

**Mid Day Meal Scheme:
Understanding Critical Issues with Reference to Ahmedabad City**

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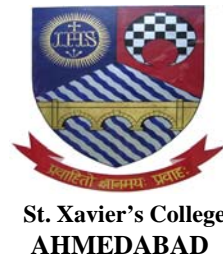
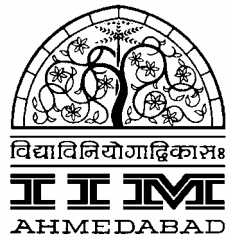
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EXECUTIVE SUMMARY

The concept of giving nutritional support to school children is not new in India. It dates back to 1925 when Madras Corporation developed a school lunch program. However, it was only in 1995 that such a scheme was launched at the national level in order to provide nutritional support to students in primary schools. The objective of this scheme was to give boost to universalization of primary education and to impact the nutrition of students in primary classes. The Mid Day Meal (MDM) scheme has been revised in 2004 and as per the Supreme Court directive it envisages provision of cooked, nutritious mid-day meal to primary and secondary school children. Importantly, it mentions about setting-up of an appropriate mechanism for quality checks. Despite these developments, over the decades, the problems of malnutrition, anaemia, vitamin-A and Iodine deficiency are very common among children in India. Today, ninety-four percent of children in the age group of 6 to 9 are mildly, moderately, or severely underweight. About 67.5 percent of children under 5 years, and 69 percent of adolescent girls suffer from anaemia due to iron and folic acid deficiency. The important thing to consider is that the expenditures on this programme have been huge. For example in 2003-04 the expenditure was Rs. 14 billion and recent 2007-2008 budget of the central government has allocated Rs. 73 billion for the MDM scheme.

Gujarat started this scheme in 1984 and was the only State after Tamil Nadu to start it so early. The objective was to provide one meal a day to students studying in primary classes (I-VII). In the year 2005-06 a total of 31,152 schools (86% of the total primary schools in Gujarat) with 3.8 million beneficiaries (47% of the students enrolled) were covered under this scheme. The State budget allocated for the scheme in the year 2005-06 was Rs 2 billion (Rs 201.08 crores).

Gujarat's 7% (about 35 lakh) population belongs to Ahmedabad which has also been running the scheme since 1984. The Ahmedabad Municipal Corporation (AMC) is responsible for implementation of the scheme in the city. AMC covers 563 schools under 61 Mid Day Meal

Centres. It caters to 1.2 million beneficiaries which is about one-third of the total number of beneficiaries in Gujarat. In the year 2005-06, about Rs 28 million were spent on the scheme.

Therefore, it becomes imperative that a comprehensive evaluation of the programme be undertaken to judge the efficacy of this scheme. The broad objective of our AMC study has been to clearly identify some of the critical issues associated with the MDM scheme and to do an objective evaluation in terms of efficiency in delivery system and service quality (which includes food safety, food nutrition and sensory aspects). We addressed three critical aspects of the scheme: managerial, technical and school logistics issues. Managerial issues pertain to understanding the planning and administration of the scheme by the central, state and local governments. For technical issues we identified nutritional and food safety concerns. This involved understanding norms in terms of nutritional recommended daily allowances (RDA) for children; identifying food safety standards in terms of microbial, chemical and physical contamination; and comparing the standards with the tests conducted on food samples from schools. We also discuss possibility of evolving food quality systems such as Hazard Analysis and Critical Control Points (HACCP) for food delivery. Logistical issues which pertain to actual day-to-day running of the scheme in government schools, such as procurement, storage, preparation, and serving and disposal of food. Issues related to meal timings and consequential implications on teacher time were also considered.

To address the above mentioned issues we collected secondary data and information on the working of the MDM scheme from various sources. This included the policy documents of the government and data available from the local and state administration. We also conducted field visits to some of the participating schools from different wards of Ahmedabad city. These included visits to 3 participating schools - in Gomtipur, Sabarmati and Ellisbridge areas – along with an NGO involved in preparation and distribution of meals. We documented our observations and collected food samples from these locations. The collected food samples were subjected to laboratory tests to analyze the nutrition content and food safety aspects of the meals.

Our study suggests that the implementation of the MDM scheme may be wanting on the grounds of nutrition and food safety. The weekly menu shows a variety of meals offered, however, the condiments and seasonings being very similar each day, the sensory variety may be lacking. The study also indicates that in terms of calorific and nutritive intake, proportionate amounts of protein and iodine are not being provided through the meals. Calcium requirements are more than met by the mid day meal. Proportionate requirements of fat and iron are also met by the meals. However, it must be borne in mind that MDM scheme is mandated to provide a minimum of 300 calories, i.e., minimum of about 15% of the daily requirement of calories. There is no guarantee that the kids will

get their rest of the 85% of calories at home, and, that their out-of-schools meals will have any significant amounts of nutrition. Hence, MDM scheme may want to provide much more than proportionate requirements of nutrition.

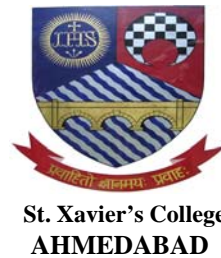
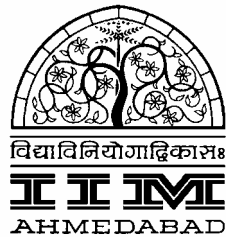
We suggest certain changes to address the above mentioned issues. For example, nutrition bars (or perhaps a local version like chikki) and fruits like banana could be considered as one of the menus on a couple of days. This will add variety and assured nutrition to the kids. It may seem that providing nutrition bars, especially the branded ones, may turn out to be an expensive proposition. However, if these bars are supplied in large quantities, economies of scale may reduce costs. Moreover, branded nutrition bars (say of ITC) could be provided only a couple of times a week, complemented by locally made items such as chikki on some other days. Large FMCG companies, especially the food companies like ITC are already involved in social development projects. They could be requested to channel their corporate social responsibility through MDM scheme.

The study also revealed traces of uric acid and Aflatoxins which if taken for a longer period of time could be carcinogenic for the children. Therefore, we suggest implementation of the HACCP system in preparation and serving of the meals. The food samples from the NGO were found to be good which are indicative of the fact that public private partnership could go a long way in making this scheme a success. However, our experience suggests that transportation of meals from the NGO kitchen to various schools was not hygienic and safe. Implementation of HACCP system can address such flaws. The visit to the schools revealed that cooking and serving food in the school premises leads to a significant if not substantive reduction in learning contact hours between the teachers and the students. A combination of warm meals on some days and pre-packed convenience foods on other days may reduce this loss of contact hours to some extent.

There are many aspects the current study could not focus on. For example, we did not focus on collecting time series data and analysing whether or not student enrolment has increased due to MDM, *ceteris paribus*. Moreover, although we were able to fathom the magnitudes of financial and administrative data at the national, state and local level, the scope of this study could be expanded to ascertain administrative and financial efficiencies (or the lack of it) in much more detail. A separate and contextual study may be conducted to understand these aspects. In fact, a much larger study at the regional or national level could be conducted that not only includes aspects not covered in this study, but also widens the sample size of schools, cities, and meals to get a much broader and representative picture of India's MDM scheme.



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Chapter 1

Introduction**1.1 Motivation**Background

Introduction of mid day meal scheme (MDM) in India occurred almost a century ago. It was the then Madras Corporation that first developed a school lunch programme way back in 1925. However, it was about 50 years later that such a scheme was given any serious attention at the national level. In the year 1974, the National Policy on Children declared that country's children are its supreme human resource. This policy enjoined the state to ensure full physical and mental development of children. Later, the National Programme of Nutritional Support to Primary Education (Mid Day Meal Scheme) was launched in 1995. The objective of this scheme was to give boost to universalization of primary education and impacting on nutrition of students in primary classes³. At about that time the union territory of Delhi did implement a Mid Day Meal scheme. Recently, a revised Mid-Day Meal Scheme has been launched in 2004⁴. The incumbent government at the centre has emphasized its implementation in its Common Minimum Programme. It envisages provision of cooked, nutritious mid-day meal to primary and secondary school children. Importantly, it mentions about setting-up of an appropriate mechanism for quality checks.

Despite these developments over the decades, the problem of malnutrition, anemia, deficiency in vitamin A and Iodine is very common among children in India. Today, ninety-four percent of children in the age group of 6 to 9 are mildly, moderately, or severely underweight! About 67.5 percent of children under 5 years, and 69 percent of adolescent girls suffer from anemia due to iron and folic acid deficiency.⁵ The Mid Day Meal scheme implemented in Delhi in the late nineties was found to be wanting on many evaluation

³ Government of India. "Guidelines of National Programme of Nutritional Support to Primary Education [Mid-Day Meal Scheme]," <http://education.nic.in/htmlweb/mdm/mdm1995.htm>

⁴ Government of India. "Guidelines of Revised National Programme of Nutritional Support to Primary Education [Mid-Day Meal Scheme]," <http://education.nic.in/htmlweb/mdm/mdm2004..htm>

⁵ Government of India. "Task Force Report on Micronutrients, D/WCD, 1996.

parameters.⁶ In fact, at this time, Mid-Day Meal scheme in many states including Punjab, West Bengal, Bihar, Himachal Pradesh, and others covers only 12 percent or less of the children attending government primary schools. The poor performance, however, is in stark contrast to the actual spending under this programme. For example, in the year 2002-03 and 2003-04 the actual expenditures on this programme were about Rs. 1100 crores (11 billion) and Rs. 1400 crores (14 billion) respectively. Therefore, it becomes imperative that a comprehensive evaluation of the programme be undertaken. In this effort, as a first step, one will have to clearly identify the critical issues and lacuna, if any, that mar the efficacy of the programme.

Economic Logic Behind MDM Scheme

The simplest answer to implementing the spirit of MDM scheme could have been to give direct income support to eligible disadvantaged households. Consider the choice a household makes between spending money on food for the kids and spending money on other goods. The preference for these two goods for a household is shown by an indifference curve I as shown in Figure 1.1. At the same time, the household has its budget (income) constraint given by the line segment AB. Given the preferences and the income constraint, a household chooses a bundle (F, G) that maximizes its utility. If government or NGOs for that matter, give direct income support to the targeted households, there is no guarantee that food consumption of the kids will go up. As shown in Figure 1.2, with income support, the household budget constraint shifts outward, say to line segment MN. The household preference for the two goods is such (indifference curve II) that food consumption of the kids may go down further, for disadvantaged households may choose other goods even more.

