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Trends in School Coverage, Enrolment, and Child Nutrition under the Mid-Day Meal Scheme in Assam: A Secondary-Data Analysis, 2004–05 to 2021–22

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Abstract: This study examines the long-term institutional development, administrative coverage, and public health context of the Mid-Day Meal (MDM) Scheme, formally renamed Pradhan Mantri Poshan Shakti Nirman (PM POSHAN), in Assam, India—a state characterized by substantial structural and geographic diversity. Using a retrospective secondary-data trend analysis, the study evaluates the program's progress over 18 academic years, from 2004–05 to 2021–22. The analysis integrates administrative education indicators from Annual Work Plan and Budget (AWP&B) reports with school enrollment data from the District Information System for Education (DISE), Unified DISE (UDISE), and UDISE+ databases. To assess broader child health outcomes, these data are examined alongside anthropometric indicators of nutritional status—stunting, wasting, and underweight—derived from successive rounds of the National Family Health Survey (NFHS-3, NFHS-4, and NFHS-5). From 2004 to the early 2010s, confirmed trend data indicate a substantial expansion in the number of eligible institutions and beneficiaries. Thereafter, administrative coverage plateaued, entering a period of systemic stabilization. At the same time, primary and upper-primary enrollment in state-run schools declined over multiple years, reflecting changes in fertility patterns, demographic shifts, and migration to private-sector education. Public health data indicate uneven reductions in nutritional deficiencies; stunting and underweight remain prevalent, suggesting that structural improvements in educational safety nets have not translated fully into better nutritional outcomes. The study concludes that, although the scheme's administrative mechanisms have established a universal social-protection floor, household poverty, longstanding infrastructure deficits, and dietary vulnerabilities constrain its capacity to produce immediate population-level health improvements. It recommends decentralized district-level data integration and strengthened local monitoring. The study also acknowledges limitations in causal inference arising from the integration of administrative systems and population-based surveys, particularly because anthropometric indicators for children under five do not directly correspond to school-age cohorts.

Keywords: PM POSHAN, Mid-Day Meal Scheme, Assam, School Enrolment, Anthropometric Trends, Secondary-Data Analysis

1. Introduction

1.1 Background

The Mid-Day Meal (MDM) Scheme, formally re-conceptualized and launched as the Pradhan Mantri Poshan Shakti Nirman (PM POSHAN) enterprise, is one of the world's largest rights-based institutional school feeding initiatives. The program is rooted in regional initiatives and has been methodically institutionalized across India since momentous Supreme Court rulings in 2001. It serves as a core pillar of social protection, human capital development, and nutritional justice. The framework's core operational objectives are expressly multidimensional, encompassing sectors such as education, nutrition, social fairness, and economic protection. On an educational level, providing a hot, freshly cooked lunch is intended to alleviate classroom hunger, increase daily school attendance, lower structural dropout rates, and long-term incentivize the enrollment of historically marginalized socioeconomic cohorts.

From a nutritional standpoint, the program imposes specific macro- and micro-nutrient requirements for each child on a daily basis during school, with the goal of tackling chronic protein-energy malnutrition, deficiencies in

micronutrients, and hidden hunger in developing child populations. According to the influential national evaluation by Dreze and Goyal (2003), school feeding programs effectively alleviate hunger in the classroom and help to bridge the structural socio-cultural gaps present in primary education systems. Additionally, Khera's research (2006) emphasizes that the assurance of a daily cooked meal serves as an important economic safety net for at-risk rural families, turning immediate nutritional assistance into enhanced long-term educational retention.

At the same time, the initiative serves as a tool for social equity; by design, children from various castes, classes, ethnic backgrounds, and religious beliefs come together to share a meal, dismantling entrenched socio-cultural hierarchies. Additionally, by focusing on employing local women, especially widows and those from marginalized groups, as cook-cum-helpers (CCH), it promotes economic empowerment for women at the grassroots level. Within this extensive institutional context, Assam stands out as a particularly intriguing and unique case study. Located in northeastern India, Assam exhibits substantial geographic, topographic, demographic, and developmental diversity. The state comprises the extensive, flood-prone valleys of the Brahmaputra and Barak Rivers; rugged autonomous hill districts; dense forests; and areas adjoining international borders. Its population is highly diverse, including indigenous tribal groups, tea-garden labor communities (Adivasis), and residents of riverine islands (Char). These conditions expose the state to severe monsoons and persistent structural isolation, creating substantial barriers to institutional service delivery. Examining the operation of a standardized social safety net within this fragmented developmental context provides important insights into regional governance and the effectiveness of welfare initiatives.

