

Mid-Day Meal Scheme in Urban Delhi: Educational and Nutritional Outcomes in Low-Income Schools

Deepak Tyagi

University College Fairview

Abstract

This mixed-methods study examined the educational and nutritional impacts of India's Mid-Day Meal Scheme (MDMS) on primary-school children from low-income families in urban New Delhi. Grounded in Maslow's Hierarchy of Needs, Sen's Capabilities Approach, and Bronfenbrenner's Ecological Systems Theory, the study employed a concurrent mixed-methods design across five government and government-aided schools. Data were collected from 56 participants: 40 students in Grades 3-8, eight parents, and eight teachers and kitchen staff, using interviewer-administered student surveys, semi-structured teacher and administrator interviews, brief parent surveys, and structured non-participant observations. Instruments were piloted with three students, one parent, and one teacher outside the main sample; item clarity revisions were made and inter-observer agreement on the observation checklist reached 92%. Quantitative findings indicate that 82.5% of students reported improved attendance regularity since MDMS implementation, 90% expressed satisfaction with meal taste, and 85% reported feeling full after meals. However, meaningful variations emerged by school and gender, and only 50% of parents perceived attendance improvement. Qualitative analysis surfaced persistent operational constraints, including an average 15-minute meal-delivery delay, kitchen space and water-supply limitations, and dual teaching-supervisory role strain on teachers. A conservative benefit-cost estimation for Delhi shows that annual benefits (INR 3,900 per child) exceed annual costs (INR 2,700 per child), supporting continued investment. The study contributes context-specific evidence on urban MDMS implementation and offers practical implications for policy, school-level practice, and future research.

Keywords: *Mid-Day Meal Scheme; school feeding; educational outcomes; nutritional outcomes; urban poverty*

1. Introduction

Education and nutrition are inseparable determinants of child development, and school feeding programmes sit at the intersection of both. India's National Education Policy (NEP) 2020 emphasises the role of education in national development, with the target of universal foundational literacy and numeracy by 2026 within inclusive and equitable learning environments (Ministry of Human Resource Development, 2020). Yet the pathway to that target is uneven. Approximately 14% of New Delhi's population lives in slums and informal settlements (Census of India, 2011), where families face overcrowded housing, irregular employment, and limited access to public services. Migrant families experience transient enrolment patterns that disrupt educational continuity (Sharma, Kumar, & Singh, 2023), and the government schools that serve them frequently contend with overcrowded classrooms, insufficient kitchen facilities, unreliable water supply, and limited food storage. These structural conditions directly shape the delivery of the Mid-Day Meal Scheme (MDMS) in urban India (Ministry of Education, 2022, 2023). Understanding how MDMS actually functions in urban low-income schools is therefore a question of educational equity: whether NEP 2020's promise reaches the children it was designed to serve.

The MDMS, recognised as one of the largest school feeding programmes in the world, is a strategic policy instrument to reduce child malnutrition and promote educational equity. Launched in 1995 under the National Programme of Nutritional Support to Primary Education and subsequently rebranded as PM POSHAN, the scheme provides free cooked meals to children in government and government-aided schools. The Government of India allocates approximately INR 12,000 crore (about USD 1.5 billion) annually, reaching roughly 120 million schoolchildren (Ministry of Education, 2022). Research has consistently shown that MDMS improves enrolment, particularly among socially disadvantaged groups and girls (Hoque, 2023), and that prolonged exposure to school feeding is associated with better reading and mathematics attainment (Chakraborty & Jayaraman, 2019).

Despite this acknowledged potential, the effectiveness of MDMS in improving the health status and academic performance of primary-school pupils in urban low-income settings remains underexplored. Most existing evaluations concentrate on rural implementation; the urban context of New Delhi presents a distinct set of challenges compounded by dense enrolment, ageing infrastructure, and socio-economic disparities (Singh, Kumar, & Sharma, 2020). A fundamental gap lies in the paucity of studies that simultaneously evaluate educational outcomes (attendance, retention, engagement) and nutritional outcomes (satiety, dietary diversity, perceived well-being); the two are often examined in isolation (Chaudhary, Meena, & Pandey, 2021). Moreover, implementation faces persistent operational barriers such as delayed food distribution, inconsistent meal preparation, and inadequate monitoring (Verma & Kumar, 2022), while the roles of teachers, parents, administrators, and community organisations in shaping implementation quality remain thinly documented.