This perverse choice results because disadvantaged households do not have full information about nutritional aspects and the long term benefits of healthy upbringing. Another solution to this could be on the lines of Food Stamps Program that is implemented in the United States. Disadvantaged households are given food stamps which they can exchange for food items in the grocery shops. For example, a four member household which has gross (net) income level of \$26,000 (\$20,000) or less is eligible for about \$500

⁶ Government of N.C.T. of Delhi, Planning Department. "Evaluation Study Report on Mid-Day-Meal Programme," March 2000.

worth of food stamps per month⁷. However, such food stamp scheme may not work in the context of India's MDM scheme for the same reason mentioned above. A secondary market may evolve for food stamps where disadvantaged households may sell the food stamps to relatively well-off households at discounts and use the money for other goods as mentioned above. And, even if the households use the stamps for their own use, one does not know how much will go to the kids. Therefore, the situations will be similar to the one described in Figure 1.2.

Figure 1.1: Household Spending on Food for Kids and Other Goods

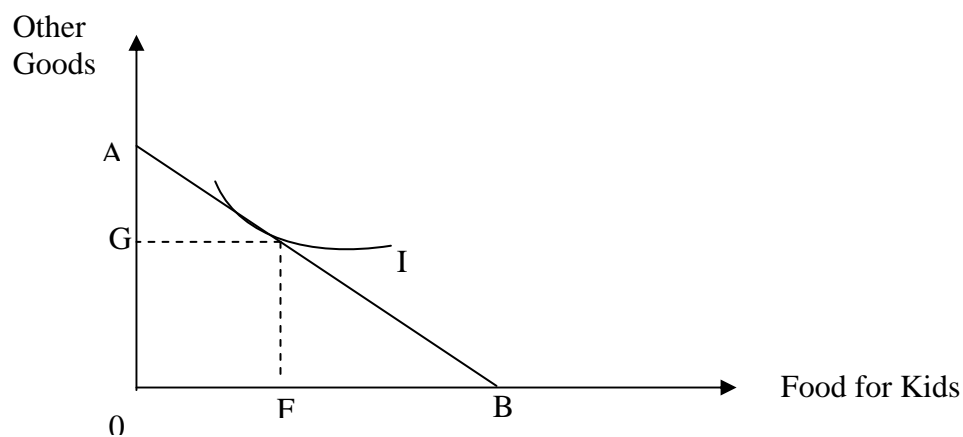
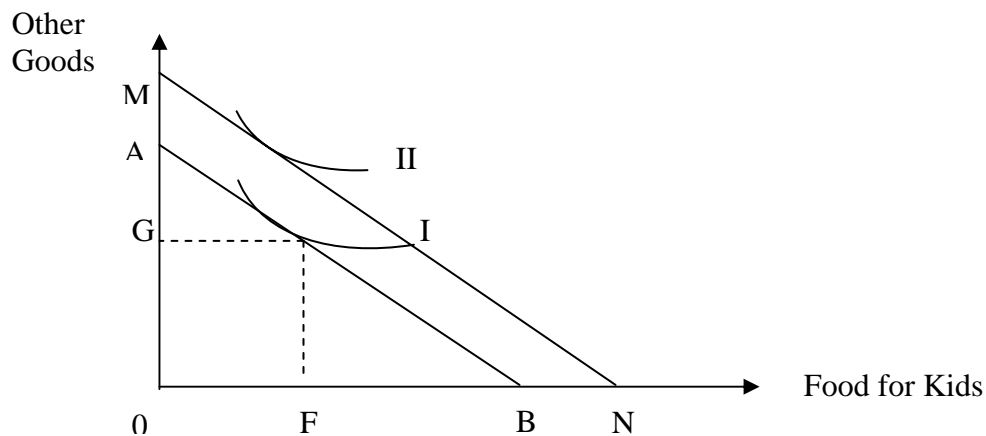


Figure 1.2: Spending on Food for Kids and Other Goods with Income Support



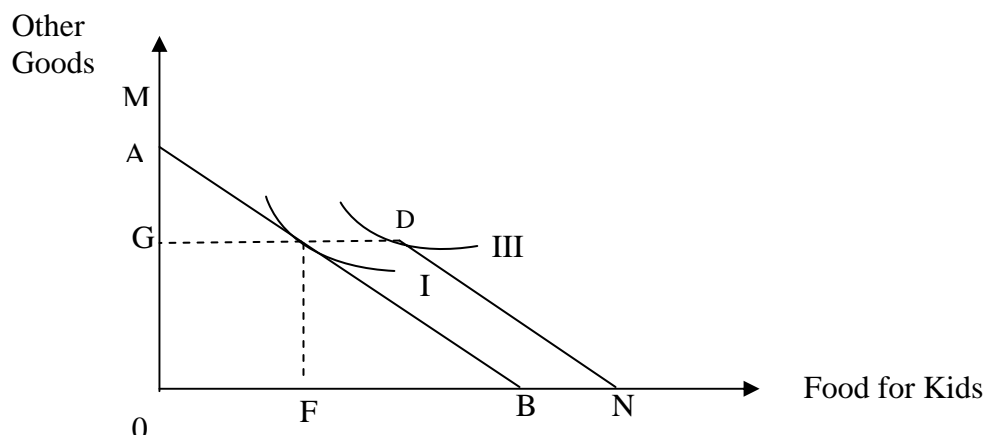
The long term solution to this problem is to have an extension activity to educate disadvantaged households about the importance of nutrition and healthy growth of children.

⁷ Source: Food Stamps Program, http://www.fns.usda.gov/fsp/applicant_recipients/fs_Res_Ben_Elig.htm

Basically, this amounts to changing the household preferences (indifference curves I and II in the diagrams above) in favour of food consumption by the kids. If this is achieved by health ministries and departments at various governmental levels in the long run, then one can think of providing income support or food stamps to disadvantageous households. However, one is uncertain about how long is the long run and what would be the degree of impact of the extension activity. Hence, something urgent needs to be done in the short and the medium run. The solution lies in providing incentive in such a fashion that households choose to send their kids to school and increase kids' food consumption.

This possibility is described in Figure 1.3. Instead of giving income support or food stamps, government or an NGO organizes to provide lunch in (mostly) government run schools where kids of the disadvantage households get enrolled. The new budget line of the disadvantageous households is now GDN. i.e., since, no income support is given, no food stamps are distributed, and kids take their lunch at school (parents cannot resell the lunch), the MD part of the spending option is just not available to the households. Given the household preferences are not changed, the optimal decision occurs at point D, a corner solution. Households do not alter their spending on other goods but they end up providing higher consumption of food to their children. Indifference curve III represents this situation where the household has a higher level of satisfaction as compared to no-scheme situation. As described in Figure 1.2, if the MD portion of the budget line was available to households, they would have increased their "satisfaction" further by being on the indifference curve II. But that situation is not socially optimal as disadvantageous households do not have full information about nutritional aspects and long term benefits of healthy upbringing.

Figure 1.3: Increase in Kids' Food Consumption with MDM Scheme in Place.



1.2 Objectives and Methodology

It is obvious from the above discussion that societal welfare would be higher if we choose to implement MDM scheme over income supports and/or food stamps programme. The Supreme Court ruling and the expressed commitments of the government on this issue make it imperative that MDM scheme not only gets implemented it gets implemented with desired results. The budget allocation for the scheme is enormous, and the challenge of successful delivery of the scheme in terms of child development indices is equally enormous. Therefore, the broad objective of this study has been to clearly identify some of the critical issues associated with the MDM scheme and to do an objective evaluation in terms of efficiency in delivery system and service quality (which includes food safety, food nutrition and organoleptic aspects). Broadly, we addressed three critical aspects of the scheme: managerial, technical and school logistics issues.

Managerial issues pertain to understanding the planning and administration of the scheme by the central, state and local governments, and identification of their roles and interdependencies. For technical issues we identified nutritional and food safety concerns. This involved understanding technical standards in terms of nutritional recommended daily allowances (RDA) for children; food safety norms in terms of microbial, chemical and physical contamination; and comparison of the standards with the actual sample data from participating schools. We also discuss possibility of evolving food quality systems such as Hazard Analysis and Critical Control Points (HACCP) for food delivery. Then there are logistical issues which pertain to actual day to day running of the scheme in government schools. This would involve logistical issues such as procurement, storage, preparation, and serving and disposal of food.

We adopt a three fold approach: (a) Field visits to 3 schools in Ahmedabad as also the kitchen of an NGO food service provider, Stri Shakti, (b) Document working of the MDM at the macro and micro level. I.e., working of the policy at various governmental levels and, working of the preparation and delivery of food at the school level. This is done through observations regarding food hygiene, food quality and end user expectations, (c) and performing laboratory testing of food items both prepared and raw materials in terms of nutrition and safety and comparing them with the prescribed minimum requirements.

Chapter 2

Three Tiered Perspective on MDM Scheme

2.1 The National Perspective

National Programme of Nutritional Support to Primary Education (commonly known as Mid Day Meal Scheme) was launched as a centrally sponsored scheme on 15th August 1995 with an objective of “Universalization of primary education by increasing enrolment, retention and attendance and simultaneously impacting on nutrition of students in primary classes.” It was implemented in 2408 blocks in the first year. However, even after nine years of the commencement of the MDM scheme, serving of cooked meals could not be universalized in six states (Assam, Bihar, Jharkhand, Uttar Pradesh, Haryana and Jammu and Kashmir). In many of the remaining states quality of the meal served to children was not satisfactory.

The Supreme Court has been giving certain directions in its orders passed from time to time. In its judgment in the case *People’s Union for Civil Liberties vs. Union of India* (Writ Petition (Civil) No. 196 of 2001) the apex court decreed that state governments must “implement the mid day meal scheme by providing every child in every government and government assisted primary schools with a prepared mid day meal with a minimum content of 300 calories and 8-12 grams of protein each day of school for a minimum of 200 days. Those governments providing dry rations instead of cooked meals must within three months (by 28 February 2002) start providing cooked meals in all government and government-aided primary schools in half of the districts of the state (in order of poverty) and must within a further period of three months (by 28 May 2002) extend the provision of cooked meals to the remaining parts of the state⁸.”

