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Handling Classroom Hunger: Comparing Modes of Mid-Day Meal Delivery in Anekal Block, Karnataka

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Handling Classroom Hunger: Comparing Modes of Mid-Day Meal Delivery in Anekal Block, Karnataka

Shreelata Rao Seshadri, Rishikesh B. S., Prateeti Prasad and Sheetal Patil



Abstract: *The Mid-Day Meal (MDM) is an important nutrition-specific intervention of the Government of India, providing a specified quantum of food and calories for children in primary schools across the country. The New Education Policy (2020) reiterates the importance of ensuring that childhood flourishing is not impeded by classroom hunger. There are currently several models for providing the MDM in schools – either through kitchens established within the schools or through an external agency (NGO).*

The study aimed to evaluate the impact of a quality-controlled mid-day meal program from a centralized kitchen on children's nutritional indicators and learning outcomes, in comparison to the standard meal provided by government/NGOs. In addition, the study looked at household characteristics of students to determine their impact on children's nutritional outcomes.

The study was conducted in Anekal block in Bangalore district, Karnataka, and looked at the difference in nutritional outcomes of children in schools where the MDM was a) cooked within the school; b) provided by Akshay Patra, and c) provided by an alternate NGO. Anthropometric measures were taken of children in 16 government schools, as well as their learning outcomes in Kannada and Mathematics. In addition, household characteristics were recorded.

The findings show that children in primary school are at nutritional risk, and MDM is a key intervention that can make a material difference. Ensuring that this meal is wholesome, nutritious and adequate is critical. Of the three sources of MDM studied, students in schools supplied by Akshay Patra were found to be statistically significantly better off in terms of standard anthropometric measures. Taste and hygiene are important determinants of whether children eat the MDM.

A simple regression analysis of children's/household characteristics and BMI revealed the following significant coefficients at the .05 level: gender, type of kitchen (Akshay Patra), age of the child, mother's weight, availability of ration card and consumption of green, leafy vegetables by the index child. Regarding the relationship between nutritional status and learning outcomes, the data did not show any correlation between learning outcomes and BMI status in any of the groups by gender or class.

India's mid-day meal scheme is the largest scheme of its type globally. To reap its full benefit, the government needs to focus on improving its quality and nutritional value, and thereby enhance its impact. In addition, the outreach of nutritional support programs that enhance household availability of food, such as the Public Distribution System, should be expanded. The paper also argues for better management of schools: our data show a strong relationship between learning outcomes and overall school management; and demonstrates that it has implications for the MDM delivery model selected by the school. This reinforces the importance of putting more resources towards strengthening school management capacity, for the positive impacts on both nutritional and learning outcomes.

Keywords: *Mid-Day Meal Scheme, Akshay Patra, childhood nutrition, learning outcomes, classroom hunger.*

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Introduction

School meals can be an incentive to children for attending school, thereby increasing enrolment and attendance. They can also reduce hunger, positively impacting attention, cognition and memory. In populations with high levels of food insecurity, school meals can reduce undernutrition and potentially contribute to catch-up growth in stunted children, thereby improving short and long-term health and productivity.

In 2001, the Government of India mandated the provision of a hot cooked meal for all children in government-funded primary schools. This was named the Mid-Day Meal (MDM) Scheme. Basic nutritional guidelines were set for the meal, which were streamlined according to local diets and tastes. The New Education Policy (2020) has reaffirmed the importance of the school meal in the overall development of the child. In point 2.9 of the Policy, it specifically states that ‘children are unable to learn optimally when they are undernourished or unwell. Hence, the nutrition and health (including mental health) of children will be addressed, through healthy meals....’ The policy, in fact, seeks to extend the current provision, by arguing for provision of additional breakfast to children in school stating that research shows that the ‘morning hours after a nutritious breakfast can be particularly productive for the study of cognitively more demanding subjects’. It hence recommends that ‘these hours may be leveraged by providing a simple but energizing breakfast in addition to mid-day meals’. It also provides options for locations where hot meals is not possible by suggesting ‘simple but nutritious meals such as groundnuts/chana mixed with jaggery and/or local fruits’. In support of this renewed emphasis on nutritious meals at school, the Policy also calls for the allocation of extra finances. In point 26.4, the Policy lists ‘providing food and nutrition (breakfast and mid-day meals)’ as one of the key public expenditure items to improve the education system in the country.

Given this emphasis it is imperative that we identify the optimum mode in which meals can be delivered to children in school. Our study focuses on this specific aspect and hence is a useful reference for policy makers. Several large recent studies in India indicate that the prevalence of undernutrition remains high amongst school-aged children. Given that the mid-day meal currently accounts for a quarter of the education budget, there is a need for evidence of its effectiveness in reducing undernutrition and if in the long run it improves academic performance. For geographic areas with high levels of malnutrition, evidence on the effectiveness of additional supplementation in reducing undernutrition will also be useful.

The Akshaya Patra Foundation is an NGO that currently serves about 1.8 million meals a day to children in government-funded schools in India, through 52 kitchens across 12 states. The organization has received widespread acclaim for building a high quality and efficient production and delivery system. The organization aims to scale up to 5 million meals a day by 2020. At the invitation of state governments, it continues to open new kitchens in major Indian cities, serving urban and peri-urban locations. The roll out of the Akshaya Patra operations provides a unique opportunity to build evidence on the impact of a well-implemented mid-day meal programme on educational and nutritional indicators, and to test the feasibility of using the programme as a platform for other nutritional interventions to reduce hunger and undernutrition amongst school children.

This study was conducted in government primary schools of Anekal Block in the State of Karnataka and beginning in the academic year 2016-17. The location was selected specifically because there was a plan to launch a new Akshaya Patra kitchen there. At baseline, there were three methods by which mid-day meals were being provided to children in Government schools in Anekal Block – (i) in-school kitchens, (ii) meals delivered by local non-Governmental organizations (NGOs – but not Akshaya Patra) and (iii) meals provided by Akshaya Patra. Schools self-selected their preferred category; and it was not clear by what criteria this choice was made. With the planned establishment in late-2016 of a new centralized Akshaya Patra kitchen in the block, there was the possibility that Akshaya Patra would take over the entire mid-day meal programme in the block.¹ This provided a unique opportunity to collect baseline data across the different arms on a host of indicators in order to later compare the changes that Akshaya Patra meal delivery could potentially bring about.

Objective

The objective of the study was to evaluate the impact of a quality-controlled mid-day meal program from a centralized kitchen on children's nutritional indicators and learning outcomes, in comparison to the standard meal provided by government/NGOs. In addition, the study looked at household characteristics of students to determine their impact on children's nutritional outcomes.

1 We note here that the establishment of the new kitchen was delayed by more than 18 months, thus delaying the completion of the research study.

The study provides information on the nutritional and educational impact of a well-delivered school meal on primary school children, and factors that impact the effectiveness of any particular MDM model. There is little literature that examines the impact of different modes of MDM delivery on the desired nutritional outcomes, and the study provides a unique insight into this question.

In addition, the study contributes to the evidence on the impact of the school meal on nutritional status and learning outcomes of the beneficiaries. The evidence generated throws light on nutritional risks in terms of weight and height in school aged children, and the age ranges in which such risks are most likely to manifest.

We expect that the study findings will be of significant interest to a range of stakeholders, including the Central and State Governments, funders of health and education programmes, and school-meal providers. The evidence generated from the study will also contribute to the global literature, where gaps have been identified with regard to well-designed studies on the effects of large-scale school feeding programmes.