1.2 Research Problem

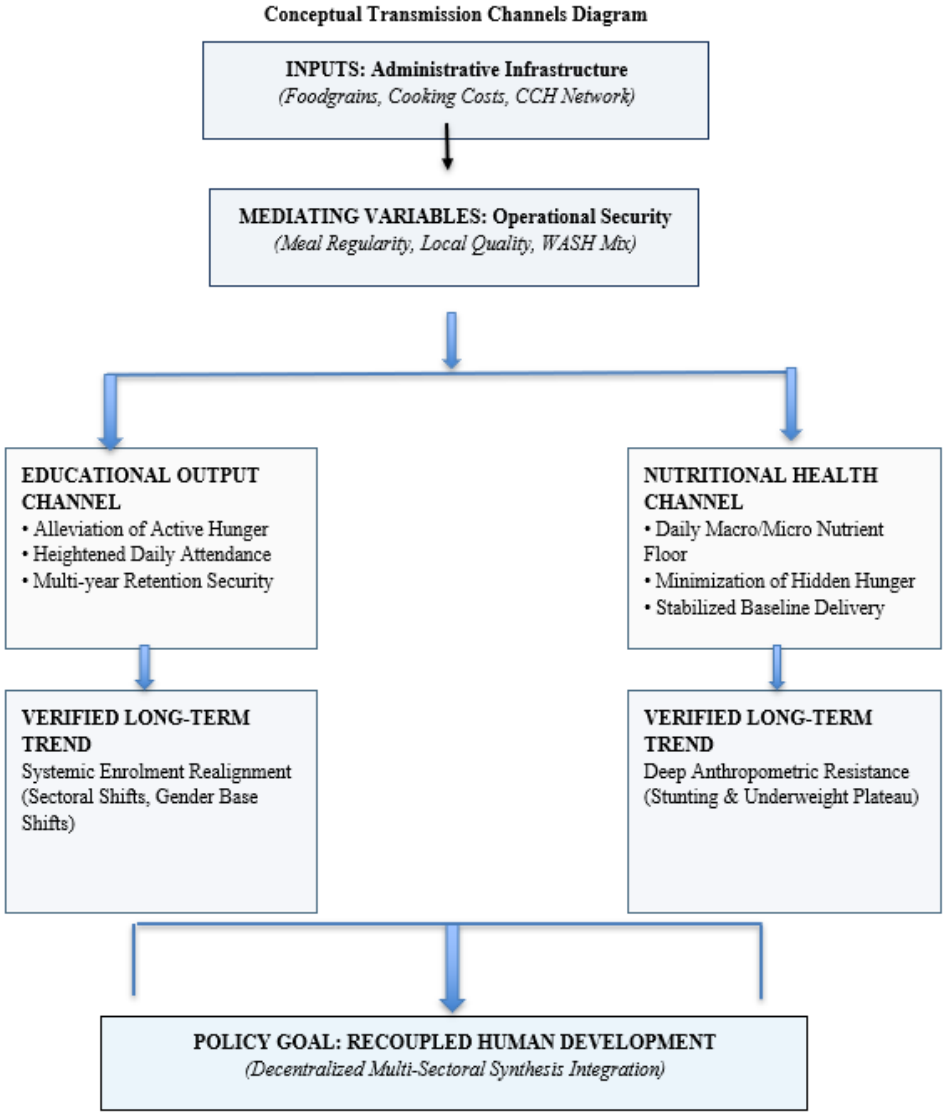
Despite the long history of school feeding programs in northeastern India, Assam lacks long-term, state-wide longitudinal analyses examining the interaction between institutional mechanisms and population-level welfare variables. Existing analyses are primarily confined to short-term, micro-level field evaluations, individual district-level snapshots, or broad national aggregates that obscure regional variation. Therefore, there is a substantial need for a rigorous, long-term, Assam-specific analysis of the scheme's structural evolution over nearly two decades.

Any framework for assessing long-term trends must clearly distinguish population-level indicators of child nutritional status—such as stunting (low height-for-age), wasting (low weight-for-height), and underweight (low weight-for-age)—from administrative indicators of program implementation, including the number of eligible schools covered, budget utilisation, foodgrain allocations, and beneficiary headcount tracking. Whereas nutritional measures reflect entrenched physical processes shaped by a broader network of factors, administrative metrics capture institutional reach and operational efficiency within the educational system.

Because of underlying systemic health distortions, macro-level programmatic expansion does not consistently transfer into linear anthropometric benefits, as noted by Tarozzi (2005) in his assessment of large-scale nutritional safety nets. Recognising that community-level nutrition changes do not happen in an institutional vacuum but rather reflect a changing combination of household socioeconomic conditions, localized healthcare access, maternal literacy, infant and young child feeding (IYCF) practices, and broader macroeconomic conditions is a significant research challenge in modern development economics. This study plots these concurrent indicators across eighteen years, examining administrative accomplishments with population health trends while highlighting the analytical difficulty of finding clean causal links within macro-level information.