In June–July, 2004, government made certain policy pronouncements in regard to MDM scheme. President of India, in his address to parliament on 7 June 2004 said, “A national cooked nutritious mid day meal scheme, funded mainly by the central government will be introduced in a phased manner in primary and secondary schools...” Later, in the budget speech, union Finance Minister said on 8 July 2004, “The poor want basic education

⁸ Source: Groundswell for Mid-Day Meal Scheme”, India Together, 30 May 2006.

for their children: we shall provide it, and we shall make sure that the child remains in school for at least eight years. We shall also make sure that the child is not hungry while he or she is at school.... The whole of the amount collected as cess will be earmarked for education, which will naturally include providing a nutritious cooked mid day meal. If primary education and the nutritious cooked meal scheme can work hand in hand, I believe there will be a new dawn for the poor children of India⁹.” These pronouncements were followed by central government’s approval of a revised scheme, “National Programme of Nutritional Support to Primary Education, 2004 (NP- NSPE, 2004).” The main objectives of this revised scheme were to

- To boost Universalization of primary education (classes 1-5) by improving enrolment, attendance, retention and learning levels of children especially those belonging to disadvantage sections,
- To improve nutritional status of students of primary stage, and
- To provide nutritional support to students of primary stage in drought affected areas during summer vacation also.

Implementation

Implementation of the programme is in various stages in different states and union territories (UTs). Full implementation has taken place in 14 states (which includes Andhra Pradesh, Chhatisgarh, Gujarat, Karnataka, Kerala, Sikkim, Tripura and Uttranchal) and all 7 UTs. They provide cooked meals to all primary school children. Partial implementation in some selected districts has occurred in 9 states (Bihar, Goa, Haryana, Himachal Pradesh, Jharkhand, Madhya Pradesh, Orissa, Punjab and West Bengal). Four states (Arunachal Pradesh, Assam, Manipur and Uttar Pradesh) have not implemented the scheme. They do not serve cooked meals but distribute food grains instead. Finally, Jammu and Kashmir has not implemented the programme in any form. Initially the programme was started in a phased manner to cover all children studying in primary classes (I-V) in government, local body and government aided schools in the country. State wise and category wise Number of schools and students covered under Mid Day Meal Scheme in India is given in the Annexure I.

⁹ Source: Extracts from policy pronouncements regarding Mid Day Meal and guidelines for National Programme of Nutritional Support to Primary Education, 2004, MOH&FW.

2.2 MDM Scheme in Gujarat

Gujarat was the first (after Tamilnadu) state in the country to start the Mid-Day Meal scheme. By October 1984, the scheme had covered 5083 schools in 68 talukas out of 225 talukas and 25 districts of Gujarat. November 1984 onwards the scheme was extended to the entire state. The aim was to feed students studying in primary classes (1 to VII), with the objective of mitigating malnutrition among the vulnerable groups. MDM scheme was discontinued for a brief period from August 1990 and was reintroduced on 15 January 1992. During 1991 and 1992, a scheme called Food for Education was implemented wherein primary school children having at least 70% attendance were provided 10 kilograms of food grains free of cost per month.

In the year 2005-2006, a total 31,152 Primary schools, accounting for 86% of the primary schools were covered under the MDM scheme. The total enrollment of the children in state has shown a rise from 60.34 lakhs in year 1985-86 to 68 lakhs in the class I-VII in the year 2004-05. In comparison, the beneficiaries of the MDM programme are much less. Table 2.1 gives an indication of recent figure of beneficiaries. A little more than 50% of the total enrolled students are benefited by the MDM scheme. A recent data shows (Table 2.2) that about 47% students might be covered under the scheme. The Schedule Caste and Schedule Tribe beneficiaries were about 5 lakhs in the 1985-86. Their number has increased to 9.25 lakhs in the year 2005-06.

Table 2.1: Beneficiaries of the MDM Programme

Standard	2002-03	2003-04	2004-05
Standard I to V	27,75,041	27,71,220	29,39,218
Standard V to VII	6,05,544	6,77,590	7,19,638
Total I to VII	33,80,585	34,48,810	36,58,856

Table 2.2: Number of MDM centers in Gujarat

Year	2005-2006
Number of MDM Centers in Gujarat	29,649
Total number of students in Centers	81,34,000
Number of students Covered	38,27,166
% of students Covered	47%

Central Assistance consists of 100 gram food-grains (wheat/rice) per child per school day where cooked meals are served. I.e., this amounts to 3 kilograms of food grains per student per month. Food-grain (wheat or rice) is supplied through Food Corporation of India (FCI), the cost of which is reimbursed at BPL rate. A transport subsidy up to a maximum Rs.50 per quintal for movement of food grains from the nearest FCI depot to schools/MDM centers is provided. At the state level, the Commissionerate of the MDM is responsible for implementation of the scheme as well as all administrative issues like providing funds to district collectorate, and coordinating the supply of food grains/edible oils etc. The procurement and supply of pulses, edible oil, food grains, (for std VI and VII) etc. is carried out by Gujarat State Civil Supplies Corporation which is supposed to distribute them at MDM centers through Public Distribution System (PDS) system (see Figure 2.1). The organizational structure at the state level is also presented in Figure 2.2. The children are to be served hot mid day meals comprising of the specific stipulated ingredients (Table 2.3). There are two Menu Committees, which are headed by Commissioner MDM at state level. As per the S. C. Judgment 196/2001, a hot cooked meal had to be provided to children for minimum of 200 days. In view of this, the implementing authority can change the menu as per the availability of food grains. The District wise menu is given in Annexure II.

Figure 2.1: Distributions of Food Grains for MDM Scheme

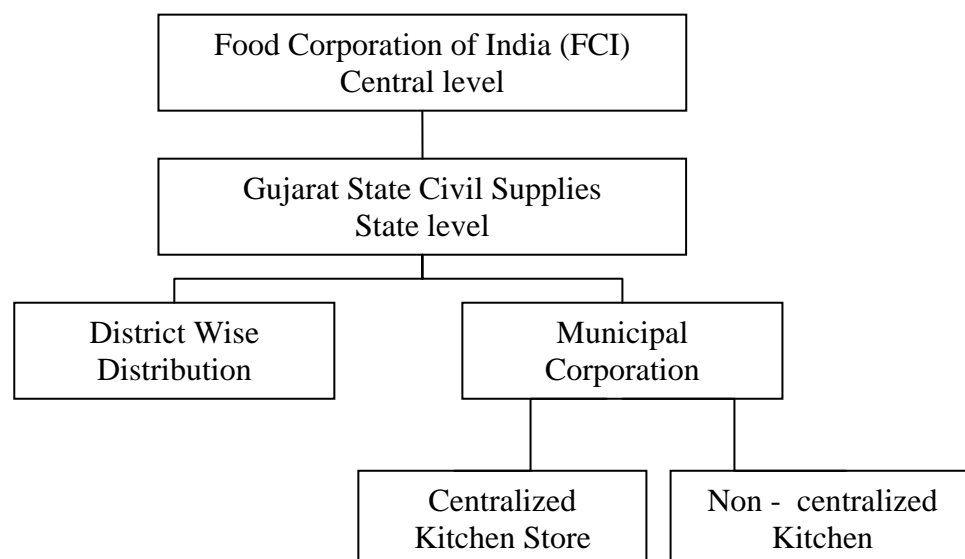


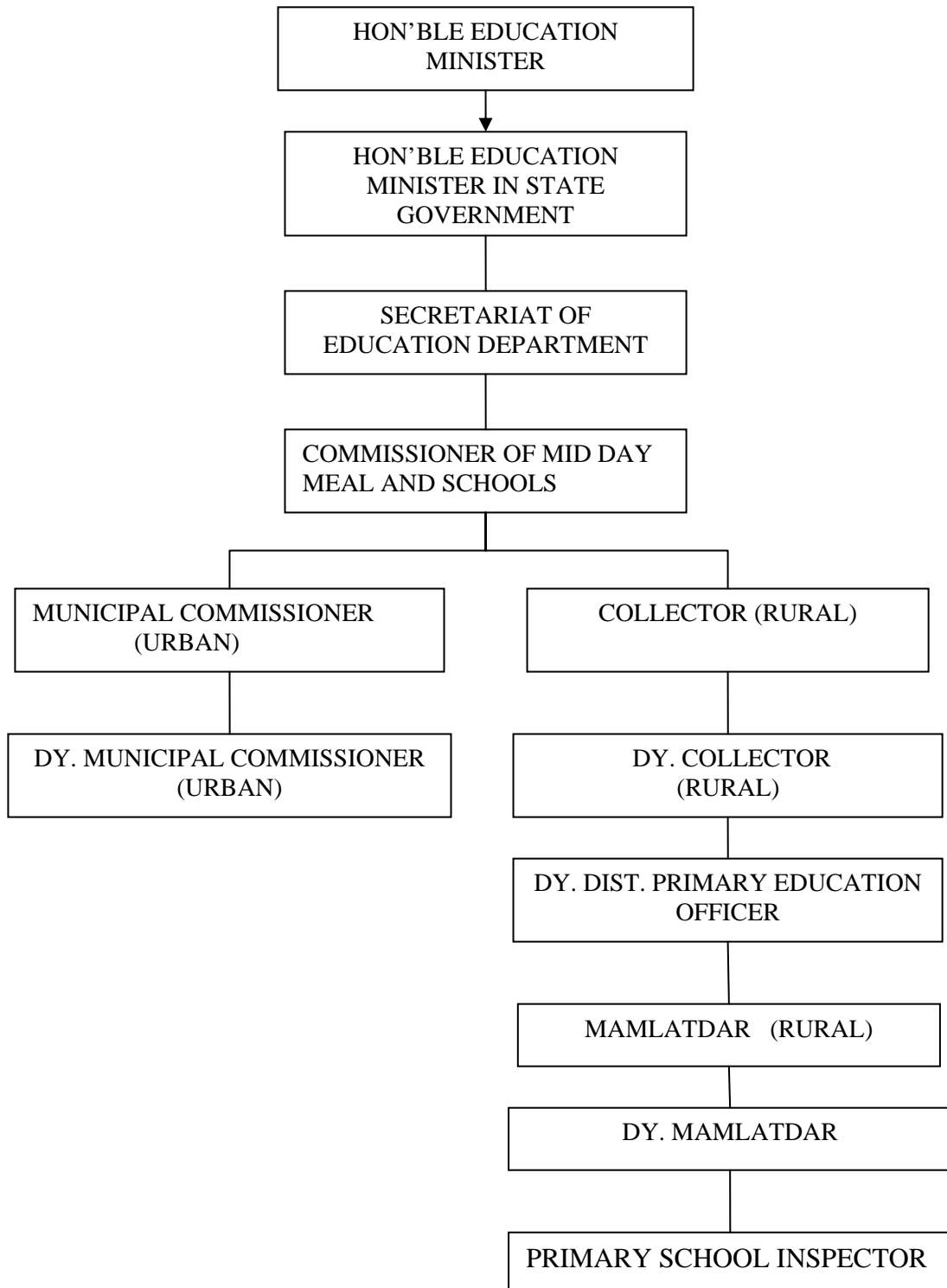
Figure 2.2: Organization Structure for MDM at State Level

Table 2.3: Allocated Food Grain and Quantity.

