2021) indicates that MDM participation by girls increases their children's HAZ value by 29% during the intergenerational success, shown in terms of improved maternal health and education, as well as later age at first birth. Here are the implementation challenges. While far-reaching, the plan has some challenges:

a. Quality and Monitoring: Poor quality of food, hygiene of meals, delay in releasing funds, and deficits in the infrastructure challenge nutritional gains.

b. Budget Fluctuations: Often, the government sets a budget, but most of the actual expenditure does not reach the budget coverage, and the quality is impacted.

c. Coverage gaps: Regional variation and suboptimal performance in low-resource states continue. Tamil Nadu and Kerala are quoted as examples of Best Practices due to their strong infrastructure and early response.

d. Double Burden of Malnutrition: It is compounded by the growing burden of overweight and obesity.

Key Studies on School Meal Policies and Nutritional Outcomes in India[6,7]

Author(s) & Year	Study Type	Study Population	Key Findings/Outcomes	Location
Raveenthiranathan L *et al*, 2024	Systematic Review	Primary & Upper Primary	MDM improved academic outcomes (attendance, enrollment); mixed results for anthropometric measures	India (13 states, 31 studies)
Chakrabarti S *et al*, 2021	Longitudinal Cohort Study	Intergenerational (Mother-Child Pairs)	MDM participation associated with 29% improvement in child HAZ; intergenerational nutrition benefits	India (National, IHDS data)
Jayalakshmi R *et al*, 2017	Cross-sectional Study	322 Primary School Children (6-10 yrs)	CIAF: 45.7%; Stunting: 13.4%; Wasting: 30.7%; Underweight: 38.8%	Kerala, India

table cont....

Patel PP *et al*, 2016	Comparative Study	1000 Adolescents (10-16 yrs)	Higher stunting (24%) & wasting (17%) in MDM recipients vs non-MDM; micronutrient deficiencies prevalent	Gujarat, India
Afridi F, 2010	Difference-in-Differences	Primary (Grades 1-5)	Cooked meals increased Grade 1 girls' attendance by 12.4 percentage pts	Rural Rajasthan, India

METHODS

Studies of interest include systematic reviews, meta-analyses, and large-scale program evaluations published from 2018 through 2025. Outcomes of interest include anthropometric measures (weight, length/height, and BMI), nutrient adequacy and dietary quality (macro- and micronutrient intake), and underlying educational variables (attendance, enrollment/registration, and accomplishment). Data were largely culled from PubMed and Scopus-indexed journals, and included studies from both high-income countries (e.g., the US, UK) and low- and middle-income countries (e.g., India, sub-Saharan Africa).

RESULTS

1. Involvement with Food Quality and Nutrient Consumption

Participation in school meals has been previously linked to improved dietary quality. Participating children consume more whole grains, lean protein, fruits, and vegetables, and have lower levels of saturated fat and added sugar compared to their non-participating peers. In US research, daily school lunch consumption was associated with reduced intakes of added sugar and fat, suggesting a healthier diet profile. Systematic reviews indicate that policy changes aimed at promoting a healthier nutritional environment, such as implementing strong nutrition standards or restricting foods that are not commonly available, result in higher intakes of healthier foods within schools and across daily diets. For example, a recent meta-analysis concluded that the adoption of school food environment policies was associated with increased consumption of targeted nutrients and a reduction in total caloric intake.[7]

Anthropometry: Growth, Stunting, BMI

Results for anthropometric indices are mixed. Several investigations that implemented meal policies in food-insecure situations have demonstrated small improvements in weight and height, as well as reductions in underweight and stunted growth. Recent studies from India have also found that the introduction of MDMS led to significant gains in height and weight among lower primary students, as well as substantial increases in mid-upper arm circumference (MUAC) in at least some states. However, there is other evidence that shows small or no gains in these outcomes, and some comparison studies reveal that even government school children receiving the free meal perform worse than their private counterparts in learning (growth standards) according to national criteria. On obesity were context-specific but predominantly positive. States with strong school meal standards tend to have lower rates of overweight and obesity among their students compared to states with weaker standards. In jurisdictions where standards are in place that hold back processed foods or sweetened beverages, there is a significant decrease in calorie density and fat exposure, thereby promoting population prevention of obesity and diet-related diseases.[7,8]

2. Academic and Secondary Outcomes

School meal policies have a positive impact on school attendance, retention, academic performance, and nutritional status. In India, the introduction of MDMS was associated with higher enrollment and attendance rates, as well as lower dropout rates. Internationally, there is a consensus that better nutrition at school leads to improved cognitive outcomes and increased readiness to learn.[2-4]