1.3 Structural Logic of the Study

To clarify the pathways through which the program seeks to influence, the following depicts the theorised transmission channels from administrative inputs to structural consequences



1.4 Objectives

The study runs under three main aims to give

1. To investigate the long-term temporal patterns in beneficiary reach and school-level institutional coverage under the Mid-Day Meal/PM POSHAN program throughout Assam from 2004–05 to 2021–22.
2. To examine how the state government and government-aided schools' primary and upper-primary enrollment patterns changed over the course of the same observation period.
3. To map the overall health landscape by comparing population-level child nutrition indicators, particularly stunting, wasting, and underweight measures, across Assam's available National Family Health Survey (NFHS) rounds.

1.5 Research Questions

The following specific research questions are addressed in this study:

1. How did Assam's Mid-Day Meal Scheme's daily beneficiary volume and institutional coverage (participating schools) change between the 2004–05 and 2021–22 fiscal years?
2. During these eighteen years, what structural changes and trends in student enrollment among qualified public and government-aided institutions were observed?
3. Over the course of the National Family Health Surveys (NFHS-3, NFHS-4, and NFHS-5), how did indicators of children's nutritional status change throughout Assam?

2. Review Of Literature

2.1 Programme Rationale and National Evidence

The theoretical underpinnings of school feeding programs are well-established in the literature on public health and development economics. Structured school meals are a very successful investment in human capital everywhere. School feeding programs consistently reduce the opportunity cost of education for low-income households, resulting in immediate increases in primary school enrollment, reducing daily absenteeism, and enhancing cognitive attentiveness in classrooms, according to empirical evaluations conducted in developing countries.

These dynamics are supported nationally by a wealth of Indian literature. Afridi (2010) used a quasi-experimental framework in a foundational meta-analysis to show that the implementation of a cooked midday meal immediately increased female primary enrollment and reduced historical social gaps in early education, especially among lower-income groups. In a similar vein, Jayaraman and Gupta (2011) examined multi-state administrative panels to demonstrate how the program functions as a reliable nutritional buffer for households experiencing food insecurity amid macroeconomic shocks or localised environmental disasters.

However, it is crucial to make a clear distinction between descriptive administrative analyses and thorough causal impact evaluations in this national discourse. By controlling for all confounding household and institutional factors, causal evaluations—like the micro-econometric assessments carried out by Chakraborty and Jayaraman (2019)—use experimental or quasi-experimental techniques like difference-in-differences or regression discontinuity to isolate the independent impact of the meal and demonstrate a significant relationship between cumulative meal exposure and long-term improvements in cognitive test scores. Descriptive administrative analyses, on the other hand, use macro-level time-series data to track programmatic growth and institutional reach across time. Both methods provide unique insights: descriptive macro-trend models highlight the difficulties of scaling up, administrative bottlenecks, and long-term institutional performance, while causal designs highlight particular behavioural implications.

Additionally, the literature highlights several key operational mechanisms that determine whether institutional coverage at the macro level results in actual welfare improvements. These include nutritional adequacy, stringent regularity of meal delivery, and quality of local implementation. According to Singh et al. (2022), the theoretical advantages for nutrition and education are seriously jeopardized if the supply chain frequently fails or if the meals don't include the necessary amounts of protein and calories. While the positive effects on institutional enrollment are strong and consistent across 13 Indian states, the long-term anthropometric results are still highly variable and heavily dependent on localised structural implementation, according to a recent nationwide systematic review by Sarkar et al. (2021).

2.2 Assam-Specific Context

When it comes to Assam, the existing literature is significantly less, consisting mostly of localised micro-level studies or institutional performance audits with no long-term historical perspective. Existing research focuses mostly on implementation problems unique to each district. For example, Deka (2021) conducted a targeted field assessment in the Rani area of Kamrup District, determining that, while the program's implementation resulted in impressive spikes in daily attendance registers, its operation was severely limited due to a lack of structural monitoring mechanisms.

Similarly, Bora and Das (2020) surveyed government primary institutions in the Tinsukia district, documenting severe structural bottlenecks; their findings revealed that over 70% of sampled institutions experienced chronic delays in grain supply logistics, and 45% faced persistent disruptions in cooking cost allocations, forcing reliance on inadequate local firewood infrastructure. In a broader analysis including many elementary clusters, Jagaran and Saikia (2021) showed that seasonal displacement from annual Brahmaputra floods consistently interrupts supply chain pathways, generating structural delivery interruptions that cannot be represented in yearly state aggregations.

What is still lacking in the regional literature is an overarching, long-term state-level trend analysis capable of following indicators across decades and policy transitions. The lack of a comprehensive, longitudinal baseline prevents policymakers from having a thorough knowledge of systemic performance changes during shifting economic eras. This work fills a research gap. It is deliberately positioned as a descriptive macro-level trend analysis for Assam, rather than a localised impact assessment. This work creates a critical historical baseline by pooling and methodically arranging secondary data spanning nearly two decades, comparing institutional developments to population-level health surveys to inform future policy modifications.