Food Grains	Quantity (Grams)
Wheat	50
Rice	50
Pulses	20
Vegetable & Condiments	50
Edible Oil	10
Total	* 180

*Total 180 grams equivalent to 450 calories and 15 Gms of protein

In all there are 29,649 MDM centers, and to handle the operations, about 83,944 honorary employees are involved in the programme (Table 2.4). The organizers, cooks and the helper are selected on the basis of school attendance. They are engaged in cooking activities on purely temporary and part time basis. They are given breaks during the summer and winter holidays for which they are not paid anything. The monthly honorariums paid to the organizer of the urban and rural area are different. In rural areas the schools are scattered and the number of students is also less. At an urban (corporation) MDM center organizer is paid 1500 Rs. whereas at district area it is Rs. 500. Tables 2.5 and 2.6 give details of the criteria used for recruiting the employees and the honorarium paid to staff. At the urban centres the cooking is done for more than one school catering to the needs of large no of students.

Table 2.4: No of Staffs involved in MDM programme.

Staff	2002-03	2003-04	2004-05
Hon. Organizers	26,078	26,140	27,438
Hon. Cooks	25,581	25,681	28,132
Hon. Helpers	27,267	27,319	28,374
Total	78,926	79,140	83,944

Table 2.5: Criteria for Recruiting Cook and Helper

No of child at center	No of cooks	No of Helper
1 to 250	1	1
251 to 500	1	2
501 to 750	2	2
More than 751	2	3

Table 2.6: Monthly Honorarium

Staff	Corporation Area (Rs)	District Area (Rs)
Organizer	1500	500
Cook	800	250
Helper	500	175

The expenditure for MDM scheme per child per day (PCPD) is around Rs 2.40 for standard 1st to 5th and Rs 3.40 for Standard 6th 7th (Table 2.7). As for standard 1st to 5th food grains are provided by Central Government. The infrastructure for the cooking purpose is to be provided by states/local bodies by utilizing their own funds along with those available under various centrally sponsored Schemes¹⁰. The budget outlay has increased from Rs. 9000 lakh in the year 1999-2000 to Rs. 18,400 lakhs in the year 2004-2005. The actual expenditure for this period has increased from Rupees 8697 lakhs in 1999 -2000 to Rs. 14,865 lakhs in the year 2004-2005. Table 2.8 mentions the details of plan outlay and year wise expenditure. For the total expenditure incurred in the year 2005-2006 State Government spends around 61.2% on diet, 13% on honorarium paid to the staff and 7% on administrative expenditure.

Table 2.7: Per Child Per Day Expenditure on MDM Scheme:

No	Sub Heads	1 st to 5 th Grade* (Rs)	6 th – 7 th (Rs)
1	Food Grains	1.15	2.70
2	Fuel, Vegetable and Condiments	0.70	0.70
3	Honorarium to Staff	0.34	0.34
4	Admin	0.25	0.25
	Total	2.40	3.40

* Food grains are provided by GOI.

¹⁰ Source: National Programme of Nutritional Support to Primary Education, 2004, (Mid day meal Scheme) Guidelines, Min of HRD, GOI, December, 2004

Table: 2.8: Statement of Year wise Plan Outlay and Expenditure¹¹

Year	Outlay (Rs in lakhs)	Expenditure (Rs in lakhs)	Beneficiaries (In lakhs)
			Target
1999-2000	9,000.00	8,697.00	27.0
2000-2001	9,120.00	9,120.00	28.0
2001-2002	8,250.00	6,913.00	29.0
2002-2003	8,352.00	8,775.82	33.0
2003-2004	10,352.00	15,282.43	34.0
2004-2005*	18,400.00	14,865.67	36.0

* 2004-2005 The figures of Actual Expenditure upto 2/2005.

2.3 MDM Scheme in Ahmedabad

There are Six Municipal Corporations in Gujarat. Ahmedabad Municipal Corporation (AMC) has been running Mid Day Meal Scheme since 1984. AMC has 61 Mid Day Meal Centers covering 563 schools. Out of the 61 centers, 43 are under centralized kitchen, and 18 are without centralized kitchen. 538 schools are linked with centralized kitchens and 25 with non-centralized ones. 231 schools run morning sessions and 332 run afternoon sessions. A total of 12, 93,590 beneficiaries are covered amounting to about 68% of registered student population. Details of total beneficiaries as per different caste are also available as given in Table 2.9 below. Details of monthly registration and number of beneficiary for the year 2005-06 is given in the Annexure III. The weekly menu offered at the Mid Day Meal Scheme in the AMC is presented in Table 2.10 below. The responsibility of the scheme at corporation level is with the Commissioner of MDM scheme who is assisted by Deputy Commissioner, Deputy Collector and Deputy Mamlatdar (Figure 2.3). For effective implementation and proper coordination and linkage with community, a local implementation committee is formed. Committee organizes a meeting once in a month. The committee includes school principal and associate school principal and guardians of school children and organizer.

¹¹ Source: Gujarat govt. website: <http://gujarateducation.gswan.gov.in/mdm/statistics/stat002.htm>

Table 2.9: Numbers of Beneficiaries of Mid Day Meal under AMC in 2005-06

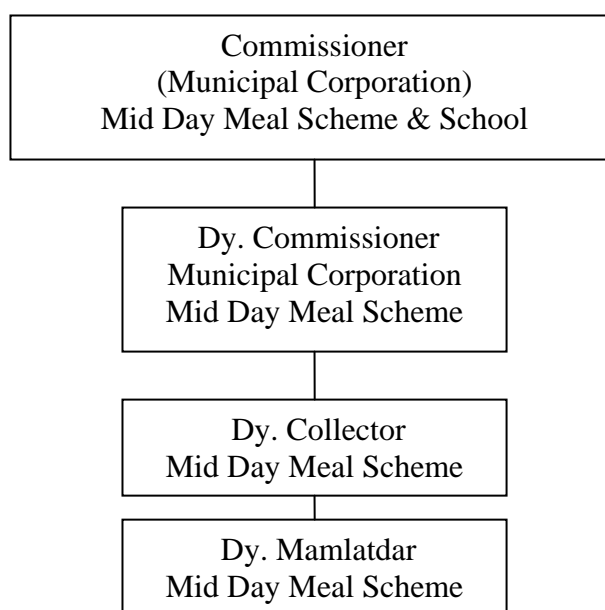
Strength as per 206 child days	Registered Students	Total Beneficiaries
Scheduled Caste	4,26,600	3,13,876
Scheduled Tribe	48,110	36,130
Backward Class	7,33,720	4,53,327
Others	6,62,720	4,90,257
Total	18,71,150	12,93,590

Source: AMC Annual report of the MDM, Govt of Gujarat

Table 2.10: Menu

Days	Menu
Monday	Rice – Dal
Tuesday	Lapsi – Sabji
Wednesday	Dal Dhokli
Thursday	Khichdi – Sabji
Friday	Upma
Saturday	Vegetable Pulav

Source: AMC Annual report of the MDM, Govt of Gujarat

Figure 2.3: Organization Structure for Mid Day Meal Scheme under AMC

Each kitchen centre would have a supervisor, two cooks and as per the strength of children, helpers and staff. As mentioned earlier on, they are paid the honorarium decided by the government. For example, within the municipal corporation, the honorarium paid to the organizer/supervisor of the centralized kitchen is Rs 1500 and that of non centralized kitchen is Rs 500. Ahmedabad Municipal Corporation is responsible for the implementation and monitoring of MDM scheme in Ahmedabad. It receives funds from the govt of Gujarat for the same. Center devolves funds to the state for classes 1 to 5 and class 6 and 7 are funded by the state but there is no fixed yearly budget for the scheme. Each district sends the monthly expenditure to the state headquarters which in turn sends the information to the center. Based on the expenditure finances are released for the state and further distributed by the state to respective districts. The total expenditure incurred by AMC is about Rs. 2.87 crores (Table 2.11).