This study addresses these gaps by focusing on the implementation and outcomes of MDMS for children from low-income families in New Delhi. It evaluates stakeholder roles, appraises financial and logistical barriers, and explores both tangible outcomes (attendance regularity,

satiety, energy) and intangible outcomes (peer interaction, sense of security, community engagement). By identifying critical barriers and proposing evidence-informed recommendations, the study aims to strengthen the programme's effectiveness and to contribute to policy dialogue on integrated interventions that jointly address malnutrition and educational inequity. The findings hold relevance beyond India: school feeding programmes in other Asian jurisdictions—particularly Malaysia's Rancangan Makanan Tambahan (RMT), Indonesia's Programme Makanan Tambahan (PMT), and Thailand's School Lunch Programme—share similar policy logic and can learn from context-specific evidence generated in urban Delhi. This study therefore offers not only India-specific insights but also a basis for cross-national learning within Southeast Asia (see Discussion, Section 5.4).

Significance of the Study

This study offers both theoretical and practical contributions. Theoretically, it bridges the divide between education and nutrition policy by examining both dimensions in the same field window, highlighting their intertwined nature and drawing insights from educational psychology, nutrition science, and public policy to offer a holistic reading of how integrated interventions can address systemic inequities (Agarwal & Das, 2020; Rathi et al., 2022). Practically, the findings provide evidence-informed insights for policymakers regarding operational challenges, resource allocation, and programme design. Educators and school administrators can use the findings to understand how MDMS can be leveraged to improve attendance, retention, and academic engagement, while community stakeholders may draw actionable strategies for engaging with schools and local governments to strengthen implementation.

Research Questions

The study is guided by three research questions:

How does the Mid-Day Meal Scheme influence school attendance and perceived regularity among primary-school children from low-income families in New Delhi?

How has the MDMS influenced nutritional outcomes and the overall well-being of schoolchildren in urban low-income settings?

What systemic and operational challenges hinder MDMS implementation in New Delhi's urban government schools?

2. Literature Review

2.1 Global School Feeding Programmes

Internationally, school-based feeding programmes have emerged as effective strategies for improving child health and educational participation. The World Food Programme (2021) documents successes across Brazil, Ghana, and sub-Saharan Africa. Brazil's Programa Nacional de Alimentação Escolar (PNAE) stands out for its holistic model, combining nutritional support with the economic empowerment of local farmers (Sonnino, Radcliffe, & Godin, 2019). Silva, Tavoraro, Marinho, and da Silva (2021) observed notable improvements in students' energy levels, cognitive performance, and attendance under PNAE. In Ghana, the Ghana School Feeding Programme increased enrolment and retention rates, with particularly positive effects among girls (Gelli, Mulyadi, & You, 2019). Broader evidence from sub-Saharan Africa reinforces these gains: Bundy, de Silva, Horton, Jamison, and Patton (2018) reported an approximate 20% increase in attendance associated with school feeding. In Europe, initiatives are characterised by comprehensive integration into educational and public-health systems: Finland and Sweden offer free, nutritionally balanced meals to all students, aligned with dietary guidelines and complemented by food education (Kumpulainen, Lipponen, & Hilppo, 2021). In the United Kingdom, free school meals for disadvantaged children have been linked to reductions in food insecurity and modest academic gains (Holford & Rabe, 2020). Regionally, Southeast Asian jurisdictions have also invested in school feeding as a poverty and nutrition instrument, with Malaysia's RMT serving disadvantaged pupils and providing a policy analogue for the present study's implications.

2.2 The Mid-Day Meal Scheme in India

In India, MDMS has emerged as a cornerstone policy for addressing child malnutrition, improving school participation, and promoting educational equity. Afridi (2010) reported a 30% reduction in malnutrition in rural districts with consistent implementation. Singh, Kumar, and Sharma (2021) highlight that attendance and retention rates have significantly improved in states with efficient implementation. However, urban implementation reveals distinct challenges. In cities such as New Delhi, overcrowding, poor infrastructure, and inconsistent meal quality can undermine effectiveness (De, Rathi, & Singh, 2022). Urban children face different nutritional needs that require context-specific dietary planning. Studies note concerns about nutritional adequacy, with meals occasionally lacking essential micronutrients such as iron, zinc, and vitamin A (Sharma & Joshi, 2021). Community engagement and governance also matter: urban schools frequently lack robust community involvement, limiting transparency and accountability (Jha & Kumar, 2020).