Review of Literature

There is an undeniable link between nutrition and a child's life trajectory. The nutrition a child receives in the formative years of her life has a lasting impact on life outcomes at various stages, unless the deficits are corrected before permanent damage occurs (Galler et al., 2013). A large body of medical and nutritional literature examines the links between nutrition and cognitive development and cognitive function. Economists have also studied nutrition and its effects on a child's life, their focus is on the effects of nutrition on economic development. Improving a child's nutrition has long term economic effects; children who are better nourished start school early, fall sick less, and are able to acquire knowledge better, because there is a greater learning productivity per year of schooling. Cost - benefit analysis suggests that money invested in early nutrition and school meal programmes in developing countries, have three times the potential return in forms of academic achievement (Glewwe et al., 2001).

The effects of poor nutrition are seen both immediately as well as in the long term. In the short term, children who are not receiving the proper quality or quantity of food are not able to pay attention during class as hunger prevents the child from being able to fully participate in school activities (Jyoti et al., 2005). Being hungry also has a huge impact on mood, leading to behavioral issues (Weinreb et al., 2002).

The long-term effects of malnourishment are severe and are not easily remedied. The Lancet Child Development in Developing Countries series illustrates how nutrition, specifically stunting negatively impacts learning and achievement in school children. The trend carries on in their adult life leading to poverty, ironically, it was poverty that was probably the cause of their childhood malnourishment. The cycle of poverty is closely linked to childhood health and the availability of nutrition. (Grantham-McGregor et al., 2007; Walker et al., 2007)

To end the cycle of poverty, hunger and malnourishment the Dakar Framework of Action in 2000 articulated the goals of Health and Education for all. In order to reach these goals, many countries, including India began to scale up school feeding programmes. The meals provided are either free or subsidized depending on the country. In 2013, it was estimated that more than 368 million children received a daily meal at school (*World Food Programme. State of School Feeding Worldwide. Rome: WFP, 2013*). Despite these efforts about 66 million primary school children go to school hungry in low- and middle-income countries. And approximately 3.1 million children die from hunger each year. However, school meals did improve enrolment numbers. Parents began to enroll their children in school because of the meal that they would receive. Consuming hot, nutritious food consistently, improves the overall health of a child. Studies have established the direct link that a child's health has on learning outcomes. Children with better overall health performed better in school. (Alderman et al., 2006; Glewwe and Miguel, 2007).

Schools have become the most important location for governments to address and intervene on nutritional matters. The World Bank defines the aim of school meal programmes in developing countries as 'targeted social safety nets that provide both educational and health benefits to the most vulnerable children, thereby increasing enrolment rates, reducing absenteeism, and improving food security at the household level' (Bundy et al., 2009). Serving hot meals in schools has helped improve enrollment numbers in several developing countries (Afridi, 2011a; Cheung and Berlin, 2015). The meals have not only had an impact on child health and school attendance, they have become the center for community development, by engaging with parents, providing employment and supporting local businesses. Food has always played an important role in bringing people together. When children from different class and caste backgrounds share food it promotes social equity (Drake et al., 2016; Drèze, 2004).

India's school feeding programme is the largest in the world. In 2016-17, 9.78 billion children received a hot cooked meal, the programme covers 1.2 million schools. India has had a long history of school feeding programmes, targeted at improving both the academic performance and health of school children. The earliest school feeding programme in the country started in 1925 in the Madras Presidency. It was not until 1995 that a centralized government policy required all government primary schools to provide meals to students (National Programme for Nutritional Support to Primary Education). Because of the costs, many states limited this to dry rations and snacks. However, in 2001, the Supreme Court ruled that a hot cooked meal should be provided to every primary school child attending a government school or a government aided school. This came to be known as the Mid-Day Meal (MDM) Scheme. By 2007 the scheme covered all students from grade 1 to grade 8.

Despite the reach of the programme, in 2017 India scored 31.4 on the Global Hunger Index (GHI) which is on the high end of the "serious" category. About 200 million people in India suffer from hunger - more than any other country in the world. According to the 2015-16 survey data, 21 percent of children in India suffer from wasting, and 38.4 percent from stunting (von Grebmer et al., 2017).

While there is no national level data on prevalence of undernutrition in school-aged children and adolescents, large surveys undertaken indicate persistent high levels of undernutrition amongst school children in many parts of India. In the past decade, published studies from rural and peri-urban areas and urban slums estimate the number of children who were underweight ranged from 29-61%, stunting from 21-56% and wasting from 12-53% (Dambhare et al., 2010; Dutta et al., 2009; Seshadri et al., 2016; Srivastava et al., 2012).

The Mid-day meal scheme has been studied at great length for the past few decades and has focused on enrolment, attendance, nutritional outcomes and learning outcomes. Research has shown that a hot meal has a positive impact on school enrollment. This is seen especially with the most marginalized children, caste, class and gender seem to be determining factors. Parents of these children viewed the meal as money saved and hence enrolled their child to school (Drèze & Kingdon, 2001; Garg & Mandal, 2013). The effects of this however are not uniform and do not last, as children get older the availability of the meal has little effect on enrolment (Jayaraman & Simroth, 2011). While school meals do impact overall school attendance and retention, girls seem to have benefited the most from this scheme (Afridi et al., 2016; Drèze and Kingdon, 2001; Garg and Mandal, 2013). For disadvantaged girls the midday meal is more than just access to nutrition. It is one of the only situations where they are not treated differently than boys. They eat the same food and are given the same quantity of food as their male classmates; thus, creating a space for equity. In its inception the mid-day meal was supposed to be a supplementary meal, however, in some cases it has become the only complete meal a child consumes (Garg and Mandal, 2013). Despite these situations there have been some improvement in the nutritional status of children (Afridi, 2010, 2011b; Srivastava et al., 2012).

Studies examining the effect of the mid-day meal on learning, have recorded improvements in learning (Afridi et al., 2013; Chakraborty and Jayaraman, 2016; Singh, 2008). However the evidence from these evaluations is limited (Afridi et al., 2013) and note improvements in attention; however, test scores show no improvement (Singh, 2008). The most recent work (Chakraborty and Jayaraman, 2016) concludes that the mid-day meal has a dramatic improvement in learning outcomes, with an improvement of 10-20% on test scores. According to their study students who were exposed to mid-day meals for a longer period had better learning outcomes. Their study used data from the Annual Status of Education Report (ASER) survey. The study, however, does not look into the health of the child or the variation in meal delivery.

Programme implementation studies have not focused on the delivery models (kitchen type) of the scheme, this study aims to add to the small body of work that exists, by closely examining the important link between a kitchen type and nutritional outcome. The current implementation of the MDM scheme follows two models and uses about a quarter of the educational budget.

- The centralized model – this model is used by NGOs, they have a central kitchen where food is prepared in bulk, in mechanized kitchens and delivered to schools. They receive grain and cash subsidies from the government.

- The decentralized model – in this model school receives rice, grain, groceries and money on a monthly basis to prepare food in the school kitchen.