Table 2.11: Budget and Expenditure for the year 2004-05 and 2005-06

No	Expenditure heads	Total expenditure (in Rs)	
		2004-05	2005-06
1	Administrative expenditure	43,59,482.00	42,81,049.00
2	Food grains	50,59,522.00	94,84,506.00
3	Vegetables	43,59,405.00	41,29,747.00
4	Spices	44,55,091.00	38,49,274.00
5	Fuels	39,55,425.00	40,50,545.00
6	Others	39,24,285.00	25,32,861.00
	Total	2,81,53,412.00	2,87,27,982.00

Source: AMC Annual report of the MDM, Govt of Gujarat

Chapter 3

Field Visits and Documentation

3.1 School Visits

Out of the total of 563 schools under MDM Scheme, 538 are covered by centralized kitchen system, in the remaining 25 meals are prepared in the school itself. 477 schools are served by Stri Shakti, a non governmental organization. To get a diverse experience of the implementation of the scheme, we visited 3 schools from 3 different locations in Ahmedabad, namely Gomtipur, Sabarmati and Ellis Bridge. We also visited the centralized kitchen complex of Stri Shakti. To compare kitchen infrastructure across schools, we had chosen one of the schools where kitchen infrastructure was built and donated by the firm - Torrent. Moreover, we chose to visit one of the schools without (sufficient) prior information about our visit. The location specific observations based on our field visits to 4 places are as follows:

Gomtipur School

Visit to Gomtipur School was our first visit to get acquainted with how the MDM scheme is implemented at the school level. We did not get to see actual food being prepared and served, but were able to observe the store and kitchen area. Kitchen and material storage shed were separate and at quite a distance away from each other. One striking feature we noticed was about the aluminium vessels. The vessels used for cooking and carrying food looked pretty old, shabby, deformed and broken due to overuse. We observed, albeit cursorily, that some food grain sacks had noticeable amount of husk in the grain. A sample of rice had a reddish tinge to it. The staff did prepare food for that day and we tasted Dal Dhokali. It was warm and tasted very good. During our interaction with students and cooks, it appeared that cooks were a bit reluctant to prepare Dal Dhokali for it involves elaborate preparation as compared to say Dal Bhat or Sabji Puri. Picture 3.1 vividly shows the real life Oliver Twists demanding better and more food!

Figure 3.1: Ye Dil Mange More

Sabarmati School

Sabarmati School's kitchen infrastructure has been developed by the firm Torrent for a community project called "Sparsh". It has also distributed cooking and serving vessels to the kitchen and steel plates to the children. In the school there was a separate store for food storage. The store looked clean by Indian standards. The dining area shed built for children was newly constructed, however, the floor on which students sat to have their meal quite dirty. Spilled food liquids from earlier days were not cleaned from the floor properly. The teachers themselves were expected to serve the food to the children. Watching kids eat the warm meal happily is a site one will not forget ever. However, the kids were required to wash their plates after the meal. They had to clean the plates with soil from the playground and give a quick rinse. One could conclude, on the basis of this observation, that hygiene factor seemed to be missing.

Ellis Bridge School (No. 6 & 7)

We visited Ellis Bridge School No. 6 & 7 without sufficient prior information to the employees of MDM scheme at this location. This was done to observe the scheme implementation in its natural course of business. We observed lots of flies around the

cooking area. Food was already cooked. This School has a centralized kitchen which serves 11 other schools. The organizer of the kitchen unit was not present at the site (probably because food was already cooked by the time we reached, however, it was yet to be served to the children.) There was a fire extinguisher in the kitchen, however, the year 1987, printed on it clearly showed it was quite old and probably obsolete. The quality of food was good, children did not have plates of uniform size. Some of them brought their own Tiffin box and in many cases siblings were eating from the same box. Outlet for drinking water and washing utensils were one and the same.

3.2 Stri Shakti Kitchen

As mentioned earlier, we also visited the centralized kitchen of Stri Shakti, an NGO engaged in provision of food to 477 schools of the Ahmedabad city, mostly in the eastern part of the city. This experiment of giving contract to an NGO has been initiated by AMC only in the recent past. The weekly menu offered by Stri Shakti comprises of Rice and Dal, Puri and Chana, Khichdi and Sabji, Puri and Alu sabji, Shira and Chana (desi), and Khichdi and Dal Baingan. We observed that the kitchen staffs wore clean uniform with caps on, the overall process of cleaning the grains, sorting, roasting was being done quite hygienically. Materials supplied by state government were of reasonable quality. All the cooking utensils looked clean and were made of stainless steel. There was a separate area for cleaning the vessels.

An observation shared by one of the employees of the Stri Shakti was that quality of supplies coming from FCI is not good as compared to the one provided by state government. Once the food is prepared, it is distributed to various schools by tempos. We observed loading of the food cans in the tempos, and, were aghast to see workers placing their bare feet on the part-open lids of the cooked food cans. We almost caught a person red handed (curry footed) on camera, but he managed to hide as we took the snap! (Figure 3.2). We did visit a school which receives the food from Stri Shakti. Because it takes time for the tempo to reach all of the schools, either school recess time has to be advanced, delayed or extended, or the food does not stay warm till children get to eat it. Teachers

complained that the recess time is not sufficient to serve meals. In fact, as the teachers have to manage the whole affair, they do not get time to eat their own lunch. Thus, there is additional wastage of school time. In fact, about 10 percent of the students leave school after the meal. Young ones, after having meal, quite often doze off in the class. As a result of all this, a significant amount of contact time between teachers and students is lost. One advantage of contracting out the arrangement to a third party like Stri Shakti is that government saves a lot of resources which are used up in running the MDM scheme. This is especially so because absence of private incentive among government servants prevents them exploiting market efficiencies which turn out to be beneficial to the final recipient of the scheme, the students.

Figure 3.2: Standing Bare-feet on Food Cans



3.3 Attention to Food Quality

In our opinion, there is a potential for general increase in hygiene and cleanliness at the schools and kitchens. This is evident from our anecdotal experiences shared above. Similarly, introducing private enterprise in the running of the MDM scheme may be a better idea than governmental agencies themselves getting involved in the operational delivery of the scheme. This is certainly not because government servants are any less capable of doing the job but that private incentive structure to generate market efficiency is generally absent in government sector. We also notice that the provision of meal to students is at a cost of loss of valuable teacher-student contact time. Despite paid employees of the scheme, teachers have to spend their time to serve food to the students.

Often recess time is not enough for the teachers to serve food and have their own lunch as well

An important part of efficient delivery of MDM scheme is to pay attention to food quality. Food quality has many attributes to it. Attributes such as variety, convenience, sensory appeal such as taste and flavor, nutrition, and food safety are very dear to a consumer. As demonstrated in Picture 3.1, a picture does say more than a thousand words. Although the scheme may be offering different prepared food items each day, there is bound to be repetition of flavors and seasonings in the food. Bringing variety to the daily meal may be a good idea. For example, a couple of times a week, a seasonal fruit (usually banana is the cheapest) could be offered. A couple of times, nutritional bars wrapped in foils may be offered to the children. The firm ITC is about to promote its nutritional bars and have requested Sachin Tendulkar to be their brand ambassador for this product. If corporate involvement is sought, then such nutritional bars may be offered to the kids and probably FMCG firms could partly foot the bill as a gesture of corporate social responsibility. Offering a fruit and/or a nutrition bar serves four purposes – it bring variety to the menu, it provides convenience both to children and the authorities in serving the food, they are hygienically packed (a banana has a natural hygienic packing!), and, moreover, it provides a nutritionally balanced diet. A typical package of a nutritional bar is presented in Figure 3.3 below.

Of course, one cannot do away with serving prepared warm meal. In fact that has been the government mandate for the scheme. To increase efficiency and quality of the prepared meal service, the scheme, operated either by government itself or by a contracted private parties, has to have a formal food quality management system in place. An accepted system called Hazard Analysis and Critical Control Points (HACCP) would have to be implemented for this purpose. Such system needs to be audited periodically by an external certifying agency. This generates an incentive for the food service provider to maintain quality in all its operations. Although generating HACCP system for food service operation like the MDM scheme will be a separate project in itself (which private

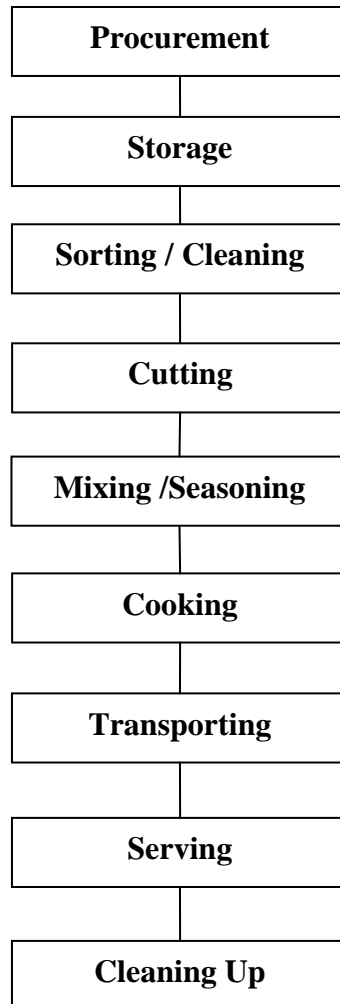
Figure 3.3: Wrapper of a Nutrition Bar



consultants do regularly), what one needs is to chalk out process flow chart and identify critical control points of the system and generate documentation. Below we provide a succinct flow chart of the MDM scheme operation at school level and the Critical Control Points decision (Figure 3.4). Once the flow chart is ready, one has to prepare a Critical Control Points (CCP) documentation described in Figure 3.4 and Table 3.1 below.

Table 3.1: Hazard Analysis, Critical Control Points, and Assigning Responsibility

Flow Chart Step	Hazards	Preventive Measures	Is it a CCP?	Responsibility
	Physical contamination through incoming raw materials.	Proper sorting and cleaning of raw materials must be required.	Yes	Cook or helper or supervisor

Figure 3.4: Flow Chart

A logical next issue to be addressed is, “to what extent does the food preparations in the existing MDM scheme measure up to the quality attributes mentioned above?” Part of the answer is to check the safety and nutritional attributes of the food served in the MDM scheme. Safety and nutritional aspects of food are quantifiable. An objective assessment of these attributes is possible by subjecting the food samples to laboratory tests. We turn to that aspect in the next chapter.