2.3 Barriers to Effective Implementation

Persistent barriers include infrastructural limitations. Many schools lack proper kitchens, clean water facilities, and safe storage (Garg & Mandal, 2019). Administrative inefficiencies, such as delays in fund disbursement, irregular food supplies, and weak monitoring systems,

further disrupt consistent operation (Singh & Kumar, 2020). Nutritional inconsistencies compromise the programme's impact on child health (Rao & Swaminathan, 2018). Stakeholder engagement remains inadequate, with limited training for cooks and insufficient community participation (Jha, Kumar, & Singh, 2021).

2.4 Impact of the COVID-19 Pandemic on School Feeding Programmes

The COVID-19 pandemic disrupted school feeding programmes worldwide, and India's MDMS was no exception. When schools closed between March 2020 and late 2021 in phases, MDMS delivery shifted from hot cooked meals in schools to dry ration distribution or direct benefit transfers in many states (UNICEF, 2021; World Food Programme, 2022). This transition exacerbated food insecurity among low-income households, as the mid-day meal had served as a critical nutritional safety net for millions of children (Afridi, 2022). Research during the pandemic period documented increased rates of child malnutrition, learning disruption, and household food stress in urban informal settlements (Das, Mittal, & Gupta, 2022; Sharma & Gupta, 2023). The post-pandemic recovery phase has introduced new challenges, including interrupted supply chains, reduced kitchen staffing, and the need for catch-up nutrition interventions as children returned to school with heightened nutritional deficits (Ministry of Education, 2023; Khera, 2023). The present study was conducted in the post-pandemic period (data collected in 2023–2024, after the resumption of full-time in-person schooling), and the findings should be interpreted in light of these recent disruptions. The operational challenges identified in this study—including infrastructure constraints and delivery delays—may partly reflect the residual effects of pandemic-related capacity losses.

2.5 Theoretical Framework

The theoretical framework draws upon three interrelated models. Maslow's Hierarchy of Needs (1943) provides a framework for analysing how MDMS addresses foundational physiological needs before advancing to higher-order psychological needs; when hunger is reduced, children can more readily engage in learning, belonging, and esteem-related activities. Sen's Capabilities Approach (1999) positions MDMS as an enabler that expands children's capabilities to attend school, retain knowledge, and secure longer-run benefits, while reducing pressure on household food budgets. Bronfenbrenner's Ecological Systems Theory (1979) offers a holistic lens for understanding how MDMS interacts with children's environments across the microsystem (immediate school environment), mesosystem (school-home relationships), exosystem (supply chains and district oversight), and macrosystem (national policy commitment). Together, these theories frame MDMS as a multi-level intervention whose outcomes depend on both what happens in the school kitchen and what happens in the supply chain, the ministry, and the home.

Figure 1: Integrated theoretical framework linking MDMS with educational and nutritional outcomes (adapted from Bronfenbrenner, 1979; Maslow, 1943; Sen, 1999).

3. Methodology

3.1 Research Design

The study employed a concurrent mixed-methods design (Creswell & Creswell, 2023), in which quantitative and qualitative data were collected in the same field window and integrated at the interpretation stage. The concurrent approach allowed triangulation of findings within a constrained field-access window in urban Delhi schools. Quantitative data captured measurable impacts through structured student and parent surveys covering attendance, meal satisfaction, satiety, and perceived well-being. Qualitative data explored lived experiences of stakeholders through semi-structured interviews with teachers, administrators, and kitchen staff, complemented by structured non-participant observation.

3.2 Context and Setting

The study was conducted in five government and government-aided schools in suburban New Delhi serving low-income neighbourhoods. Schools were selected on the basis of MDMS participation, predominant low-income family enrolment, and location in marginalised areas. School kitchens ranged from dedicated rooms with basic equipment to multi-use spaces with limited storage and constrained ventilation. Meal service typically occurred during the midday interval, with supervision shared among class teachers and designated MDMS focal persons.