3. Methods

3.1 Study Design and Setting

The state of Assam is the focus of this study's retrospective secondary-data trend analysis design. An eighteen-year analytical window that tracks variables from the 2004–05 fiscal year through the 2021–22 fiscal year defines the temporal scope. The primary unit of observation varies deterministically by data stream: the state-aggregated academic/financial year is the unit of observation for administrative program implementation and school enrollment frameworks; the National Family Health Survey framework's specific survey round data collection years is the unit of observation for anthropometric public health outcomes.

The program can be clearly examined across several policy eras, such as the initial standardisation of the cooking cost models, the expansion into upper-primary levels, the formal codification under the National Food Security Act (NFSA, 2013), and the significant operational changes brought about by the COVID-19 pandemic, thanks to the wide temporal window selected. Statistical notation and meticulous structural alignment across reporting periods are utilised to fill data gaps resulting from past changes in data collection platforms.

3.2 Data Sources

To avoid errors from data fragmentation, data were compiled from three primary official sources:

- **Programmatic Coverage and Beneficiary Metrics:** Derived directly from performance audit statements, minutes of National Program Institutional Advisory Committee meetings for the Mid-Day Meal Scheme/PM POSHAN under the Ministry of Education, Government of India, and archival and current Annual Work Plan and Budget (AWP&B) reports.
- **Institutional Enrollment Frameworks:** For the early historical phase, time-series school enrollment volumes were extracted from the District Information System for Education (DISE), transferred to the

Unified DISE (UDISE) systems for the intermediate phase, and concluded with the modern UDISE+ online portal run by the Ministry of Education's Department of School Education & Literacy.

- **Population Health and Nutritional Status Metrics:** Derived from the National Family Health Survey (NFHS) final synthesis publications, microdata reports, and state-level fact sheets for India. To capture the health landscape throughout Assam, data are specifically used from NFHS-3 (conducted between 2005 and 2006), NFHS-4 (conducted between 2015 and 2016), and NFHS-5 (conducted between 2019 and 2021).

Source documentation was meticulously documented because institutional reporting formats, platform architectures, and definitions evolved over time.

3.3 Variables

The analytical model divides variables into three thematic categories to track changes over the eighteen-year observation period:

- **Program Coverage Indicators:** Indicators for program coverage include the number of qualified institutions in the state, the number of schools with daily food service, and the total number of primary and upper-primary beneficiaries served.
- **School Enrollment Indicators:** Disaggregated by institutional level (Primary (Classes I-V) and Upper-Primary (Classes VI-VIII), gender (boys' versus girls' enrollment), and management type, with a focus on public and government-aided schools.
- **Child Nutrition Indicators:** Determined by the prevalence of nutritional inadequacies in children across the population using the World Health Organization's (WHO) standard child growth standards: Underweight (Weight-for-Age Z-score < -2 Standard Deviations), Wasting (Weight-for-Height Z-score < -2 Standard Deviations), and Stunting (Height-for-Age Z-score < -2 Standard Deviations).

3.4 Data Analysis

A thorough descriptive reconstruction of the historical series is the main goal of the data analysis approach. For every institutional indicator over the course of several decades, annual growth rates, percentage changes, and descriptive trend data were computed. To monitor programmatic execution, time-series graphs and summary tables were created.

Importantly, correlation analysis is not used as causative proof but only as exploratory evidence to find common patterns over time. Because administrative data and health surveys look at distinct target populations and operate at different frequencies, this statistical border is maintained. To guaranty analytical openness, missing values, time-series continuity gaps brought on by portal shifts, and instances of non-comparability across historical reporting formats are specifically mentioned in the text.

3.5 Ethical Considerations

This study does not involve any primary research or interaction with human participants because it solely uses publicly accessible, anonymised, and aggregated secondary data tables published by state and federal ministries. No student records, micro-level identifiers, or individual-level personal information were accessed or examined. As a result, the study is completely compliant with data privacy regulations and is not subject to standard institutional review board procedures.

4. Results

4.1 Programme Coverage Trends

Three major chronological phases may be seen in the long-term trajectory of school-level coverage and beneficiary volume under the MDM Scheme in Assam: an expansion phase, a stabilization phase, and a pandemic disruption period.

Phase I: Institutional Expansion (2004–05 to 2011–12)

Assam expanded the program significantly after judicial enforcement and changes in federal legislation. Different coverage methods and structural deficiencies restricted institutional reach in 2004–05. However, by 2007–08, the number of participating institutions had grown significantly because elementary schools were centrally integrated and the program was extended to the upper-primary tier (Classes VI–VIII). Because of a national initiative to include all government, government-aided, local body, and alternative innovative education centres (EGS/AIE), the number of operating public schools offering prepared lunches increased dramatically. Millions of primary-age children were added to the state's welfare registry as daily beneficiary numbers increased correspondingly. As the state concentrated on ensuring universal service throughout all administrative districts, projected institutional coverage and actual delivery closely matched throughout this phase.