There are variations in the taste and quality of the food prepared in both of these kinds of kitchens. The results of one study show that each model has different strengths and weaknesses and the researchers do not conclude as to which model may be better (Shankar and S. K., 2001). Another more recent study concludes that partnering with private organizations or NGOs would improve the delivery of the scheme (Deodhar et al., 2010). Our study shows that there is a link between kitchen type and nutritional outcomes, it also shows that there is a connection between the size and management of a school and kitchen type.²

Data collection and analysis

Sampling and measurements (nutritional and learning outcomes): To ensure equal representation of variables, participating schools were selected through the stratified random sampling procedure. The stratification was based on school type and the type of kitchen (Government, Akshay Patra or Other). Schools that had only a Primary section were left out of the sample. The final sample size was as follows:

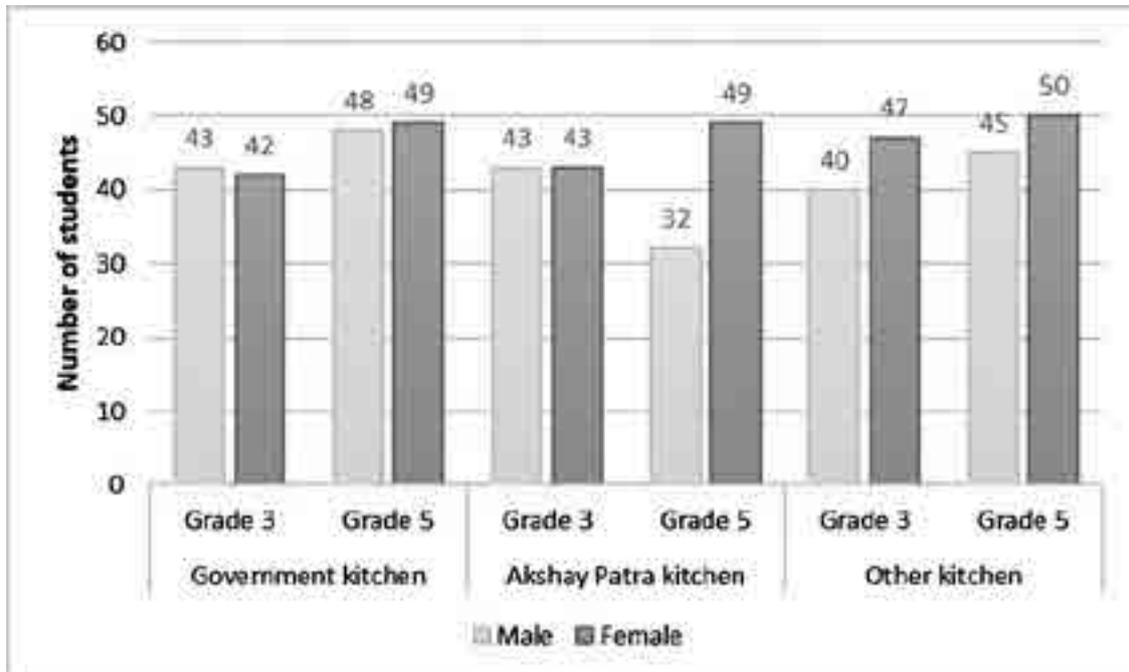
Table 1: Sample Size

Anthropometry	<ul style="list-style-type: none"> • 824 students; with 3 grades per school, height and weight measurements taken from students present on that day. • 6 schools each from the government and other organization arm and 4 schools from the Akshay Patra arm, provided 16 schools in total. • Analysis based on gender and age.
Learning Outcomes	All students of grades 3 and 5 present on the day of the test in the sample schools were administered for learning outcomes tests, totaling to around 567 students.
Household Characteristics	All students tested for Learning Outcomes were covered for collecting data on Household characteristics, totaling to 571 households.
Merged Sample: After merging all the three datasets with Child ID as the key, the sample size reduces to 531 students	

Table 2: Sample Distribution

Mid-day Meal Source	Sample Size (Children)	Percent to Total
Government kitchen	182	34.27
Akshay Patra kitchen	167	31.45
Other kitchen	182	34.27
Total	531	

² This is an annual survey that aims to provide reliable estimates of children's enrolment and basic learning levels for each district and state in India. ASER has been conducted every year since 2005 in all rural districts of India.

Figure 1: Sample Distribution by Gender (2016)

In the first round (2016), anthropometric measurements such as height and weight of all children in Class 1, 3 and 5 were conducted. Body Mass Index (BMI) was calculated using Anthro+ software, and classification of children into different categories of height (stunting) and weight (thinness) was done according to WHO Growth Standards (2007). Children in class 3 and 5 were administered 2 tests – Kannada and Mathematics – to estimate their learning outcomes. In the second round (2018), anthropometric measurements were collected from children in Class 3, 5 and 7, with the objective of tracking the status of children from the previous round. Testing for learning outcomes was not repeated as the team faced logistical constraints in conducting the tests as well as resource constraints in developing a testing tool for grade 7. However, to compensate for this, the subsequent round of analysis (under process) was undertaken using learning outcome data collected by the state government as part of its routine learning assessment survey.

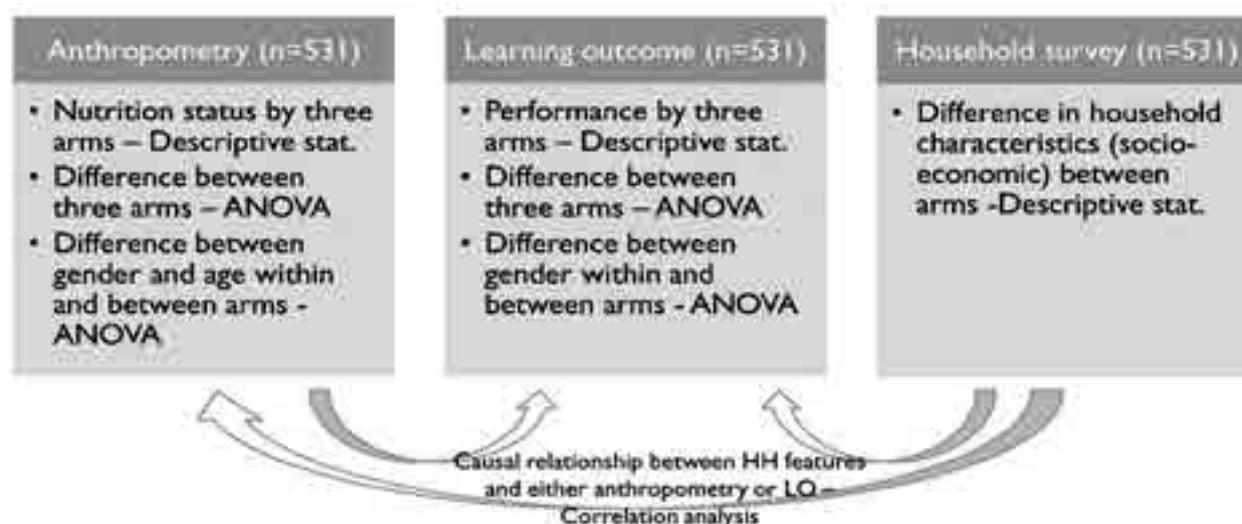
Tools used for data collection: Several tools were piloted and standardized for use in the study. These included:

- School questionnaire, administered to principal
- School register data extraction tool
- Anthropometric assessment of child
- Language and Mathematics Test administered to child
- Household Questionnaire, administered to parent of child
- Focus Group Discussion guidelines

Data analysis: In the year 2016, 16 government primary schools were chosen for the measurements of nutritional and learning status. Out of these 16, in 4 of them, Akshaya Patra served mid-day meals. Of the remaining 12, one-half were served by the school itself and another half by other non-governmental organizations. Measurements of nutritional outcomes were conducted for 824 students of grade 1, 3 and 5. But evaluation of learning outcome was administered to 567 students of grade 3 and 5 in the same schools. Additionally, data about household characteristics were collected from 571 households who sent their children to the selected schools. The difference in the number of students between nutritional and learning outcome assessment was due to the absence of students on the particular day of the learning outcome test.