3.3 Participants and Sampling

Data were collected from $N = 56$ participants across three stakeholder groups: students ($n = 40$), parents ($n = 8$), and teachers and kitchen staff ($n = 8$). Students were enrolled in Grades 3-8 and had attended MDMS-participating schools for at least one academic year. Purposive sampling with stratification by school was employed. Inclusion criteria for schools were: current participation in MDMS, service to predominantly low-income families, and location in marginalised or suburban New Delhi areas. Stratification across Delhi zones aimed to account for regional diversity. Parent participants were primary caregivers of sampled students. Staff participants included class teachers, head teachers, MDMS coordinators, cooks, and other kitchen staff actively involved in day-to-day implementation.

3.4 Instruments, Pilot Study, Validity, and Reliability

Three primary instruments were developed for the study: (a) an interviewer-administered student survey; (b) a short parent survey; and (c) a semi-structured interview protocol for teachers, administrators, and kitchen staff. A structured observation checklist was also used. Content validity was established through review by two subject-matter experts in education policy and one in child nutrition, whose feedback led to refinements in item wording and response options. A pilot study was conducted with three students, one parent, and one teacher drawn from a comparable school outside the main sample. The pilot yielded three main adjustments: simplification of one attendance item that pupils in Grade 3 found ambiguous, addition of an explicit "feeling full" anchor to the satiety scale, and reordering of

the teacher interview so that logistical items preceded evaluative items. Inter-observer agreement on the observation checklist, assessed against a co-observer during two pilot sessions, reached 92%. Intercoder reliability for the qualitative analysis was assessed on a 20% subsample of transcripts using Cohen's Kappa, yielding kappa = 0.76, which is considered substantial agreement.

3.5 Data Collection

Student surveys were interviewer-administered to reduce literacy-related bias and to address RQ1 and RQ2. Domains included recent attendance, perceived regularity change since MDMS, meal-taste rating on a 1-5 scale, satiety on a 1-5 scale, perceived well-being (energy, minor-illness frequency), and MDMS uptake. Parent surveys used a brief format capturing perceptions of attendance change, household food-expense adjustments, reported dietary diversity, and overall satisfaction with meal quality and cleanliness. Teacher and administrator interviews were semi-structured, covering training sufficiency, staff adequacy, supply-delivery timing, kitchen infrastructure, monitoring workload, observed student engagement, and improvement strategies. Non-participant observation focused on meal start timing, queue length and flow, portioning practices, student behaviour during meals, hygiene routines, and class resumption timing using structured checklists.

3.6 Data Analysis

Quantitative data were analysed using descriptive statistics (frequencies, percentages, and mean responses) and inferential tests in SPSS version 28. Mann–Whitney U tests were used for gender comparisons, with effect sizes reported as r ($r = Z/\sqrt{N}$). Chi-square tests of independence were used to examine differences in attendance improvement across schools. Ninety-five percent confidence intervals (CIs) for key proportions were computed using the Wilson score method. Qualitative interview and observation data were analysed thematically using ATLAS.ti, with open coding to identify emergent patterns, which were then clustered into broader themes. Integration occurred at the interpretation stage through side-by-side comparison of quantitative and qualitative findings, allowing convergence and divergence to be examined.

3.7 Ethical Considerations

Written informed consent was obtained from all adult participants. For students, both parental consent and student assent were obtained using age-appropriate explanations. All participants were informed of their right to withdraw at any time without penalty. Data were anonymised with alphanumeric codes and stored on password-protected devices. Institutional review board approval was obtained prior to data collection.

4. Results

4.1 Attendance and Educational Outcomes (RQ1)

Among all surveyed students (N = 40), 38 reported attending school in the previous school week, indicating near-universal short-term attendance. Further, 33 (82.5%) indicated that their attendance regularity had improved since MDMS implementation. In contrast, only 4 of 8 parents (50%) perceived an improvement in their child's attendance, revealing a notable perception gap between students and caregivers.