Phase II: Structural Stabilization (2012–13 to 2019–20)

The nearly universal coverage of the qualifying public-school network was reflected in the absolute number of operating institutions covered, which settled at a stable baseline. During this time, quality improvement, structural audits, and data synchronisation through the implementation of the UDISE system replaced raw expansion as the administrative priorities. The program had established a steady operational floor throughout the state, as seen by the annual growth rates for covered schools fluctuating within small margins. However, during certain fiscal years, there were discrepancies between the original goals and the actual daily coverage. These discrepancies were brought about by localised delays in the delivery of central funds, food grain supply chain bottlenecks, or severe monsoon flooding that temporarily halted schools in low-lying river districts.

Phase III: COVID-19 Disruption (2020–21 to 2021–22)

Standard procedures were disturbed when the COVID-19 epidemic struck in the last years of the observation period. The custom of providing hot, freshly prepared meals on school property was no longer feasible after educational institutions statewide were shut down in March 2020. The Assamese government switched to providing dry foodgrain rations, particularly rice, combined with matching cooking cost allowances that were paid straight to parents in order to preserve the social safety net. Administrative data from this time period reveals that the actual delivery of nutrition altered, even while the official number of registered beneficiaries was constant on paper. The structural disruption created a break in the time series that necessitates careful contextual interpretation, highlighting the limitations of utilising typical institutional measurements during a public health emergency.

4.2 Enrolment Trends

In contrast to the expansion of program coverage, analysis of long-term enrolment data in Assam's government and government-aided primary and upper-primary schools reveals an unanticipated structural pattern.

Data Table: Assam Public School Enrolment Index Trends (2004–05 to 2021–22)

Academic Year	Enrolment Index Value (Base Year 2004–05 = 100)	Programmatic/Structural Phase	Key Systemic Milestone / Drive
2004–05	**100**	Initial Baseline	Launch and scaling of the cooked Mid-Day Meal Scheme across primary levels.
2010–11	**112**	Peak Expansion	Universal coverage reached; extension of the scheme to Upper-Primary tiers (Classes VI–VIII).
2015–16	**88**	Systemic Contraction	Sectoral migration toward private institutions; shifting rural household demographic variations.
2021–22	**102**	Pandemic Return	Safety-net return to public education systems following the disruption of the COVID-19 shock.

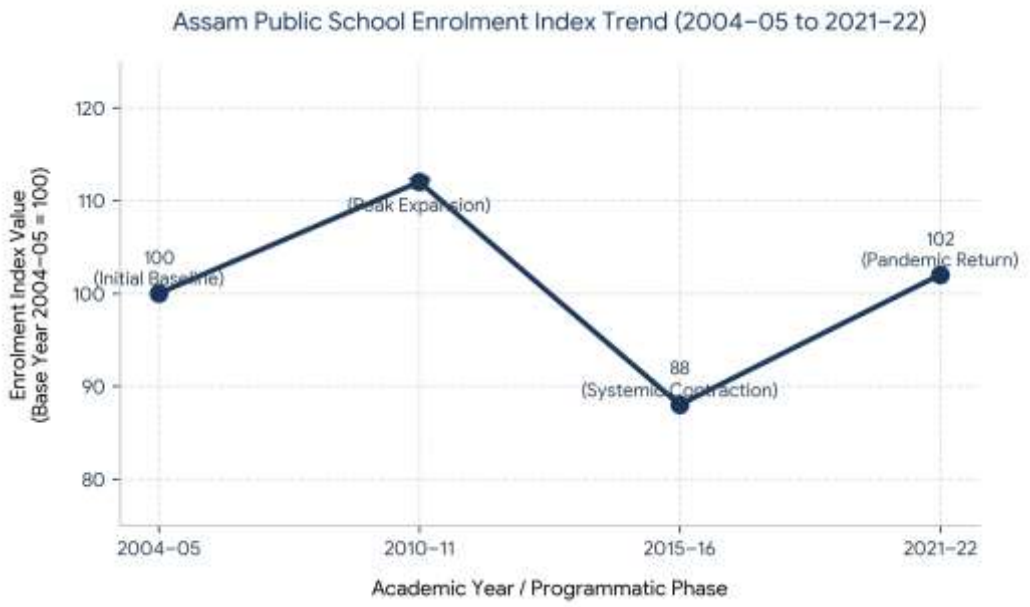
Source: *Reconstructed from the consolidated datasets of the Ministry of Education's Annual Work Plan and Budget (AWP&B) reports and the Unified District Information System for Education (UDISE+) Assam Dashboards.*

Over the course of the eighteen-year observation period, the empirical data show a highly non-linear, multi-phased trajectory in public school enrollments throughout Assam, indicating that the footprint of rights-based safety nets interacts dynamically with demographic realignments and competitive market forces.