Upon merging the data about nutritional and learning outcomes and household characteristics, there were 531 common observations in each of the data set. Using this merged data, an analysis was planned in a systematic manner as depicted in the figure below. Statistical software package SPSS-v11 was used for the analysis.

Figure 2: Data analysis scheme



The following table gives an idea of the number of students in each kitchen-type under different gender and class.

Table 3: Number of students for analysis by gender and class (2016)

	Government Kitchen		Akshaya Patra Kitchen		Other Kitchen		Total
	Class 3	Class 5	Class 3	Class 5	Class 3	Class 5	
Male	55	57	43	32	28	36	251
Female	57	67	43	49	32	32	280
Total	112	124	86	81	60	68	531

Source: Primary survey

Analysis of nutritional outcome data: This data consisted of anthropometric measurements of all the enrolled students of grade 1, 3 and 5. Using these measurements, BMI and stunting index was calculated. Both these indices were used as indicators of nutrition resulted from various factors, including meals served at school.

Data for BMI and stunting was categorized into three groups by the kitchen type of mid-day meal viz. Akshaya Patra, Government and Others. Nutritional outcomes were compared between the school types using ANOVA (analysis of variance). Students from each group were divided into two subgroups by age or grade and gender. This analysis revealed the level of significance for differences between and within these subgroups as well as between the main groups (by kitchen type).

Table 4: Primary Outcomes and Mediating Variables

Category	Indicators	Means of assessment	Source of Data
Nutritional Outcomes	Weight gain	weight gained within a year	Anthropometry
	Underweight	BMI for age	
	Height gain	Height gained within a year	
	Stunting	Height for Age	
Learning Outcomes*	School Enrolment	Number of children enrolled	School Register
	School attendance	Number of school days missed	
	Academic Performance	Language test score	Language Test
		Mathematics test score	Mathematics Test
Household Level Mediating Variables	Socio-economic Status	Parental Education Assets Land ownership Occupation Family Size	Household Questionnaire
	Dietary Diversity	48-hour consumption of major food groups	Household Questionnaire
	Food Security	Shortage of Food Lack of dietary diversity Hunger	Household Questionnaire

*Learning outcome test was conducted for students who were present on the day of the test, thus the number of students varies between nutritional outcome test and learning outcome test.

Analysis of learning outcome data: Learning level of children was measured using assessment conducted for two subjects - regional language (Kannada) and Mathematics.³ The percent score by each child in both the assessments was used for analysis with learning outcome.

As in the case of the nutritional outcome, same groups were maintained for comparing learning outcomes - groups by kitchen type, groups by grade and groups by gender. Using the distributive

3 The tests were developed by in-house learner assessment experts of the Azim Premji Foundation, and consisted of a series of grade-appropriate multiple-choice questions covering various aspects of the prescribed curriculum in Kannada and Mathematics.

statistics (box and whisker plots) the range of scores between groups was compared. Among the three groups compared, children served by Akshaya Patra kitchen had lesser scores but a wide range of scores in both the assessments. Using analysis of variance, the difference between and within groups was calculated. Irrespective of kitchen type, learning outcome was compared between groups of children by nutritional status as well.

Analysis of household survey data – Household survey data consists of socio-economic details such as social group, family members, education, occupation, income, housing condition, diet, health, etc. Descriptive statistics for all key variables and their comparison between different groups was carried out. Some of the variables from the household survey were used only to correlate with either nutritional status or learning outcomes. These variables included parental (mother and father separately) education and occupation, pre-school attendance by the child, the weekly diet of the family, illness and housing structure.

Correlation between data collected – The three datasets were analysed for causal relationship between them. The correlation was drawn between following three pairs of datasets –

- Nutritional status and Learning outcome
- Household survey and Nutritional status
- Household survey and Learning outcome

Results

Starting with the analysis of anthropometric measurements and then learning outcomes, this section focuses on the results obtained from the analysis of variance between the schools served by different kitchen types. The section will also discuss the results of comparative analysis between class and gender. Results of correlation analysis will be briefed at the end of the section.

a. Analysis of Anthropometric Measurements

The table below presents the nutrition status in terms of BMI and stunting categories identified before.

Table 5: Nutrition Status – BMI and Stunting in total sampled students (2016)

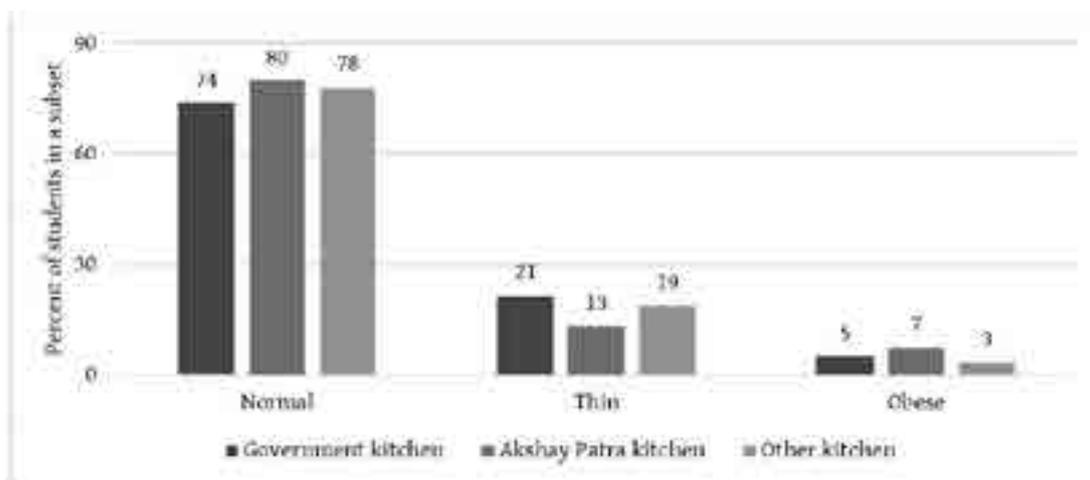
BMI Code	No. of Students (n=531)	% of Total
Normal	409	77
Thin	95	18
Obese	27	5
Stunting Code	No. of Students	
Normal	421	79
Stunted	110	21

Source: Primary anthropometric measurements

Overall, 77% and 79% of the children were within the normal range for weight and height respectively. 18% were either thin or severely thin (WHO Growth Standards, 2007) and a small percentage were obese. 21% of the students were stunted.

The analysis by type of kitchen yielded interesting results:

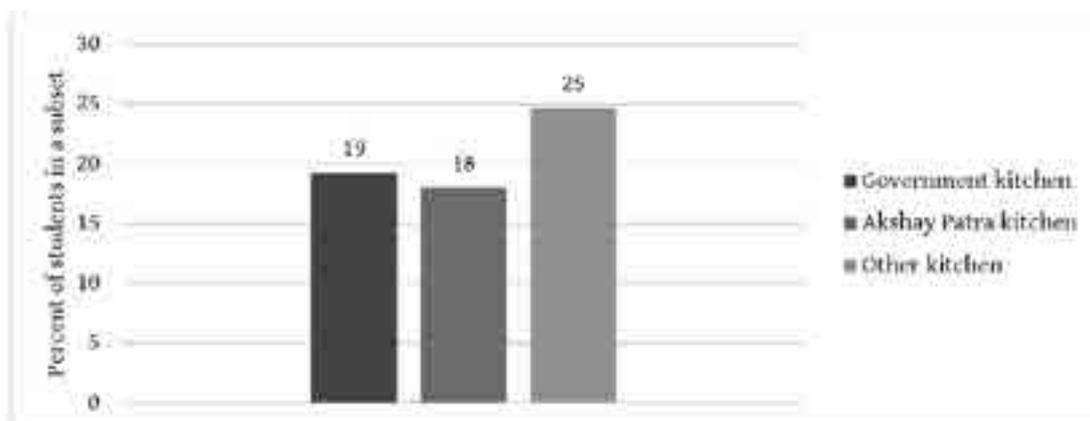
Figure 3: Nutrition Status by type of kitchen serving MDM (2016)



Source: Primary measurements

The data show that BMI (z-score) of Akshay Patra kitchen is significantly (95%) better than Government kitchen ($p=0.029$) and Other kitchen ($p=0.022$). Percentage of stunting was also lowest in Akshay Patra kitchens, although the difference was not found to be significant at the .05 level.