Table 1

Student Perceptions of Attendance Regularity by School and Gender (n = 40)

School	Gender	N	Reporting Improvement	Not Reporting
School A	Female	3	2	1
School A	Male	5	5	0
School B	Female	3	1	2
School B	Male	5	4	1
School C	Female	6	5	1
School C	Male	2	2	0
School D	Female	4	4	0
School D	Male	4	3	1
School E	Female	4	3	1
School E	Male	4	4	0
Total		40	33	7

Subgroup analysis revealed variation across schools and gender. Girls in School A and School D reported the highest perceived improvements (100%). Among boys, the highest improvements were reported in School C (100%) and School B (80%). A Mann–Whitney U test found no statistically significant gender differences in taste ratings ($U = 38.5$, $p = 0.42$) or fullness ratings ($U = 34.0$, $p = 0.25$), suggesting that boys and girls experienced the meal similarly on the two most immediate satisfaction dimensions.

4.2 Nutritional Outcomes (RQ2)

Student self-reports indicated strong perceived nutritional benefits. Thirty-six of 40 students rated meal taste as good or excellent (4–5 on a 5-point scale; 90%, 95% CI [76.9%, 96.0%]), 34 reported feeling full or very full after eating (85%, 95% CI [70.9%, 92.9%]), 38 of 40 reported greater energy since MDMS implementation (95%, 95% CI [83.5%, 98.6%]), and 30 reported experiencing fewer minor illnesses (75%, 95% CI [59.8%, 85.8%]).

Table 2

Student-Reported Nutritional and Well-Being Outcomes of the MDMS (N = 40)

Outcome	Number of Students	%
Attended school in last school week	38	95
Improved attendance regularity since MDMS	33	82.5
Meal taste rated good or excellent (4-5/5)	36	90
Reported feeling full or very full	34	85
Reported more energy since MDMS	38	95
Reported fewer minor illnesses since MDMS	30	75

Parent-reported data indicated more limited dietary diversity: staples and vegetables were frequently served (50-63% of children received them on three or more days per week), but only about 28% received fruit or egg with similar frequency, pointing to gaps in micronutrient-rich food provision. Parents also reported modest reductions in the household food budget spent on children's midday meals, with a small number of caregivers indicating that the savings were redirected toward evening meals or school-related expenses.

4.3 Operational Challenges: Qualitative Findings (RQ3)

Teachers, administrators, and kitchen staff consistently identified supply-delivery delays as a significant challenge. Field notes and interview data indicated an average delivery delay of approximately 15 minutes across the five sites, resulting in rushed preparation, postponed service, or occasional truncation of the post-meal cleaning window. Many schools operated with undersized kitchens and insufficient storage: staff reported infrastructure limitations with three explicit mentions of space constraints and three reports of equipment shortages. Additional consistent challenges included the lack of a reliable running-water point for handwashing and infrequent deep cleaning of kitchen spaces. Monitoring, when it occurred, tended to focus on quantitative reporting requirements (numbers of meals served, ration usage) rather than on qualitative aspects of the meal experience such as hygiene, wait times, or child engagement.

Teachers frequently described juggling educational duties with supervisory responsibilities. One teacher commented: "We are supposed to teach, but half the morning goes in checking supplies and supervising food distribution." Another noted: "Children eat in classrooms. After that, it takes time to clean before we can resume lessons." Cooks highlighted issues with ingredients, working conditions, and social recognition: "Sometimes dal arrives late or in less quantity. We have to adjust recipes," and "We have one large pot, but no gloves or aprons. It is hot and risky." Teachers nevertheless perceived improved attendance and punctuality following MDMS: "For many of these children, this is the only complete and guaranteed meal of the day. You can see the difference in their concentration in the afternoon class."

4.4 Integrated Findings

Integration of the quantitative and qualitative strands revealed several patterns. While MDMS is widely perceived to encourage school attendance, its impact varies by school context and student gender. Student satisfaction with taste and fullness corroborates reports of reduced hunger and greater classroom energy. However, persistent operational challenges (delivery delays, space constraints, and equipment shortages) were consistently identified across both strands. The divergence between student self-reports (82.5% seeing improved regularity) and lower parental perception (50%) highlights the importance of multi-informant assessment and points to a school-home communication gap that programme governance has yet to address.

4.5 Benefit-Cost Estimation

A conservative benefit-cost estimation was carried out for the Delhi context using publicly available programme cost figures and household food-expense self-reports collected in the parent survey. Estimated annual benefits per child (approximately INR 3,900) combined household food savings, reduced out-of-pocket food expenditure on breakfast substitutes, and an expected education-attendance premium. Estimated annual costs per child (approximately

INR 2,700) reflected per-plate food cost, cooking honoraria, and a share of infrastructure maintenance. The resulting benefit-cost ratio of approximately 1.44 supports continued programme investment, though the estimation is context-specific and sensitive to assumptions about attendance-driven gains.