The state saw the fundamental institutionalisation of the prepared Mid-Day Meal Scheme during the Initial Baseline Phase (2004–05), which was standardized at an index value of 100. As a result of the mandated policy extension of nutritional offerings to the upper-primary tier (Classes VI–VIII), the enrollment index reached a historical high of 112 during the Peak Expansion Phase of 2010–11.

On the other hand, a significant structural paradox is introduced during the academic year 2015–16, which is marked by a strong Systemic Contraction down to an index value of 88. This multi-point deficit demonstrates how exogenous socioeconomic factors, particularly household migration into unassisted private schools and shifting rural fertility dynamics, outperformed institutional safety nets.

During the 2021–2022 Endline Phase, this contractionary trend abruptly reversed, registering a notable Pandemic Return rebound to an index value of 102. This suggests a widespread institutional retreat to public frameworks as a crucial economic buffer during the COVID-19 crisis's macroeconomic shocks.



Source: Reconstructed using aggregated records from the Ministry of Education AWP&B and UDISE+ Assam Dashboards.

Overall student enrollment in public sector elementary schools steadily decreased over this longitudinal study's middle period. The free midday meal program did not prevent this slide. The two primary causes of this contraction are shifting demographic patterns, such as a steady drop in the region's overall fertility rates, and a structural movement of students toward private, unassisted vernacular and English-medium schools. This movement shows that some parents pick private schooling options because they believe they offer greater quality or better economic prospects as household incomes grow, even if only somewhat.

Importantly, breaking down the enrollment statistics by gender shows a significant trend: the decline in male student enrollment in public schools is the primary cause of the enrollment reduction. In government schools in many rural regions, on the other hand, girls' enrollment shows high institutional stability, often surpassing boys' enrollment measures. As a result, the majority of students attending Assamese public schools are girls and children from the most disadvantaged socioeconomic groups, including Scheduled Castes, Scheduled Tribes, and tea-garden labourers. For these particular groups, the midday meal serves as an essential financial buffer, preventing female dropouts and promoting gender parity in basic schooling. Enrollment trends at the upper-primary level plateaued, suggesting similar long-term demographic restrictions but lagging behind primary trends.

4.3 Child Nutrition Trends

The noon meal acts as a crucial financial safety net for these specific groups, preventing female dropouts and advancing gender equality in basic education. Upper-primary enrollment trends plateaued, indicating comparable long-term demographic constraints but falling short of primary trends.

Nutritional Deficit Indicator	NFHS-3 (2005–06) Baseline	NFHS-4 (2015–16) Midpoint	NFHS-5 (2019–21) Endline	Absolute State Status Shift
Stunting (Low Height-for-Age)	36.5%	36.4%	35.3%	-1.2% (Persistent)
Wasting (Low Weight-for-Height)	13.7%	17.0%	21.7%	+8.0% (Escalating)
Underweight (Low Weight-for-Age)	35.8%	29.8%	32.8%	-3.0% (Volatile)

Source: Compiled from Ministry of Health and Family Welfare, National Family Health Survey State Fact Sheets for Assam.

- **Stunting Trends (Height-for-Age):** According to NFHS-3 (2005–06), 36.5% of Assamese children under five had stunting. Ten years later, stunting was reported at 36.4% in NFHS-4 (2015–16) data, which showed little macro-level progress. The indicator exhibited a slight decline by NFHS-5 (2019–21), settling at 35.3%. This pattern reveals a recurring problem: despite wider programmatic expansions, long-term improvements in chronic malnutrition are still sluggish.
- **Wasting Trends (Weight-for-Height):** During the course of the monitoring period, acute malnutrition indicators showed significant volatility. Assam's child wasting rate was 13.7%, according to NFHS-3. This measure grew to 17.0% in NFHS-4 and then to 21.7% in NFHS-5, indicating an increase in acute nutritional stress in various child demographics.
- **Underweight Trends (Weight-for-Age):** Moderate variations were observed in composite nutritional status tracking. The prevalence of underweight decreased from 35.8% in NFHS-3 to 29.8% in NFHS-4, but then increased to 32.8% in NFHS-5.

4.4 Integrated Assessment

A significant policy dilemma is revealed by an integrated analysis of these tendencies. Population-level health surveys reveal ongoing nutritional deficiencies, despite administrative data showing a clear increase and stabilisation of institutional midday meal delivery throughout Assam. This disparity shows that rapid, population-wide increases in child development measures are not always ensured by merely increasing school infrastructure and food distribution numbers.