Chapter 4

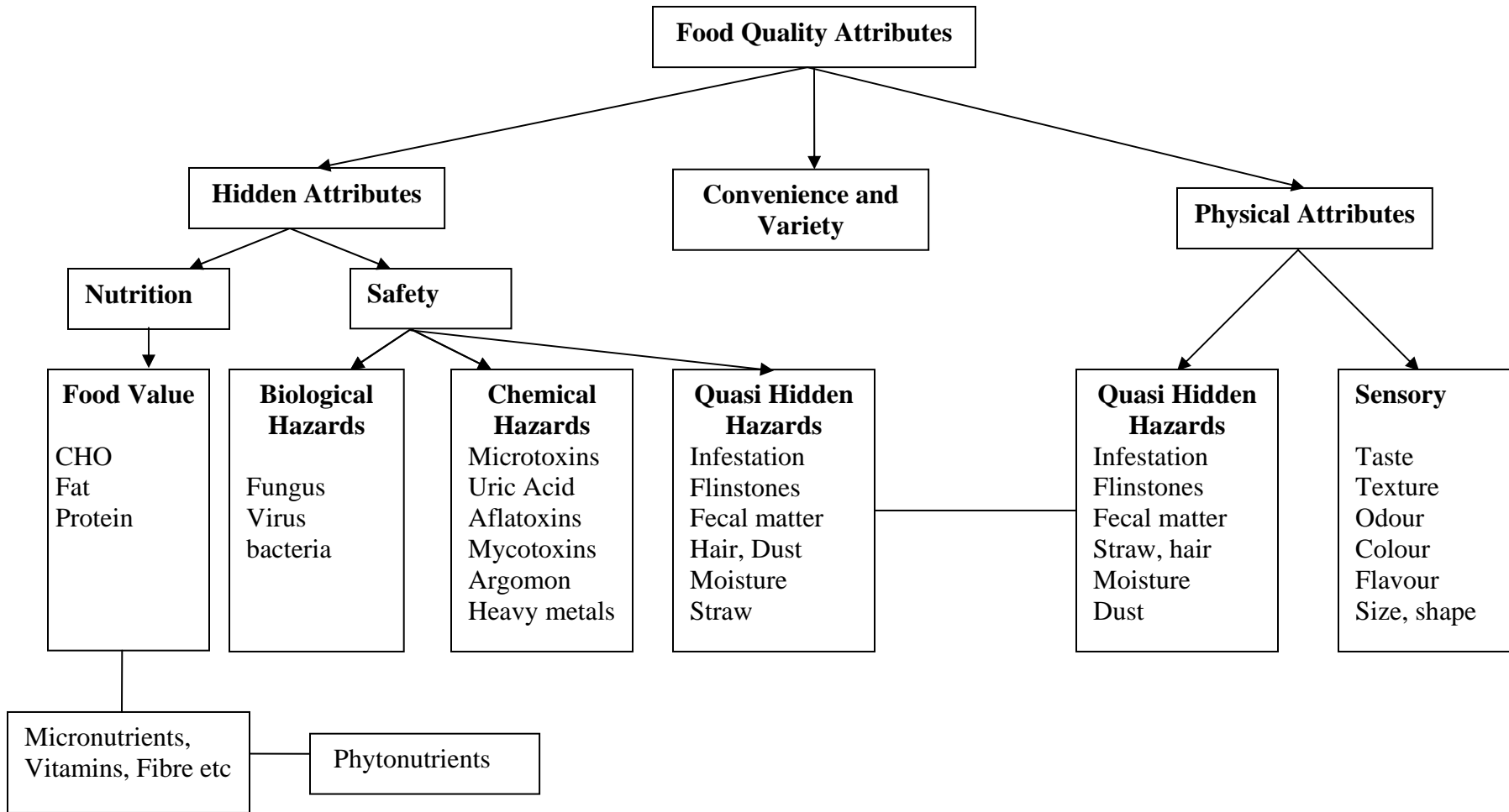
Evaluation of Food Quality Attributes

4.1 Classification of Food Quality Attributes

Food quality attributes can be broadly classified into two categories: Hidden and Physical. In the context of food service provision, however, one can think of one more category – Convenience and Variety. The category of physical attribute can be further classified into sensory (organoleptic) attributes that can be experienced by a person directly and quasi hidden attributes. Sensory attributes include taste, colour, texture, flavor, size, shape etc. Quasi hidden attributes are the physical hazards such as infestation, flintstones, fecal matter, moisture, straw, hair, dust which one may or may not necessarily notice by naked eye. We may not be able to say anything categorically about the sensory attributes as they are very subjective and individual specific. However, we tried to establish in the previous chapter that while the prepared foods might be alright in the conventional sense of the sensory attributes, kids may like convenience and variety in their foods. We believe that provision of a fruit and/or nutrition bar may provide that convenience and variety (apart from the important consideration of nutrition, of course). The classification of food quality attributes is presented in Figure 4.1.

The hidden attributes of food can be divided into nutrition, food safety, and quasi hidden hazards. Nutrition, of course, refers to the energy and nutrients such as protein, carbohydrates, fats, vitamins, micronutrients, and fibre. The other important hidden attribute of food is safety. Food may not be safe due to the presence of biological, chemical and quasi hidden physical hazards. Harmful bacteria and viruses such as salmonella, E-coli are examples of the biological hazards. Chemical hazards could arise due to natural toxins such as aflatoxins, and residues of pesticide, chemicals, and heavy metals. As mentioned above, quasi hidden hazards may or may not be observable by naked eye, and hence, we classify them both in hidden and physical attributes.

Figure 4.1: Food Quality Attributes



4.2 Quality Evaluation

The taste of the pudding may be in the eating, but the test of nutritional and safety attributes lies in quantifying them in laboratory. We conducted laboratory tests on the prepared meal samples collected from the schools and the NGO Stri Shakti. Similarly, we also conducted tests on the raw materials such as wheat, rice, and dal used in the preparation of these meals. Appendix IV gives a brief description of the tests conducted.

Nutrition

Table 4.1 shows some of the nutritional recommended daily allowances (RDA) as prescribed by the Indian Council of Medical Research (ICMR).¹² The supreme court ruling and National Programme of Nutritional Support to Primary Education (NP-NSPE, 2004) requires the scheme to provide a minimum of 300 calories and 8 to 12 grams of proteins per day per child for at least 200 days. Based on the 300 calorie diet, Table 4.1 also indicates proportional quantities of nutrients the mid day meal should provide at minimum to the school children. In fact, with effect from 1 July 2005, the programme guidelines do expect the scheme to provide micronutrient supplementation in the meals.

Table 4.1: Recommended Daily Allowance (RDA) for Children*

	ICMR RDA		MDM Minimum Expected
	Age 7-9	Age 10-12	
Protein (gms/day)	41	54	8 to 12 (NP-NSPE, 2004)
Fat (gms/day)	15	15	2.25 (300 cal equivalent)
Calcium (mg/day)	400	600	60 / 90 (“ “)
Iron (mg/day)	25	28*	3.75 / 4.2 (“ “)
Folic Acid (µg/day)	100	100	15 (“ “)
Iodine (ug/day)	120 ⁺	150	18 / 25 (“ “)
Total Calries	1925	2050	300 (NP-NSPE, 2004)

* Average for boys and girls, + Source: NRC, USA, for boys.

The estimated values of the samples from 2 locations, Ellis Bridge School 6 and the Stri Shakti Kitchen are presented in Table 4.2. Sample of khichadi and sabji, and, cooked rice and sabji were picked up from these two locations respectively. The quantities of protein and iodine contained in the samples in both locations are extremely low compared to the minimum proportional requirement for 300 calorie diet expected

¹² Source: ICMR, 1989, as reported in Swaminathan, M. (1999), “Food and Nutrition,” Vol.2, Appendix 1.

from the meal. In fact, kids may not partake balanced and nutritious food at home, and, hence, one should expect nutrition provided in the mid day meal to be much more than the proportional requirement. Inadequate amounts of iodine only confirm that no fresh vegetables or raw food are served in the meal. However, provision of calcium seems to be quite generous. The provision of fat and iron is close to the proportional requirements of the expected 300 calorie diet. It must be noted that the mandated mid day meals are supposed to provide only a minimum of 300 calories out of the total requirement of about 2000 calories per day. Thus, a massive MDM exercise is contributing only to the extent of a minimum of 15% of the daily requirement of a child. The efficacy of the nutrition delivery could be increased by offering fortified foods. We have alluded to this fact earlier on when we mentioned about the possibility of providing nutrition bars and/or a fruit like banana.

Table 4.2: Analysis of Prepared Food Samples

	Ellis Bridge School No. 6		Stri Shakti Kitchen	
	Khichadi	Sabji	Cooked Rice	Sabji
Wet Weight (gms)	600	600	700	600
Protein (gms/day)	2.56		1.79	
Fat (gms/day)	1.80		3.25	
Calcium (mg/day)	245		226	
Iron (mg/day)	4.9		3.43	
Iodine (ug/day)	8.4		9.5	

Food Safety

Just as we evaluated nutritional aspects of the prepared meals, we also evaluated the hidden and quasi hidden hazards present in the uncooked or raw food materials. Existence of such hazards in the raw material indicates that safety of prepared foods may also be jeopardized. In Tables 4.3, 4.4, and 4.5 we present the presence of such hazards in wheat, rice, and tur dal; and, relate them to the legal safe limits given by the Prevention of Food Adulteration (PFA) Act¹³.

¹³ Source: The Prevention of Food Adulteration (PFA) Act, 1954, and PFA Rules 1955, as amended upto 9 May 2006 and published by Commercial Law Publishers (India) Pvt. Ltd., Delhi.

Table 4.3: Test Results for Hidden and Quazi Hidden Attributes in Wheat

	Uric Acid	Infestation	Moisture	Aflatoxin	Broken
PFA Rules →	NMT* 100mg/kg, i.e.< 1%	Weevilled NMT 10% by count	NMT 14% by weight	NMT 30mg/kg	% count
Type	Sabarmati				
Cleaned	0.12**	3.0	1.3	-	8
Uncleaned	0.18	4.5	2.4	-	12
	Ellis Bridge**				
Cleaned	1.65	7.5	7.1	-	3
Uncleaned	1.90	11.5	6.5	-	5.5

* Not more than. ** All numbers are expressed in percent terms.