5. Discussion

The findings corroborate international literature affirming school feeding programmes as effective incentives for school attendance (Afridi, 2010; Bundy et al., 2018). The attendance improvement reported in this study aligns with earlier work on MDMS benefits in rural areas, while confirming that urban implementation carries a distinct set of challenges (De et al., 2022). Student satisfaction with taste and fullness (90% and 85%, respectively) exceeds some previously reported figures, possibly reflecting the acute food insecurity of the study context, where any nutritionally regular meal is highly valued (Gelli et al., 2019).

The divergence between student and parent perceptions (82.5% versus 50% reporting improvement) extends existing literature by highlighting communication gaps within the programme's ecosystem. This can be read through Bronfenbrenner's Ecological Systems Theory: parents, situated in the mesosystem, may not directly observe the daily attendance patterns and small behavioural cues that students and teachers in the microsystem experience. It suggests that outreach mechanisms, such as periodic parent updates on attendance and meal participation, could bring perceptions into closer alignment and increase caregiver advocacy for programme quality.

Operational challenges identified in this study, including delivery delays, infrastructure constraints, and water-supply issues, directly mirror the implementation gaps documented in the broader literature (Garg & Mandal, 2019; Singh & Kumar, 2020). The average 15-minute delivery delay and space constraints corroborate findings from urban school studies (Rathi, Singh, & De, 2022; Verma & Kumar, 2022). These exosystem-level failures constrain otherwise positive microsystem outcomes, echoing an ecological reading of the programme in which the school kitchen depends on functioning district-level supply and governance chains.

Theoretically, the study substantiates Maslow's Hierarchy of Needs: MDMS successfully addresses foundational physiological needs (food, satiety), enabling progression toward higher-order needs (belonging, esteem) within the school environment. Student reports of increased energy (95%) and fewer illnesses (75%) indicate that the scheme is meeting basic needs and creating conditions for cognitive engagement. Sen's Capabilities Approach frames MDMS as a tool that expands children's freedoms: by providing a guaranteed meal, the scheme enables regular school attendance and participation without hunger distraction, while offering families economic relief that can be redirected toward children's well-being. Bronfenbrenner's ecological framing offers the most comprehensive lens: positive microsystem outcomes are consistently mediated by mesosystem communication, exosystem supply reliability, and macrosystem policy commitment.

For readers in Malaysia and other Southeast Asian jurisdictions, these findings have direct resonance. Programmes such as Malaysia's Rancangan Makanan Tambahan (RMT) share the underlying policy premise that targeted school feeding can simultaneously improve nutrition and educational participation among disadvantaged pupils. The Delhi evidence suggests that visible attention to logistics, kitchen infrastructure, and parent communication is likely to be as important as menu design in translating such programmes into measurable outcomes.

5.4 Implications for Southeast Asian Contexts

The findings from this Delhi-based study offer several transferable lessons for Southeast Asian school feeding contexts. Table 3 presents a structured comparison of India's MDMS (PM POSHAN) and Malaysia's RMT.

Table 3- Comparison of MDMS (India) and RMT (Malaysia)

Feature	MDMS / PM POSHAN (India)	RMT (Malaysia)
Target group	Government & government-aided school children (Classes 1–8)	Pupils from low-income families (means-tested); primary & secondary schools
Coverage	~120 million children nationwide	~600,000 pupils (means-tested)
Meal type	Hot cooked meal (grain + pulse + vegetable; eggs in some states)	Monetary aid for food purchase; some schools provide supplementary food
Funding	Central & state government (~INR 1,200 crore/year)	Federal government (Ministry of Education budget)
Key challenges	Infrastructure deficits, delivery delays, teacher role strain, monitoring gaps	Targeting accuracy, adequacy of monetary value, stigma from means-testing

First, the operational challenges documented here—delivery delays, infrastructure deficits, and teacher role strain—are not unique to Delhi. Studies in Malaysian schools have similarly identified kitchen infrastructure, staffing, and supply-chain reliability as critical mediators of RMT effectiveness (Ministry of Education Malaysia, 2022; Chan & Tee, 2021; Rahman, Ismail, & Ali, 2020). The parallel between Delhi’s findings and Malaysian experience suggests that Southeast Asian school feeding programmes share a common implementation logic: visible attention to logistics, kitchen infrastructure, and parent communication is likely to be as important as menu design in translating policy intent into measurable outcomes for disadvantaged pupils.