Figure 4: Stunting by type of kitchen serving MDM (2016)

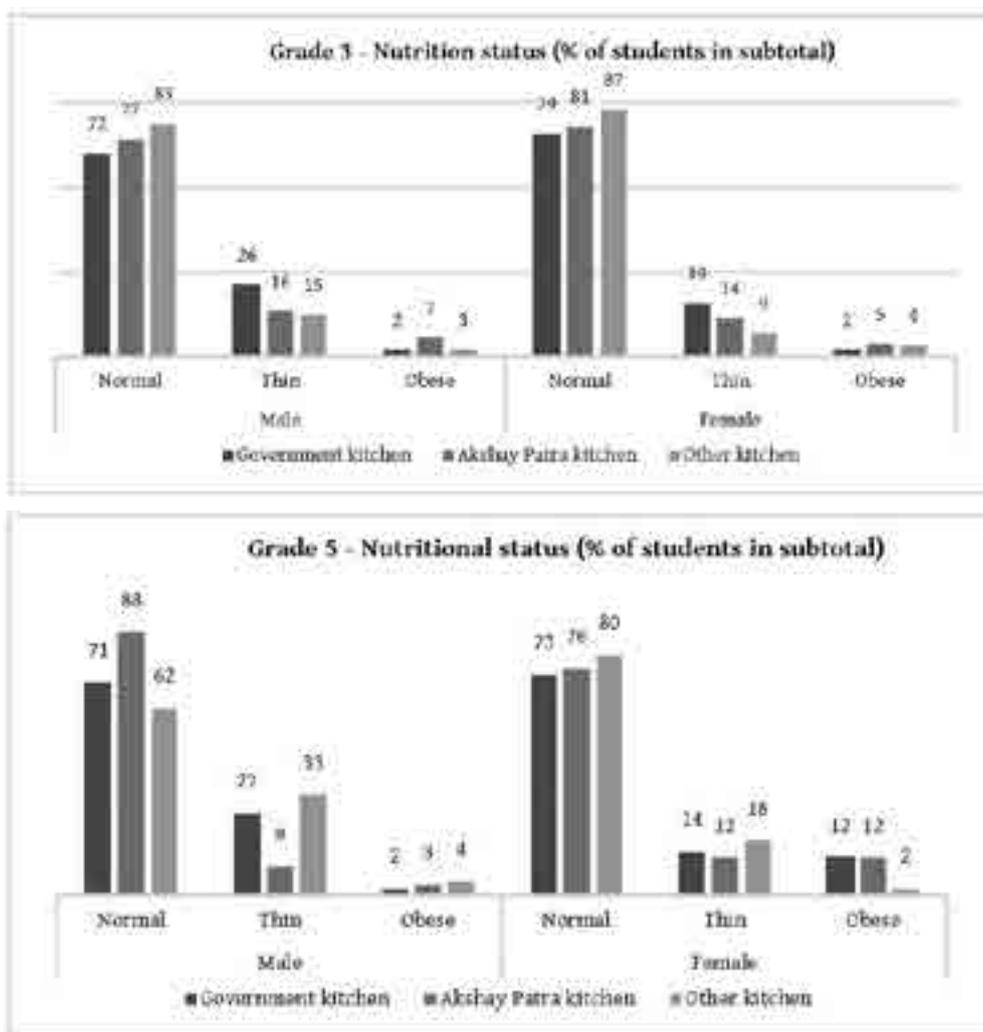


Source: Primary measurements

A cross-tabulation of BMI with stunting provides interesting insights: more than 60% of the children are normal for both weight and height; another almost 15% are normal for weight but moderately stunted; and 10% are normal for height but thin. This leaves about 15% of the students who are not in the normal range for either weight or height. The policy implications of this will be discussed in the next section.

Further classifying the students based on the type of kitchen, gender and grade, the nutritional status looks like in the figure below.

Figure 5: Nutritional Status by type of kitchen, gender and grade (2016)



Source: Primary measurements

The data show that in both age groups, girls have better nutritional outcomes (BMI) than boys (with the exception of Akshay Patra kitchens in Class 5): about 72%-83% of boys are in the normal range in Class 3 as compared to about 79%-87% of girls in the same class. Girls were also less likely to be thin or obese. Similarly, in both government and other kitchens, in Class 5, boys in the normal range drop to about 71% and 62% respectively, while the range for girls is higher at 73.5% and 80%. Only Akshay Patra kitchens show a different pattern with more boys in the normal range than girls, and fewer in the thin range as well. Overall, thinness among girls was much less than boys in this age group, however, obesity was much greater. Essentially, the data indicate that nutritional outcomes are better for girls than for boys at both age groups studied and that they decline for both boys and girls as they get older, and this decline is less substantial for girls.

b. Household Data

Few significant differences were found between the different households of the students. Largely, they could be described as follows:

Table 6: Characteristics of sample student households

Household characteristics	Percent of household in the sample
Nuclear family	98
Household head – Male	81
Literate mother	78 (another 17% can only sign)
Literate father	72 (another 17% can only sign)
Own house	58
Have toilet	All
BPL card	77
Use LPG for cooking	96
Use firewood for cooking	17
Piped water connection inside the house	42
Fetch water from common tap	30
Parents employed (formal or informal)	58
Index child attended Anganwadi	93
Index child attended another school	18

Source: Primary survey

A simple regression analysis of children's/household characteristics and BMI revealed the following significant coefficients at the .05 level: gender, type of kitchen (Akshay Patra), age of the child, mother's weight, availability of ration card and consumption of green, leafy vegetables by the index child.

Table 7: Simple Regression of BMI and Household Characteristics

Student and household characteristics	Coefficient	Std. Err.	t	P>t
Gender	0.460	0.170	2.750	0.010
Type of Kitchen (Akshay Patra)	0.560	0.180	3.130	0.000
Age in months	0.040	0.010	6.410	0.000
Mother's weight	0.020	0.010	1.940	0.050
Availability of ration card	0.380	0.190	2.040	0.040
Consumption of green leafy vegetables by the index child	-0.440	0.100	-4.250	0.000
Constant	10.010	0.840	11.900	0.000