Table 4.4: Test Results for Hidden and Quazi Hidden Attributes in Rice

	Uric Acid	Infestation	Moisture	Aflatoxin	Broken
PFA Rules →	NMT 100mg/kg, i.e.< 1%	Weevilled NMT 10% by count	NMT 16% by weight	NMT 30mg/kg	% count
Type	Sabarmati				
Cleaned	1.2*	8.5	3.8	+**	65
Uncleaned	1.2	12.5	5.1	+	65
	Ellis Bridge ^s				
Cleaned	1.8	11.5	8.1	-	5.5
Uncleaned	2.9	39.5	8.0	+	29
	Stri Shakti Kitchen				
Uncleaned	1.2	17.5	2.0	-	37.5

* All numbers are expressed in percent terms. ** traces found. \$ Worms found in rice

Table 4.5: Test Results for Hidden and Quazi Hidden Attributes in Tur Dal

	Uric Acid	Infestation	Moisture	Aflatoxin	Broken
PFA Rules →	NMT 100mg/kg, i.e.< 1%	Weevilled NMT 3% by count	NMT 14% by weight	NMT 30mg/kg	% count
Type	Sabarmati				
Cleaned			-	-	
Uncleaned	2.91	25.5	3.1	-	13.5
	Ellis Bridge				
Cleaned	2.00	0	6.5	-	5.5
Uncleaned	2.96	29.5	6.7	-	?
	Stri Shakti Kitchen				
Cleaned	0.83	6	8	-	4.5
Uncleaned	1.26	1	6.7	-	3.5

* All numbers are expressed in percent terms.

Except for wheat in Sabarmati school and tuar dal in Stri Shakti kitchen all other samples had levels of uric acid much higher than the stipulated rules of PFA. This only points to the possibility of the presence of rodents in storage areas, either in schools or at the warehouses of Food Corporation of India (FCI). While infestation is close to PFA limits for cleaned material, unclean materials have very high percentage of infestation. The quantity of broken grains was quite high in all three places for uncleaned rice. In Ellis Bridge location worms were found in rice. No foreign matters such as animal droppings or hair were found in the samples. Traces of aflatoxin were found in rice at the Ellis Bridge location. Presence of aflatoxins in food samples is a serious concern. Although PFA and USFDA allow some (30 ppb) intake of aflatoxin, its intake is quite undesirable for children. Our observation regarding aflatoxins was further corroborated by the laboratory isolation of fungi such as *Aspergillus flavus* and *Aspergillus parasiticus* which are well known for producing aflatoxins. At a later stage, we may measure the presence of aflatoxins using the sophisticated ELISA test so that extremely small amounts expressed in micrograms (μg) can also be detected.

Chapter 5

Concluding Observations

The concept of implementing Mid Day Meal Scheme (MDM) is almost a century old in India. Although, its presence was only in a few regions, such as the then Madras Presidency. In the post independence period, attempts have been made, with some success, to implement MDM in various states including Tamil Nadu, Delhi and Gujarat. However, if one looks at the indices that measure child health, one realizes the inadequacy of such schemes. For example, 69 percent of adolescent girls in India suffer from anaemia due to iron and folic acid deficiency, and 94% of children in the age group 6-9 years are mildly, moderately or severely underweight. In the recent past, however, the importance of implementation of the MDM scheme has caught the attention of the judiciary and the government. More than Rs. 14 billion are being spent annually on this programme. In fact, the latest 2007-2008 budget of the central government has allocated about Rs. 73 billion for this programme.

Thus, the scheme is important in terms of its potential for substantially improving the health of the younger generation of the country as also in terms of the enormity of spending of tax payers money. Therefore, it becomes imperative that a comprehensive evaluation of the programme has to be undertaken to judge its efficacy. The broad objective of this study has been to clearly identify some of the critical issues associated with the MDM scheme and carry out an objective evaluation in terms of efficiency in delivery system and service quality (which includes food safety, food nutrition and sensory aspects). Broadly, we addressed three critical aspects of the scheme: managerial, technical and school logistics issues. Managerial issues pertain to understanding the planning and administration of the scheme by the central, state and local governments. For technical issues we identified nutritional and food safety concerns. This involved understanding norms in terms of nutritional recommended daily allowances (RDA) for children; identifying food safety standards in terms of microbial, chemical and physical contamination; and comparing the standards with the tests conducted on food samples

from schools. We also discuss possibility of evolving food quality systems such as Hazard Analysis and Critical Control Points (HACCP) for food delivery. Then there are logistical issues which pertain to actual day-to-day running of the scheme in government schools. This would involve logistical issues such as procurement, storage, preparation, and serving and disposal of food. Issues related to meal timings and using up of teacher time are also considered.

To address the above mentioned issues we collected secondary data and information on the working of the MDM scheme from various sources. This included the policy documents of the government and data available from the local and state administration. We also conducted field visits to some of the participating schools from different wards of Ahmedabad city. These included visits to 3 participating schools and an NGO involved in preparation and distribution of meals. We documented our observations and collected food samples from these locations. The collected food samples were subjected to laboratory tests to analyze the nutrition content and food safety aspects of the meals.

Our study seems to indicate that the implementation of the scheme may be wanting on the grounds of nutrition and food safety. The weekly menu shows a variety of meals offered, however, the condiments and seasonings being very similar each day, the sensory variety may be lacking. The study also indicates that in terms of calorific and nutritive intake, proportionate amounts of protein and iodine are not being provided through the meals. Calcium requirements are more than met by the mid day meal. Proportionate requirements of fat and iron are also met by the meals. However, it must be borne in mind that MDM scheme is mandated to provide a minimum of 300 calories, i.e., minimum of about 15% of the daily requirement of calories. There is no guarantee that the kids will get their rest of the 85% of calories at home, and, that their out-of-school meals will have any significant amounts of nutrition. Hence, MDM scheme may want to provide much more than proportionate requirements of nutrition.

We suggest certain changes to address the above mentioned issues. For example, nutrition bars (or perhaps a local version like chikki) and fruits like banana could be

considered as one of the menus on a couple of days. This will add variety and assured nutrition to the kids. It may seem that providing nutrition bars, especially the branded ones, may turn out to be an expensive proposition. However, if these bars are supplied in large quantities, economies of scale may reduce costs. Moreover, branded nutrition bars (say of ITC) could be provided only a couple of times a week, complemented by locally made items such as chikki on some other days. Large FMCG companies, especially the food companies like ITC are already involved in social development projects. They could be requested to channel their corporate social responsibility through MDM scheme.

The study also revealed traces of uric acid and Aflatoxins which if taken for a longer period of time could be carcinogenic for the children. Therefore, we suggest implementation of the HACCP system in preparation and serving of the meals. The food samples from the NGO were found to be good which are indicative of the fact that public private partnership would go a long way in making this scheme a success. However, our experience suggests that transportation of meals from the NGO kitchen to various schools was not hygienic and safe. Implementation of HACCP system can address such flaws. The visit to the schools revealed that cooking and serving food in the school premises leads to a significant if not substantive reduction in learning contact hours between the teachers and the students. A combination of warm meals on some days and pre-packed convenience foods on other days may reduce this loss of contact hours to some extent.

There are many aspects the current study could not focus on. For example, we did not focus on collecting time series data and analyzing whether or not student enrolment has increased due to MDM, *ceteris paribus*. Moreover, although we were able to fathom the magnitudes of financial and administrative data at the national, state and local level, the scope of this study could be expanded to ascertain administrative and financial efficiencies (or the lack of it) in much more detail. A separate and contextual study may be conducted to understand these aspects. In fact, a much larger study at the regional or national level could be conducted that not only includes aspects not covered in this study, but also widens the sample size of schools, cities, and meals to get a much broader and representative picture of India's MDM scheme.

Annexure I

State/Category-wise Number of Schools and Students Covered under Mid-Day Meal Scheme in India (2002-2003 to 2004-2005)												
States/UTs	2002-2003				2003-2004				2004-2005			
	School	Total Students	SCs	STs	School	Total Students	SCs	STs	School	Total Students	SCs	STs
Andhra Pradesh	68730	7456254	1698536	829847	71749	7717673	1157639	69458	80207	9081299	544878	1362195
Arunachal Pradesh	1289	166637	292	82641	1729	181606	217	27774	2824	177984	0	135870
Assam	30650	3149361	N.A.	N.A.	42199	3210526	273534	457439	34136	3387583	322894	572240
Bihar	50405	8095780	1425051	93450	62399	8868044	1502612	96766	91049	9791760	1778580	85009
Chhatisgarh	29122	2889116	429410	866761	29662	2828582	414658	890657	29662	2828582	414658	890657
Goa	1126	68878	816	15	1160	69647	998	8	1143	68489	976	8
Gujarat	29391	3259341	354239	73651	29131	3004496	357236	707964	30048	3011034	321816	740841
Haryana	8041	1538006	597117	0	8995	1578538	508733	0	8629	1627834	502841	0
Himachal Pradesh	10282	639974	287525	70458	10599	614847	202601	31129	10712	590351	194827	30577
Jammu and Kashmir	9730	821890	12178	40428	9730	738777	12178	40428	9730	738777	12178	40428
Jharkhand	19436	2254066	N.A.	N.A.	19436	2254066	0	0	32165	3280001	448096	940848
Karnataka	44108	5621960	1177411	442924	44036	5349540	1129913	441635	46400	5126042	1139271	437249
Kerala	11514	2355686	239908	28126	11330	2166510	234520	34751	10441	2116354	233618	33561
Madhya Pradesh	79936	7579750	1436571	1620062	86191	7729652	1589610	1840828	83343	7649784	1479824	1833917
Maharashtra	74591	9930938	1445355	1378455	82941	9721167	1476344	1131515	84658	9665362	1416494	1160544
Manipur	2992	287506	7182	141317	3027	296211	8038	146380	3035	305695	7366	158586