The observed school- and gender-level variability also warrants attention. That girls in Schools A and D reported the highest perceived attendance improvement, while boys in Schools B and C reported the strongest gains, suggests that the same programme can produce meaningfully different outcomes depending on local school culture, teacher engagement, and the physical conditions in which meals are served. Rather than treating MDMS as a uniform intervention, policymakers may need to think of it as a policy chassis that requires school-level tuning, informed by locally sensitive monitoring data.

5.1 Limitations

Several limitations should be acknowledged. First, the sample size ($N = 56$) limits statistical power and generalisability. The small subsample sizes in subgroup analyses (by gender and school) further constrain the ability to detect meaningful between-group differences, and the non-significant findings in chi-square and Mann–Whitney tests should not be interpreted as evidence of no difference but rather as inconclusive given limited power. Second, the study relies on self-reported and perception-based data without objective measures such as anthropometric assessments or clinical health records. Third, the cross-sectional design captures perspectives at a single point in time and cannot establish causal relationships. Fourth, elements of convenience sampling were present at the participant level within each school, which may introduce selection bias. Fifth, the geographic scope is limited to five government schools in suburban Delhi; findings should not be generalised uncritically to all urban settings or to other states.

6. Conclusions, Implications, and Suggestions

This mixed-methods study evaluated the impact of the Mid-Day Meal Scheme on educational and nutritional outcomes in urban low-income schools in New Delhi. Data from 56 participants across five schools revealed that MDMS is widely perceived as a successful intervention that encourages attendance, alleviates hunger, and contributes to well-being, while persistent operational constraints, including delivery delays, infrastructure deficits, and resource limitations, consistently mediate implementation quality.

6.1 Implications for Policy

A conservative benefit-cost estimation for Delhi indicates that annual benefits (approximately INR 3,900 per child, drawn from household food savings and expected education-attendance gains) exceed annual costs (approximately INR 2,700 per child), supporting continued programme investment. Policymakers should prioritise upgrading kitchen infrastructure, reliable water storage, and efficient localised supply chains. Dietary diversity should be strengthened through revised menu guidelines that ensure the regular inclusion of protein and micronutrient-rich foods such as eggs, fruit, and pulses.

6.2 Implications for Practice

Schools should be resourced to appoint dedicated MDMS coordinators, decoupling teaching from meal logistics so that class teachers can focus on instruction. Formal feedback channels should be established for regular input from students, parents, and frontline staff, and teacher training programmes should incorporate a short MDMS management component so that new teachers understand the operational and pastoral dimensions of the scheme from the outset. School leadership teams may also consider a lightweight monthly reflection on meal service quality, incorporating pupil and cook feedback, so that operational adjustments can be made in real time rather than at the end of each academic year.

6.3 Suggestions for Future Research

Future studies should employ longitudinal designs that track outcomes over multiple academic years, include objective nutritional measures such as anthropometric data and clinical health records, and extend the sampling frame across multiple urban contexts in India and comparable Southeast Asian settings. Investigating the relationship between meal quality (composition, temperature, timing) and specific learning outcomes would inform programme refinement, and comparative work between India's MDMS and Malaysia's RMT could offer valuable regional insights on how urban school feeding can be sustained and improved.

6.4 Concluding Thoughts

The Mid-Day Meal Scheme represents a critical intervention addressing the intertwined challenges of malnutrition and educational inequity in urban India. While the programme shows considerable promise, its full potential remains constrained by operational and systemic barriers. Addressing infrastructure deficits, logistical inefficiencies, and stakeholder communication gaps can transform MDMS from a well-intentioned subsidy into a reliably effective intervention capable of shaping healthier and better-educated futures for India's most vulnerable children, and providing lessons for comparable programmes across Asia. Above all, the evidence gathered here suggests that the difference between a successful and a merely nominal school feeding programme lies less in policy ambition than in the sustained attention paid to the everyday logistics of getting a hot, adequate, and dignified meal to each child on time.

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