c. Learning Outcomes

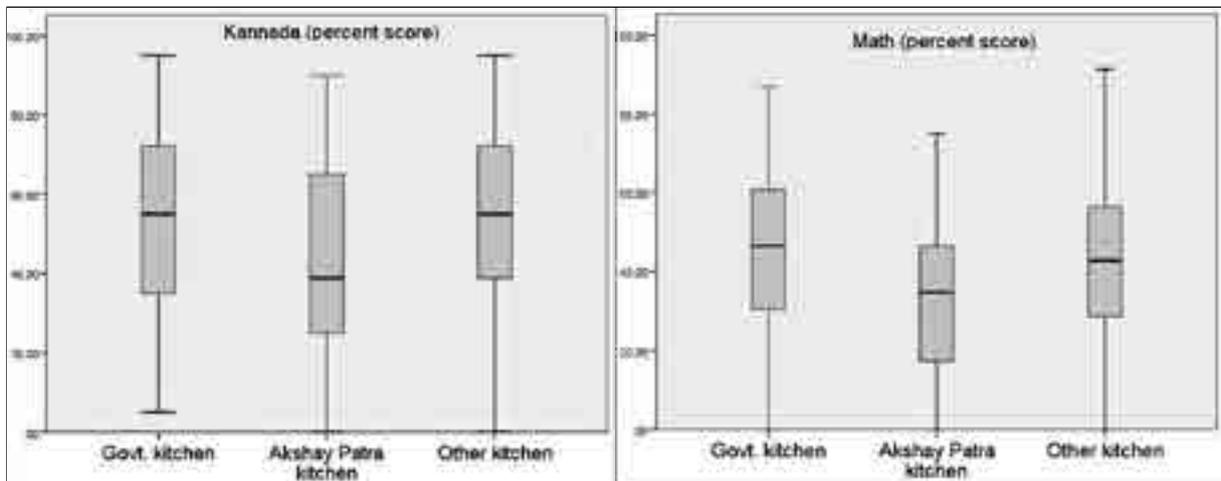
Table 8: Learning Outcomes by Nutritional Outcomes, Gender and Class (mean score in 2016)

BMI	Grade 3				Grade 5			
	Male		Female		Male		Female	
	Math	Kannada	Math	Kannada	Math	Kannada	Math	Kannada
Normal	41.28	46.16	45.87	50.92	34.68	46.56	41.25	57.52
Thin	44.38	56.94	45.17	45.06	40.44	50.97	43.34	57.95
Obese	36.52	36.67	39.13	38.89	31.25	37.50	45.06	59.62

Source: Primary assessment

The data did not show any correlation between learning outcomes and BMI status in any of the groups by gender or class. The following set of charts shows learning outcomes by kitchen categories:

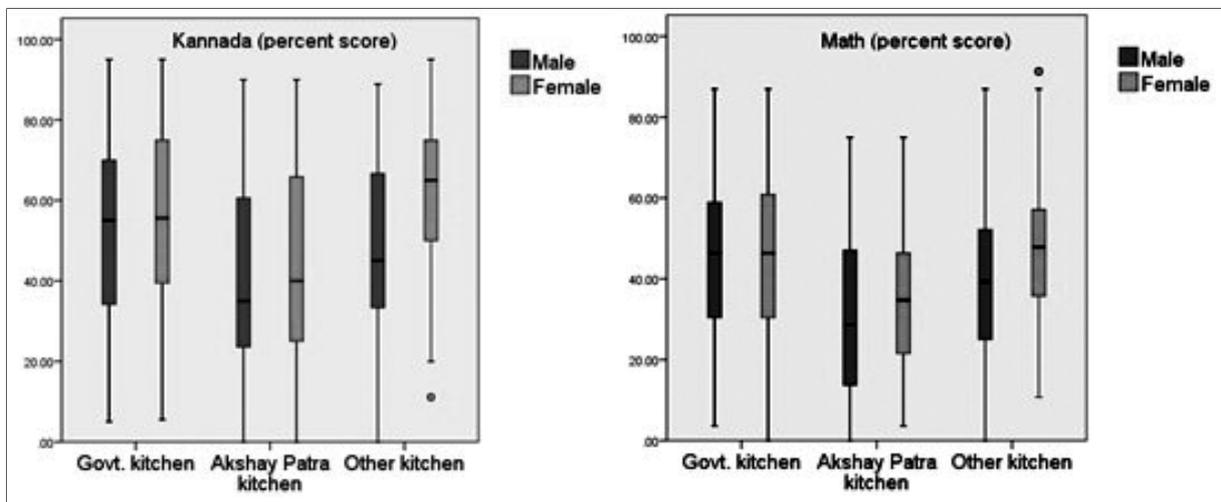
Figure 6: Test scores by kitchen-type (2016; n=531)



Source: Primary assessment

This was further disaggregated to show differences by gender:

Figure 7: Test scores by gender and kitchen-type (2016; n=531)



Source: Primary assessment

The data show that there is a significant difference in learning outcomes when the analysis is done by gender and type of kitchen. A key finding was that girls with normal BMI had significantly better learning outcomes for both Kannada and mathematics than boys with a normal BMI (mean difference: 7.92; $p = 0.007$).

Contrary to expectations, while Akshay Patra performed better than the other two kitchen types on nutritional outcomes, it performed consistently worse than both government and other kitchens on learning outcomes. Girls from schools with both in-school kitchens and other kitchens performed significantly better than both boys and girls from schools where Akshay Patra was delivering the MDM.

d. Qualitative Responses

Analysis of the FGDs conducted with students, parents and teachers provided the following information:

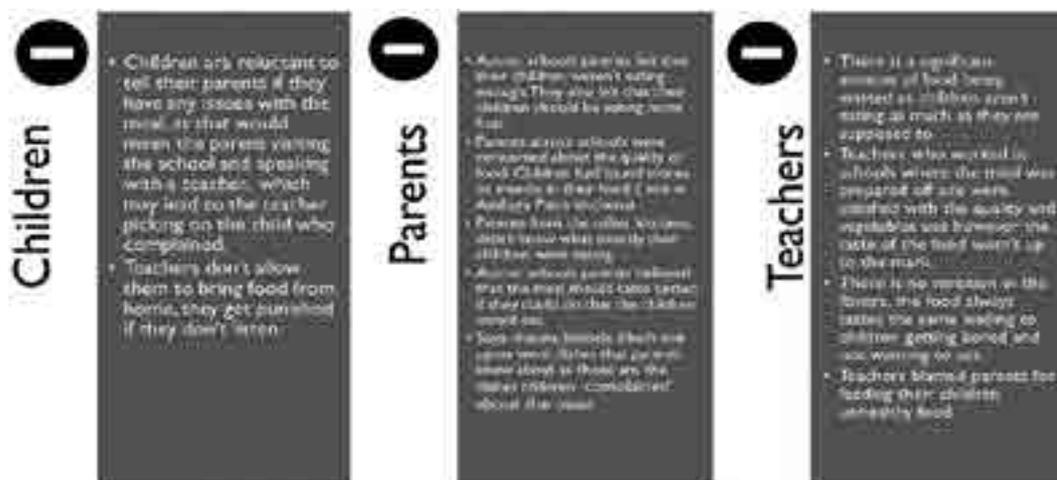
On the positive side, the findings were:

Figure 8: Positive Reactions to the Mid-Day Meal



On the negative side, all groups had different opinions:

Figure 9: Negative Reactions to the Mid-Day Meal



Discussion

The study has yielded a rich set of insights on the nutritional status of primary school children and their learning outcomes. Some of the findings confirm other studies (Rao Seshadri and Ramakrishna, 2018): nutritional status of girls is significantly better than that of boys in primary school; and the nutritional status of both boys and girls declines significantly as they grow older.