Annexure: II
District-wise Weekly Menu

No. District/ Corporation	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
1 Amreli	Lapsi, Dal	Dal-Rice	Dal-Dhokli	Khichdi, Veg.	Roti, Vrg.	Pulav
2 Bhavnagar	Lapsi, Veg.	Dal, Rice, Veg.	Mix Dal-Dhokli	Dal Mix	Ormu, Veg.	Salted Khichdi
3 Junagadh	Roti, Bhakri, Veg.	Khichdi, Veg.	Lapsi, Veg.	Dal, Rice	Dal-Dhokli	Salted Khichdi, Khichdi-Veg.
4 Porbandar	Roti, Bhakri, Veg.	Khichdi, Veg.	Lapsi, Dal	Dal, Rice, Veg.	Thepla, Veg.	Pulav, Sambharo
5 Jamnagar	Khichdi, Veg.	Thuli, Veg.	Dal, Rice, Veg.	Mithi	Lapsi, Veg.	Mix Pulav, Salted Khichdi
6 Rajkot	Lapsi, Veg.	Khichdi, Veg.	Dal, Dhokli, Veg.	Dal, Rice, Veg.	Lapsi, Veg.	Salted Khichdi, Veg.
7 Surendranagar	Roti, Bhakri, Veg.	Khichdi, Veg.	Lapsi, Veg.	Dal, Rice, Veg.	Roti, Bhakri, Veg.	Salted Khichdi, Khichdi, Veg.
8 Kutch-Bhuj	Salted Rice	Lapsi, Veg.	Ras Muthia	Dal-Dhokli	Khichdi, Veg.	Dhari, Lapsi, Veg.
9 Banaskantha	Dal, Rice, Veg.	Bhakri, Veg.	Khichdi, Veg.	Roti, Veg.	Mix Veg., Khichdi	Sukhadi, Lapsi
10 Sabarkantha	Pulav	Muthia	Dal-Dhokli, Rice	Lapsi	Dal-Dhokli, Rice	Pulav
11 Mehsana	Muthia, Veg.	Khichdi, Veg.	Lapsi	Dal, Rice, Veg.	Muthia, Veg.	Khichdi, Veg.
12 Patan	Dal, Rice, Dhokli	Salted Khichdi	Guard/MathiMuthia	Dal-Dhokli	Lapsi/Dhooili, Veg.	Khichdi, Veg.
13 Gandhinagar	Guard/Mathi Muthia	Dal Dhokli, Rice	Khichdi, Veg.	Dal-Dhokli	Guard/Mathi Muthia	Salted Khichdi, Khichdi Veg.
14 Ahmedabad	Lapsi	Khichdi, Veg.	Dal-Dhokli	Dal-Rice	Muthia, Handwo	Pulav
15 Nadiad	Khichdi, Veg.	Dal-Rice, Veg.	Dal-Dhokli	Khichdi, Vegetable	Veg/Pulao, Khichdi	Sukhadi
16 Anand	Lapsi, Khichdi, Veg.	Dal-Rice	Dal-Dhokli	Khichdi, Vegetable	Khichdi, Veg., Mix Veg.	Sukhadi
17 Panchmahal	Salted Khichdi, Vegetable	Lapsi, Vegetable	Dal-Rice, Vegetable	Khichdi	Khichdi, Veg., Dal-Dhokli	Sukhadi
18 Dahod	Lapsi,	Dal-Rice,	Dal-Dhokli	Khichdi,	Khichdi,	Sweet Kansar

		Khichdi, Vegetable	Vegetable		Vegetable	Vegetable	
19	Vadodara	Khichdi, Vegetable	Lapsi, Veg., Thuli	Dal-Rice, Veg.	Dal-Dhokli	Khichdi, Veg.	Sukhadi, Lapsi
20	Bharuch	Khichdi, Vegetable	Thuli, Veg., Lapsi	Dal-Rice, Vegetable	Dal-Dhokli	Khichdi, Veg.	Sukhadi
21	Narmada	Khichdi, Veg.	Thuli, Veg., Lapsi	Dal-Rice, Veg.	Mithi	Lapsi, Veg.	Mix Pulav, Salted Khichdi
22	Surat	Khichdi, Veg.	Thuli, Veg., Lapsi	Dal-Rice, Vegetable	Dal-Dhokli	Khichdi, Vegetable	Lapsi
23	Valsad	Lapsi, Dal	Dal-Rice, Vegetable	Dal-Dhokli, Muthia	Khichdi, Vegetable	Lapsi, Dal	Pulav
24	Navsari	Khichdi, Vegetable	Muthia	Dal-Rice, Vegetable	Mix	Dal-Dhokli, Kachumbar	Sukhadi, Shero
25	Dang	Lapsi, Dal	Pulav, Mix Veg. Khichdi	Sweet Upma, Dal, Veg.	Dal-Rice, Vegetable	Veg., Salted Wehat Khichdi	Khichdi, Vegetable
Municipal Corporation							
1	Ahmedabad	Dal-Rice	Lapsi, Veg.	Dal-Dhokli	Khichdi, Veg.	Upma	Pulav, Veg.
2	Rajkot	Lapsi, Veg.	Salted Khichdi	Dal-Rice	Pulav-Rice	Lapsi-Veg.	Salted Khichdi
3	Vadodara	Dal-Rice, Veg.	Sukhadi, Veg.	Khichdi, Veg.	Phada Khichdi	Dal-Dhokli, Veg.	Salted Khichdi
4	Jamnagar	Khichdi, Shero	Vatana Rice	Pulav, Upma	Khichdi, Veg.	Chana Masala, Mix Pulses	Sukhadi, Lapsi
5	Bhavnagar	Lapsi, Veg.	Dal-Rice	Dal-Dhokli	Pulav	Upma	Pulav/Khichdi
6	Surat	Dal-Rice	Lapsi, Veg.	Khichdi, Veg.	Pulav	Pulav, Veg.	Lapsi, Veg.

Annexure III
Number of Beneficiaries in the Year 2005-06

Month	No of functional centers	No of days food is served	No of Registered Students					No of beneficiaries					Average no of beneficiaries				
			SC	ST	OBC	Others	TOTAL	SC	ST	OBC	Others	TOTAL	SC	ST	OBC	Others	TOTAL
June '05	61	19	42660	4811	73372	66272	187115	24436	3279	33166	37544	98424	19874	2706	28009	31162	81751
July '05	61	23	42660	4811	73372	66272	187115	30117	3400	42318	46379	122124	24679	2858	35964	39244	102745
August'05	61	18	42660	4811	73372	66272	187115	28516	3349	40969	48619	121463	23861	2859	35219	41695	103634
September'05	61	22	42660	4811	73372	66272	187115	34091	3854	49431	43382	140758	27722	3279	42203	44728	117932
October'05	61	18	42660	4811	73372	66272	187115	31371	3644	45887	44933	125835	26156	3132	39164	37887	106339
November'05	61	11	42660	4811	73372	66272	187115	29795	3765	43358	48553	125471	24036	3160	36808	40525	104529
December'05	61	27	42660	4811	73372	66272	187115	34262	3716	50464	56304	144747	28322	3180	42747	46755	121004
January'06	61	23	42660	4811	73372	66272	187115	32952	3646	48032	49842	134472	27057	3116	40731	41499	112403
February'06	61	23	42660	4811	73372	66272	187115	33495	3670	49684	50012	136861	27708	3102	42260	41377	114447
March'06	62	24	42660	4811	73372	66272	187115	34841	3797	50018	54688	143344	28377	3278	42405	45825	119885
Total		207	426600	48110	733720	662720	1871150	313876	36130	453327	490257	1293590	257792	30670	385510	410697	1084669

Annexure IV

Laboratory Tests¹⁴

1. Nutritional Attributes

Total fats were measured using gravimetric method. Petroleum Ether was used to extract total fat. Total weight was expressed in grams percent (gm%). Total proteins were measured using Bradford's method and were expressed in gm%. Extraction of proteins was done in extraction buffer containing PMSF. Ash samples of different food items, cooked as well as uncooked grains were prepared at moderately high temperatures by igniting the food materials in crucibles. The Ash was then solubilized in 2 N HCl and centrifuged. The acidic supernatant was used as samples for all the following estimations. Iron estimation was carried out using KSCN (Potassium Thio Cyanate), which was read at 478 nm spectrophotometrically. Known concentrations of FeCl₃ were used to establish standard curve. Iron was calculated %mg. Calcium estimation was done titrimetrically using EDTA and Erichrome Black T indicator. Iodine contents were estimated by the method established by Anderson *et al.* which uses Ceric Ammonium Sulphate and Arsenous acid. Absorbance was taken at 363 nm. The readings were taken on a spectrophotometer and the contents were calculated in mg%.

2. Food Safety Attributes

Quasi Hidden Attributes:

The samples were examined as a whole for its general condition including odour and infestation as well as for the presence of any deleterious material to human health rendering the grain inedible. The contents were mixed and spread out evenly on a flat smooth surface. From this spread a specified quantity was taken. Then, if required with the help of magnifying glass, various items of refraction were picked up by hand and care was taken that every refraction is accounted for only once. Wevilled and insect damaged or infested grains were separated and counted. The samples were carefully examined for the presence of rodent hair or droppings in the sample. Excess humidity increases possibility of microbial and fungal growth. The grains were initially weighed and then put in the oven at around 60-80° C for 2 hours. The weight was taken again and moisture content was calculated using standard formula.

¹⁴ All the methods followed in the tests are BSI recommended methods except the cases where mentioned specifically. Technical assistance in laboratory tests provided by the undergraduate students of biochemistry is acknowledged. Their names are: Ms. Nami Chopra, Ms. Karuna Kolhar, Ms. Foram Kayastha, Ms. Viny Verghese, Ms. Janet D'Sa, Ms. Kruti Shah, Ms. Shailee Joshi, Ms. Devanshi Jhaveri, and Mr. Gajendradhar Dwivedi

Hidden Attributes:

To estimate presence of uric acid on the surface of grains, which indicated rodent activity, 1gram grains were soaked in 10 ml demineralized double distilled glass water for around 10-15 minutes. These water samples were then used to check the presence of uric acid in samples using Jaffe's reaction, which produced blue colour, which was read on a spectrophotometer at 680 nm. Presence of Aflatoxins in both cooked and uncooked samples was measured by Thin Layer Chromatography. Silica plates were prepared and chloroform extract of food samples were applied on plates after their activation at 110° C for an hour. Different solvent systems were tried and Methanol: Chloroform (95:5) was found to give the best result for separation and identification of Aflatoxin bands. The plates were visualized under UV light (366 nm). Presence of Blue and Green Fluorescent bands indicated the present of Aflatoxins B and G respectively. Confirmatory tests were carried out to ascertain the presence of aflatoxin. For fungal recovery, Potato Dextrose Agar (PDA) was used and the cultures were incubated for at least 3 days at humid place having lower temperatures ($25 \pm 2^{\circ}$ C.). Colony characteristic of each isolate was observed and noted. Live preparations of fungal colonies were prepared on slides and were observed under the microscope for their identification.