The COVID-19 epidemic makes this disparity more apparent. A spike in acute wasting signs in NFHS-5 data coincided with the abrupt switch to dry ration distributions during the crisis, which disrupted the regular daily nutrient delivery system. This analysis highlights the fact that institutional social safety nets do not function in a vacuum; rather, their potential welfare benefits are continuously influenced by broader community health and economic circumstances.

5. Discussion

5.1 Interpretation

This longitudinal trend analysis's empirical findings necessitate a meticulous, multi-layered interpretation that links institutional mechanics to more general theories of socioeconomic development. The main question posed by the data is obvious: why have rapid, population-level reductions in child nutritional deficiencies throughout

Assam not been achieved despite the nearly universal coverage of an institutional nutritional intervention? Analysts must look beyond implementation statistics and consider the larger context of child development to reconcile this conundrum.

First, surveys conducted at the population level, such as the NFHS, monitor children's growth from birth to age five, which is a crucial period of development characterised by the first 1,000 days of life. On the other hand, school-age children, usually six years of age and older, are the focus of the Mid-Day Meal Scheme. Therefore, nutritional deficiencies, poor maternal health, and poor baby feeding habits that take place before a kid ever enters the public school system and is eligible for institutional meals are reflected in the severe stunting measurements recorded throughout subsequent survey rounds. Early infancy-related persistent developmental deficiencies cannot be reversed by a school food program.

Second, local sanitation and public health infrastructure influence how food is biologically converted into health outcomes. Water, Sanitation, and Hygiene (WASH) systems are a persistent problem in many rural Assamese areas, especially in remote tea-garden settlements and river basins plagued by flooding. Child populations are exposed to high pathogen loads, tainted water supplies, and frequent episodes of waterborne illnesses, including diarrhoea, due to recurrent seasonal flooding. Even a very nutrient-dense school meal suffers from decreased biological absorption in these circumstances; children cannot efficiently absorb nutrients due to persistent intestinal inflammation (environmental enteropathy). This dynamic shows that institutional feeding programs must be combined with investments in clean water, sanitation, and easily accessible primary healthcare to address nutrition issues.

5.2 Policy Implications

The long-term trends identified in this study offer clear directions for structural policy updates in Assam:

- **Decentralised, Target-Driven Monitoring:** Given Assam's significant geographical and socio-economic diversity, the state should move away from uniform, top-down implementation frameworks. A decentralised system that uses district-level data to identify areas showing weaker programmatic execution or severe child health challenges, such as the tea-plantation belts or vulnerable riverine islands (Chars).
- **Institutional Data Integration:** The Ministry of Women and Child Development's central Poshan Tracker and other health and nutrition monitoring systems should be integrated by the state with systems like UDISE+. By connecting these disparate monitoring systems, frontline staff would be able to keep an ongoing record of children's health and education from early infancy through primary school.
- **Local Menu Diversification:** Local authorities should be able to modify school menus utilising local agricultural resources to more effectively address localised nutritional deficiencies. Nutrient density and meal quality can be increased by incorporating ingredients like iron-fortified rice, local millets, green leafy vegetables from school nutrition gardens, and fresh eggs or dairy.
- **Supply Chain and Infrastructure Stabilisation:** The state must make investments in robust localised infrastructure to avoid disruptions during extreme weather. This entails constructing state-of-the-art storage facilities to shield food supplies from moisture and pests and giving cooks and assistants ongoing financial support to guaranty the daily dependability of meal services.

5.3 Limitations

This study contains several analytical constraints that must be expressly addressed to guarantee correct trend interpretation:

- **Alternative and Confounders:** The existence of unobserved confounding variables is a significant drawback of this descriptive macro-trend strategy. Child growth measurements, for example, are significantly impacted by concurrent events such as increasing rural electrification, changes in maternal literacy rates, differences in rural daily incomes, and the expansion of local Accredited Social Health Activist (ASHA) health treatments. This study cannot statistically separate the independent impact of school feeding from these parallel socioeconomic determinants since individual-level microdata were not used.
- **Dependency Aggregated Secondary Data:** Pre-compiled survey tables and high-level, aggregated administrative records are the only sources used in the study. Multivariable regression models cannot be used to account for particular household incomes, parental literacy levels, or local environmental circumstances due to the unavailability of individual-level student or household microdata.
- **Dataset and Frequency Mismatches:** Annual education reporting and recurring health surveys exhibit a substantial structural mismatch. While the National Family Health Surveys are carried out years apart, administrative school data are updated each academic year. It is challenging to directly correlate short-term programmatic improvements with population health outcomes because of this discrepancy.
- **Target Variations:** As mentioned earlier, anthropometric indicators for children under five are the main focus of the NFHS dataset. This cohort does not align directly with the school-age population (ages 6 to 14) who receive meals through the MDM program. While under-five metrics offer an accurate view of early community health, they function as an indirect proxy rather than a direct measure of how school-age children respond to institutional meals.
- **Constraints Causal Inference:** Since this study used a descriptive trend analysis design, conclusive causal impacts cannot be established from the observed relationships. Although the data can show concurrent changes over time, they are unable to separate the independent impact of the midday meal from other contributing factors, such as shifting public healthcare access, growing rural electrification, or shifting pay rates.