The type of kitchen made a significant difference: children attending schools where the MDM was provided by Akshay Patra were significantly better off nutritionally than the other types of kitchen. The Focus Group Discussions (FGDs) could provide some clues to this: (i) while children getting MDM from all kitchen types had items that they liked and disliked in the menu, but children from Akshay Patra schools did not have any complaints regarding the quality of the food such as worms, stones, etc. that put many of the children off from their food from the government and other kitchens. *'We got small worms, stone and pearls in it. If we bite it thinking that it is pepper it turns out to be a piece of stone.'* (Student from in-school kitchen school). *'I got stomach pain one day and when I showed the doctor, she said it was because of outside food. She asked if they find worms in mid-day meal. I said yes.'* (Student from in-school kitchen school); (ii) Akshay Patra supplies cold milk, sometimes with Badam flavor and sugar. Children seem to prefer this to the milk supplied from other sources; and (iii) Akshay Patra food is hot when served. This is true also of the food served from the school's own kitchen.

In addition,

- (i) Mother's weight – underweight mothers had underweight children: this is in keeping with the literature: malnutrition has been shown to be inter-generational, and a malnourished mother is likely to have a malnourished child.
- (ii) Families with a ration card were less likely to have an underweight child: direct food support through the Public Distribution System is meant to increase access to and availability of food grains for poor households. and
- (iii) Regular consumption of green, leafy vegetables by the child had a significant positive impact on the child's nutritional status: quality and dietary diversity are both importantly associated with nutritional outcomes.

In terms of learning outcomes, learning outcomes of girls were significantly better than that of boys. There were two unexpected findings: (i) source of MDM had no impact on learning outcomes, and in fact, were consistently poorer in schools receiving food from Akshay Patra as compared to the other kitchens; and (ii) nutritional status of the children (BMI) did not impact learning outcomes either.

Reasons for these findings required a further investigation into the schools themselves, and factors other than the type of kitchen that could possibly contribute to differences between them. In order to do so, we collected data from the School Report Cards produced annually by the government on a range of school characteristics, including Pupil-Teacher Ratio (PTR),

availability of facilities (playground, library), implementation of Right to Education (RTE) and so on (<http://schoolreportcards.in/index.html>). The table below summarizes the data and presents a snapshot of the status of the schools with an in-school kitchen versus the other kitchens. This is merely an exploratory attempt to understand what could explain the differences in learning outcomes, based on other school characteristics.

Table 9: Key Indicators on Study Schools

	In-school kitchen (N=8)		Non-Government Kitchen (N=8)	
	Mean	Std. Err.	Mean	Std. Err.
Total Children	167.1	18.8	192.9	31.9
Total Teachers	6.9	1.0	6.5	1.0
PTR	25.1	1.9	29.4	1.6
RTE Grade	8.5	0.5	8.0	0.6
No. visits by CRC	8.8	1.5	9.8	1.7
No. visits by BEO	2.3	0.8	2.8	0.7
Index Visits	11.0	2.0	12.5	2.2
Regular Teachers	6.5	0.9	5.5	0.9
Post-Graduate and above	1.6	0.7	1.3	0.5
Index Teacher Quality	8.1	1.4	6.8	1.3
No. of classrooms	9.0	1.9	9.3	1.2
No. of other rooms	1.5	0.8	1.5	1.1
Availability of Head Teacher*	0.6	0.2	0.1	0.1
Total Toilets	2.8	0.4	3.6	0.6
No. of books	2984	540	2450	581.2
Playground (%)	63	0.2	50	0.2
Total students enrolled	182.8	25.1	212.6	43.2
Student classroom ratio	27.8	8.3	24.5	4.8
% Girls enrolled	50.2	1.3	50.6	1.2
% Muslim students	7.3	2.4	21.9	12.5
% SC students	30.6	4.1	33.7	5.2
% ST students	4.4	1.2	5.1	1.6
% OBC enrolment	59.7	4.2	58.7	6.2

* Difference significant at .05 level

A few factors stood out as being noteworthy: (i) teacher quality as measured by the number of regular teachers (as against contract staff) employed by the school and their qualifications. Schools with In-school kitchens have a larger number of regular teachers with higher qualifications; and (ii) availability of a Head Teacher. Schools with In-school kitchens were significantly more likely to have a Head Teacher ($p = .05$). These factors not only seemed to predict better learning outcomes in those schools, but also seemed to be a determining factor in whether the school opted for an outside agency to supply the MDM. This is an important insight provided by this study; and furnishes specific information on the criteria for the choice of kitchen type which was not earlier clearly

articulated anywhere. The overall preference of both parents as well as teachers, as revealed in the FGDs, was to have the MDM cooked on the premises, in these schools. A Head Teacher clearly plays a critical role in school management; and wherever s/he is available, are able to manage the logistical challenges of having an operational school kitchen. Schools without a Head Teacher are more likely to opt for an external agency. These preliminary findings need to be confirmed with further specific research.

VII. Conclusion and Recommendations

This study has highlighted several key issues. First, children in primary school are at nutritional risk, and the MDM is a key nutrition-specific intervention that can make a material difference. Ensuring that this meal is wholesome, nutritious and adequate is critical. Currently, the MDM is based on a calculation of calorific intake and is heavily skewed towards carbohydrates. This needs to change, with the introduction of more protein and a greater variety of vegetables of all kinds. The hesitation to provide eggs and fruit due to cultural/religious concerns needs to be seen within the larger context of child nutrition and its long-term beneficial effects.

The mode of delivery of the MDM depends critically on school capacity. Smaller schools with fewer resources appear to favor supply of MDM from a centralized kitchen. Our evidence shows that the MDM from a centralized kitchen has a positive impact on nutritional outcomes, but not necessarily on learning outcomes. This points to two options, both of which require school capacity to be strengthened. If the school lacks the resources to run its own MDM, it needs to allocate time and attention to managing the external supplier more stringently. On the other hand, if the school opts to run its own kitchen, the challenge is to ensure that the composition of the MDM is nutritionally adequate. The quality of the food, its acceptability, diversity and so on need to be managed by a strong school administration. Making sure that all schools have a Head Teacher and full complement of other staff is essential no matter which source is selected.

Taste and hygiene are important determinants of whether children eat the MDM. Not enough attention is paid to this, particularly by external agencies that provide the food. In this sense, cooking in the school kitchen can benefit from employing local cooks who can cater to local tastes, thus ensuring that children relish the food better. Even where this is not feasible, accounting for local tastes and preferences is very important if the objective is to make sure that children eat an adequate meal.

The interlinkages between different government nutrition programmes need to be strengthened. For example, ensuring that all vulnerable families have a ration card will support the nutritional adequacy of diets for the poorest households. Making sure that adolescent girls/pregnant mothers from these households avail of the benefit of a cooked MDM in the Anganwadi, as well as iron supplementation programmes through the ASHA or ANM, will help women to overcome their own undernutrition and thereby break the cycle with the next generation. Nutrition is an inter-generational issue that is multi-faceted: food supply needs to be adequate, available and nutritious.

The linkage between the MDM and learning outcomes appears to be weak. Our analysis shows that the relationship of learning outcomes to overall school management appears to be much stronger; and the decision to either provide the MDM from an in-school kitchen versus outsourcing it (either to Akshay Patra or another entity) is a complex one and requires more detailed study.

India's mid-day meal scheme is the largest scheme of its type globally. It recognizes the fact that an investment in the nutrition of a child is one that has immense individual and social benefits. Now that it is well-established across the country, to reap the full benefit from the scheme, the government needs to focus on improving its quality and nutritious value to enhance its impact. With the renewed support provided by the New Education Policy, the possibility of strengthening school feeding programmes in India has received a fresh impetus which bodes well for the future flourishing of school children.