DISCUSSION

There is strong evidence to support the positive effects of school meal policies on attendance, enrollment, retention, and educational achievement. There is also circumstantial evidence supporting a decrease in stunting and an improvement in micronutrient status, particularly with the implementation of well-designed nutritional fortification and supplemental interventions. Yet, the still-high

post-project rates of wasting, anemia, and underweight among beneficiaries underscore the importance of a more diverse diet, increased monitoring, family and community support, and closer links with maternal-child nutrition programs.[5,6]

1. Policy Implications & Recommendations

Enhance the quality and variety of meals by setting higher standards for food diversity, micronutrient fortification, and compliance with local nutritional profiles.

i. Bolster monitoring and evaluation: Broaden real-time digital oversight and systematic inspection; bring local communities into governance.
ii. Link with health & early childhood programs: Align MDM food with Anemia Mukt Bharat, maternal health services, Anganwadi support, and nutrition education campaigns.
iii. Tackle double burden: schools should promote physical activity and balanced diets, aimed at addressing both undernutrition and obesity.
iv. Fair and equitable distribution: Focus on marginalized areas and lagging states; learn from best practices in high-performing regions.

2. Policy Successes and Key Mechanisms

Key achievements of school meal policies include increasing access to healthy food and aligning meal content with dietary guidelines. Strong government control of food standards in schools, including the outlawing of sugary beverages, regulating portion sizes, and implementing product-based bans, is a necessary component of positive nutritional change. The importance of robust nutrition guidelines and policy enforcement in various geographic regions is well-founded. Co-benefits, including the reduction of poverty, promotion of gender equity (with a focus on increasing girls' school attendance), and beneficial changes in household food consumption patterns, have been documented in many contexts.[7]

3. Persistent Challenges

Discrepancies have an impact on program effectiveness, quality of implementation, and resource limitations. When delivery deficiencies are present in the provision of food (e.g., portion size, variety of food on menus, or meals delivered at irregular times), improvements in nutritional status may be curtailed. Issues of meal quality, particularly in low-resource schools, include being out of compliance with prescribed levels, as well as taste/palate preferences, and a lack of menu variety. There is also the concern that some children may compensate for the extra calories at lunch by eating less elsewhere and offsetting any overall nutritional gain. Research indicates that the "double burden" of malnutrition and child obesity should continue to be addressed through integration of nutrition education and PA components, with meal delivery provided.

4. Global versus Indian Experiences

The impact on overweight/obesity and nutrient quality is usually more pronounced in the HIC with established school meal policies (e.g., USA, UK). In low and middle-income countries (LMICs) like India, the primary benefits are those of resolving absolute food insecurity and supporting linear growth, although translating this into catch-up growth achieving population level anthropometric standards is challenging.

5. Nutrition for children under five in India

Undernutrition remains a major public health concern in India, especially among children under five, despite gradual improvement. This review highlights the burden of stunting and wasting in West Bengal, using UNICEF and NFHS-5 data, and links these findings to the Estimated Average Requirement (EAR) guidelines for young children. It also provides practical dietary recommendations for parents and stakeholders to improve child nutrition in both rural and urban settings.[9]

Improper lifestyles, limited awareness, and time constraints among working parents are increasingly impacting children's health. A study explored parents' perceptions of their children's eating and exercise habits through three focused group discussions involving 24 parents of underweight, overweight, and diabetic children. Findings highlight a clear need for nutritional counseling delivered through telemedicine to better support child health.[10]

RECOMMENDATIONS

a. Enforce evidence-based, up-to-date nutrition standards for school meals based on localized diets and dietary guidelines.

b. Improve monitoring and evaluation of school meal quality, coverage, and adherence to planned calorie and nutrient levels.

c. Expand the training of cafeteria staff, and provide more infrastructure funding so that regular meals are diverse and culturally appropriate.

d. Incorporate nutrition education, hygiene, and PA components into school health/ policy frameworks for maximum benefit.

e. Motivate intersectoral cooperation with ministries of health, education, women and child development, and agriculture for program sustainability.

CONCLUSION

School meal policy interventions are a crucial means of enhancing child nutrition and reducing health disparities, particularly in areas where resources are scarce. Although the benefits of the programs are well-documented for dietary quality and specific anthropometric outcomes, ongoing programmatic challenges necessitate continued adjustments to the programming, accompanied by rigorous evaluation. Long-term political will, sufficient investment, and locally adapted policy formulation are essential to optimise the impact of school meal interventions on both child nutrition and education.

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