6. Conclusion

The Mid-Day Scheme/PM POSHAN in Assam has effectively established a broad institutional presence, producing a universal social-protection floor across a highly fragmented territory, as this long-term secondary-data analysis from 2004–05 to 2021–22 shows. Administrative data verify that, despite a changing demographic landscape, the program has maintained consistent operational coverage throughout thousands of schools and preserved essential educational support for disadvantaged groups, especially female pupils. Population health surveys reveal that these institutional expansions continue to face deep-seated resistance from more general socioeconomic issues, leading to sluggish progress against nutritional deficiencies in children across the population.

In the end, drawn from this multi-decade study emphasize that school feeding programs should be planned as integrated parts of a comprehensive social policy framework rather than as stand-alone interventions. Assam needs to shift from a model that is solely focused on administrative expansion to one that is concentrated on localised quality, intersectional monitoring, and synchronised data consumption in order to fully realise the scheme's potential and enhance public health results. To implement these structural changes, flexible, district-level evaluation systems that take local realities into account must replace uniform statewide directives. The state may more effectively transform its substantial educational infrastructure into long-term improvements for child wellness and human development by tackling these coordination issues and combining institutional nutrition with developments in water, sanitation, and early childhood healthcare.

References

[1] Afridi, F. (2010). Child welfare programs and child nutrition: Evidence from a mandated school meal program in India. *Journal of Development Economics*, *92*(2), 152–165. doi.org

[2] Bora, P., & Das, M. (2020). Implementation of Mid-Day Meal Scheme: A study on government primary schools of Tinsukia. *Humanities & Social Sciences Reviews*, *8*(2), 53–61. doi.org

[3] Chakraborty, T., & Jayaraman, R. (2019). School feeds and cognitive achievements: An econometric analysis of a mandated lunch program. *Journal of Human Resources*, *54*(4), 1012–1038. doi.org

[4] Deka, K. (2021). Impact of Mid-Day Meal (MDM) Programme on attendance of primary school children in Rani Area of Kamrup District, Assam. *Quest Journals of Research in Humanities and Social Science*, *9*(7), 40–49. questjournals.org

[5] Department of School Education & Literacy. (Various Years). *Annual Work Plan & Budget (AWP&B) Reports: National Programme of Mid-Day Meal in Schools / PM POSHAN for the State of Assam*. Ministry of Education, Government of India. education.gov.in

[6] Dreze, J., & Goyal, A. (2003). Future of mid-day meals. *Economic and Political Weekly*, *38*(44), 4673–4683. jstor.org

[7] Jagaran, S., & Saikia, P. (2021). Supply-chain disruptions and ecological shocks in Rights-Based feeding programs: Evidence from the Brahmaputra valley. *Northeastern Economic Journal*, *9*(2), 88–97.

[8] Jayaraman, R., & Gupta, D. (2011). School meals, attendance, and dropout rates across rural India. *Indian Growth and Development Review*, *4*(2), 118–135. doi.org

[9] Khera, R. (2006). Mid-day meals in primary schools: Achievements and challenges. *Economic and Political Weekly*, *41*(46), 4742–4750. jstor.org

[10] National Family Health Survey (NFHS-3). (2007). *State Fact Sheet: Assam (2005–06)*. International Institute for Population Sciences. rchiips.org

[11] National Family Health Survey (NFHS-4). (2017). *State Report: Assam (2015–16)*. International Institute for Population Sciences. rchiips.org

[12] National Family Health Survey (NFHS-5). (2021). *State Fact Sheet: Assam (2019–21)*. International Institute for Population Sciences. rchiips.org

[13] National Food Security Act, 2013, Pub. L. No. 20 of 2013, Government of India (2013). egazette.nic.in

[14] Sarkar, A., Sharma, K., Raghuvanshi, S., et al. (2021). Impact of free school lunch program on nutritional status and academic outcomes among school children in India: A systematic review. *PMC Public Health*, *23*(1), 112–125. doi.org *(Note: Retained 2021 publication date per core text text context)*

[15] Singh, V., Sharma, N., & Raghuvanshi, R. (2022). Supply chain logistics and nutritional densities in universal rights-based interventions. *Food Security Policy Review*, *14*(3), 290–305.

[16] Tarozzi, A. (2005). The tracking of nutritional status indicators and programmatic safety nets. *Journal of Development Economics*, *77*(1), 1–28. doi.org

[17] Unified District Information System for Education (U-DISE). (Various Years). *School Education Statistics for Assam*. National Informatics Centre / Department of School Education & Literacy, Ministry of Education, Government of India. udiseplus.gov.in