References

- 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.
- Afridi, F.** (2011). The Impact of School Meals on School Participation: Evidence from Rural India. *The Journal of Development Studies*, 47(11): 1636–1656. <https://doi.org/10.1080/00220388.2010.514330>. Accessed on February 25, 2018
- Afridi, F., Barooah, B. and Somanathan, R.** (2013). School meals and classroom effort: Evidence from India. *International Growth Centre*. <https://www.theigc.org/wp-content/uploads/2014/09/Afridi-Et-Al-2013-Working-Paper1.pdf>. Accessed on February 25, 2020.
- Afridi, F., Barooah, B. and Somanathan, R.** (2016). *Student responses to the changing content of school meals in India*.
- Alderman, H., Hoddinott, J. and Kinsey, B.** (2006). Long term consequences of early childhood malnutrition. *Oxford Economic Papers*, 58(3): 450–474.
- Bundy, D., Burbano, C., Grosh, M. E., Gelli, A., Juke, M. and Lesley, D.** (2009). Rethinking School Feeding: Social Safety Nets, Child Development, and the Education Sector. *The World Bank*. <https://doi.org/10.1596/978-0-8213-7974-5> (accessed October 2, 2020)
- Chakraborty, T. and Jayaraman, R.** (2016). *School Feeding and Learning Achievement: Evidence from India's Mid-day Meal Program*. IZA Discussion Paper No. 10086. <http://ftp.iza.org/dp10086.pdf>. Accessed on October 2, 2020.
- Cheung, M. and Berlin, M. P.** (2015). The Impact of a Food for Education Program on Schooling in Cambodia. *Asia & the Pacific Policy Studies*, 2(1): 44–57.
- Dambhare, D. G., Bharambe, M. S., Mehendale, A. M. and Garg, B. S.** (2010). Nutritional status and morbidity among school going adolescents in Wardha, a Peri-Urban area. *Online Journal of Health and Allied Sciences*, 9(2).
- Deodhar, S. Y., Mahandiratta, S., Ramani, K. V. and Mavalankar, D.** (2016). *An Evaluation of MidDay Meal Scheme*. <https://www.semanticscholar.org/paper/An-Evaluation-Of-Mid-Day-Meal-Scheme-Deodhar-Mahandiratta/ed6b0a66ebc6d31529dd32917d8b6dff68309ac>. Accessed on October 2, 2020
- Drake, L., Woolnough, A., Burbano, C. and Bundy, D. (2016). *Global School Feeding Sourcebook: Lessons from 14 Countries*. Imperial College Press © Lesley Drake. <https://openknowledge.worldbank.org/handle/10986/24418> License: CC BY-NC-ND 3.0 IGO." Accessed on February 28, 2018.
- Drèze, J.** (2004). Democracy and Right to Food. *Economic and Political Weekly*, 39(17): 1723–1731.
- Drèze, J. and Kingdon, G. G.** (2001). School Participation in Rural India. *Review of Development Economics*, 5(1): 1–24. <https://doi.org/10.1111/1467-9361.00103>. Accessed on February 28, 2018.
- Dutta, A., Pant, K., Puthia, R. and Sah, A.** (2009). Prevalence of Undernutrition among Children in the Garhwal Himalayas. *Food and Nutrition Bulletin*, 30(1): 77–81.
- Galler, J. R., Bryce, C. P., Zichlin, M. L., Waber, D. P., Exner, N., Fitzmaurice, G. M. and Costa, P. T.** (2013). Malnutrition in the first year of life and personality at age 40. *Journal of Child Psychology and Psychiatry, and Allied Disciplines*, 54(8): 911–919. <https://doi.org/10.1111/jcpp.12066>. Accessed on February 27, 2018
- Garg, M. and Mandal, K. S.** (2013). Mid-day meal for the poor, privatised education for the non-poor. *Economic & Political Weekly*, 48(30): 155.
- Glewwe, P., Jacoby, H. G. and King, E. M.** (2001). Early childhood nutrition and academic achievement: A longitudinal analysis. *Journal of Public Economics*, 81(3): 345–368.
- Glewwe, P. and Miguel, E. A.** (2007). Chapter 56 The Impact of Child Health and Nutrition on Education in Less Developed Countries. In *Handbook of Development Economics*, Vol. 4 (2007): 3561–3606. Science Direct, Elsevier. [https://doi.org/10.1016/S1573-4471\(07\)04056-9](https://doi.org/10.1016/S1573-4471(07)04056-9). Accessed on March 12, 2018.
- Grantham-McGregor, S., Cheung, Y. B., Cueto, S., Glewwe, P., Richter, L., Strupp, B. and Group, I. C. D. S.** (2007). Developmental potential in the first 5 years for children in developing countries. *The Lancet*, 369(9555): 60–70.

- Jayaraman, R. and Simroth, D.** (2011). *The impact of school lunches on primary school enrollment: Evidence from India's midday meal scheme.*
- Jyoti, D. F., Frongillo, E. A. and Jones, S. J.** (2005). Food Insecurity Affects School Children's Academic Performance, Weight Gain, and Social Skills. *The Journal of Nutrition*, 135(12): 2831–2839.
- Seshadri, R. S., Parab, S., Bhor, N. and Latha, N.** (2016). What we ate then and what we eat now: A grandmother's tale. *Azim Premji University (Working Paper No. 2).*
- Shankar, P. and S. K., N.** (2001). *Best practices for the implementation of urban school nutrition programs in India An examination of decentralized and centralized Mid-Day Meal models in Delhi and Ahmedabad.* A report for the Office of the Commissioners to the Supreme Court in CWP 196/2001. <https://web.archive.org/web/20141129050252/http://centreforequitystudies.org/wp-content/uploads/2012/08/Best-practices-Mid-day-meal.pdf> (Accessed October 2, 2020)
- Singh, A.** (2008). Do school meals work? Treatment evaluation of the midday meal scheme in India. *Young Lives.*
- Srivastava, A., Mahmood, S. E., Srivastava, P. M., Shrotriya, V. P. and Kumar, B.** (2012). Nutritional status of school-age children—A scenario of urban slums in India. *Archives of Public Health*, 70(1): 8.
- von Grebmer, K., Bernstein, J., Hossain, N., Brown, T., Prasai, N., Yohannes, Y., Patterson, F., Sonntag, A., Zimmerman, S.-M. and Towey, O.** (2017). *2017 global hunger index: The inequalities of hunger.* Intl Food Policy Res Inst.
- Walker, S. P., Wachs, T. D., Gardner, J. M., Lozoff, B., Wasserman, G. A., Pollitt, E., Carter, J. A. and Group, I. C. D. S.** (2007). Child development: Risk factors for adverse outcomes in developing countries. *The Lancet*, 369(9556): 145–157.
- Weinreb, L., Wehler, C., Perloff, J., Scott, R., Hosmer, D., Sagor, L. and Gundersen, C.** (2002). Hunger: Its Impact on Children's Health and Mental Health. *Pediatrics*, 110(4): e41–e41.

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Azim Premji University was established in Karnataka by the Azim Premji University Act 2010 as a not-for-profit University and is recognized by The University Grants Commission (UGC) under Section 22F. The University has a clearly stated social purpose. As an institution, it exists to make significant contributions through education towards the building of a just, equitable, humane and sustainable society. This is an explicit commitment to the idea that education contributes to social change. The beginnings of the University are in the learning and experience of a decade of work in school education by the Azim Premji Foundation. The University is a part of the Foundation and integral to its vision. The University currently offers Postgraduate Programmes in Education, Development and Public Policy and Governance, Undergraduate Programmes in Sciences, Social Sciences and Humanities, and a range of Continuing Education Programmes.



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