# AN EVALUATION OF MID DAY MEAL SCHEME

Satish Y. Deodhar*, Sweta Mahandiratta, K.V. Ramani, and Dileep Mavalankar
And
Sandip Ghosh, and Vincent Braganza

*With the twin objectives of improving health and education of the poor children, India has embarked upon an ambitious scheme of providing mid day meals (MDM) in the government and government-assisted primary schools. The administrative and logistical responsibilities of this scheme are enormous, and, therefore, offering food stamps or income transfer to targeted recipients is considered as an alternative. We show that the alternative delivery mechanism is not feasible in the Indian context, for it may lead to adverse consumption choices by the heads of the targeted households. We also test whether or not the meals offered through MDM scheme provide sufficient nutrition, food safety, and convenience and variety to the targeted children. Laboratory results show that nutritional delivery through the meals is low in comparison to the daily requirements in general, and, much lower in nutrients such as protein, fat, iron, and iodine in relation to the meal quantity in particular. Moreover, tests on food grains procured for the scheme showed presence of uric acid and aflatoxin. The delivery of MDM scheme may be improved by partnering with private entities and NGOs and by including* ***chikki, sukhdi,*** *fortified nutrition bar, and fruit in the weekly menu. This will not only complement nutritional intake, but offer safety and variety, and, by reducing the distribution time, may offer more contact time between students and teachers for study purpose.*

Key Words:
Mid Day Meal Scheme; NP-NSPE; Primary School Education; Food Stamps; Income Transfers; Food, Fuel, and Fertilizer Subsidies; Food Safety; Nutritional Deficiency; Indifference Curves; Golden Rice; Nutrition Bars; *Chikki; Sukhdi;* ICMR; PFA; HACCP.

## 1. Introduction

The concept of supplementary nutritional support through educational institutions took its root in India when Madras Corporation developed a school lunch program in 1925. In the post-independence era, Gujarat was the first state to start school lunch programme in 1984. However, it was only in 1995 that the National Programme of Nutritional Support to Primary Education (NP-NSPE) was launched at the national level [GOI, 1995]. The then union territory of Delhi followed suit immediately. The objective of this programme was to give boost to universalisation of primary education and to impact the nutritional intake of students in primary classes. Since then, the programme was revised in 2004 and is popularly known as the Mid Day Meal (MDM) scheme. The incumbent government at the centre has emphasised 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 setting-up of an appropriate mechanism for quality checks.

Despite the broad-based efforts of the central government for more than a decade and a half and a few pioneering efforts earlier on, the problem of malnutrition, anaemia, deficiency in vitamin A and Iodine is very common among children in India. Today, 94 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 [GOI, 1996]. In fact, the MDM scheme implemented in Delhi in the late 'nineties

* Corresponding author. Contact: Wing 2-G, Indian Institute of Management, Ahmedabad, Vastrapur, 380015.
E-Mail: satish@iimahd.ernet.in. Tel: +91 79 6632 4817, Fax: +91 79 6632 6896.
Sandip Ghosh, and Vincent Braganza, from S.J. St. Xavier's College, Ahmedabad.

was found to be wanting on many evaluation parameters [GNCTD, 2000]. A nationwide study by Planning Commission [2010] also shows the MDM scheme to be wanting on several evaluation parameters. The poor performance, however, is in stark contrast to the actual spending under this programme. For example, an amount of Rs. 1400 crore was spent on this scheme in the year 2003-2004, and, the budget of the central government had allocated Rs. 7324 crore for this scheme in the year 2007-2008. In the state of Gujarat, in the year 2005-2006 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 and the state budget allocated for the scheme in the year 2005-2006 was about Rs 201 crore. This allocation amounts to Rs. 2.65 per student assuming 200 school-days in an academic year. A third of the beneficiaries in Gujarat were from Ahmedabad.

Given the scope of MDM scheme in terms of the expenditures incurred and number of beneficiaries on one hand, and the abysmal health and demographic statistics on the other, it becomes imperative that an evaluation of the scheme be attempted to judge its efficacy. The obvious enormity of the administrative and logistical responsibilities of offering mid day meals in schools raises the issue of alternative forms of nutrition delivery to the children. In Section 2, using the indifference curve approach to household welfare, we explore whether or not targeted food stamps programme or income transfers, as implemented in developed countries and recently proposed by the Indian government for fuel and fertilizer, could be more suitable than the MDM scheme. Next, we focus on the quality attributes of the food provided to the beneficiaries. If we are to continue with the MDM scheme, we need to raise the question - Are the beneficiary children being provided safe and sufficiently nutritious food as has been envisaged in the scheme? To this end, in Section 3 we document food and food service quality issues observed during school visits. Moreover, objective laboratory evaluations of hidden attributes such as nutrition and food safety of a typical meal are presented in Section 4. Specific suggestions are made in Section 5 in relation to the observations and analysis presented in Sections 3 and 4. Finally, in Section 6 we summarise and provide concluding observations.

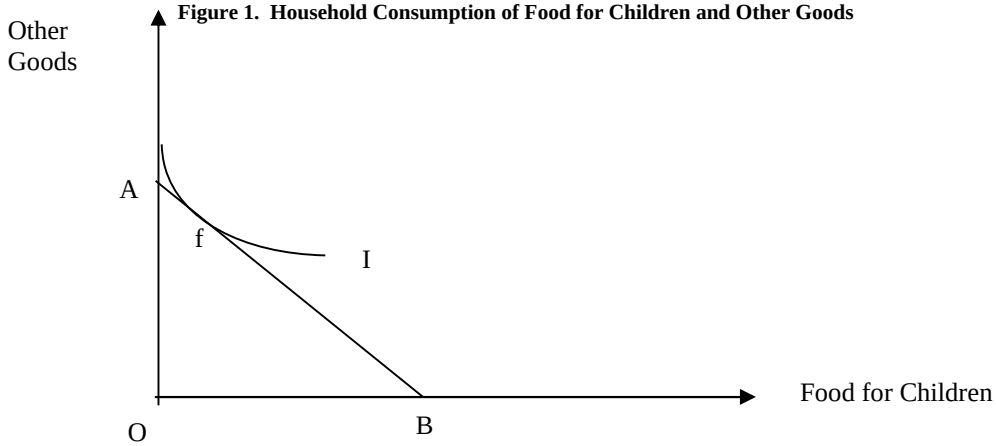
## 2. Case for MDM Scheme

Given the obvious enormity of the administrative and logistical responsibilities of offering mid day meals in schools, one may consider two alternatives to MDM scheme - the food stamps programme and the targeted income transfers. In US, for example, a food stamps programme is in place to help the poor. A four-member household which has gross annual income of $26,000 or less or a net annual income of $20,000 or less is eligible for about $500 worth of food stamps per month. This programme has worked reasonably well in the US.[1] In India, some organisations including Federation of Indian Chamber of Commerce and Industry (FICCI) have advocated use of food stamps [FE, 2010]. FICCI suggests linking various social sector schemes of the government to food stamps and it also calls for mandatory enrolment of minor dependents in schools. Similarly, though not related to food distribution, the incumbent government at the centre would like to give fuel and fertiliser subsidies to farmers as direct income transfers instead of continuing with subsidised prices. It is hoped that with the implementation of Aadhar, the unique identification number for each individual, government would be able to hand out such subsidies to the targeted farmers.

To understand the efficacy of the food stamps programme or the income transfer as an alternative to MDM, let us consider the choice a household makes between spending money on food for the children and spending money on other goods. The preference for these two goods for a

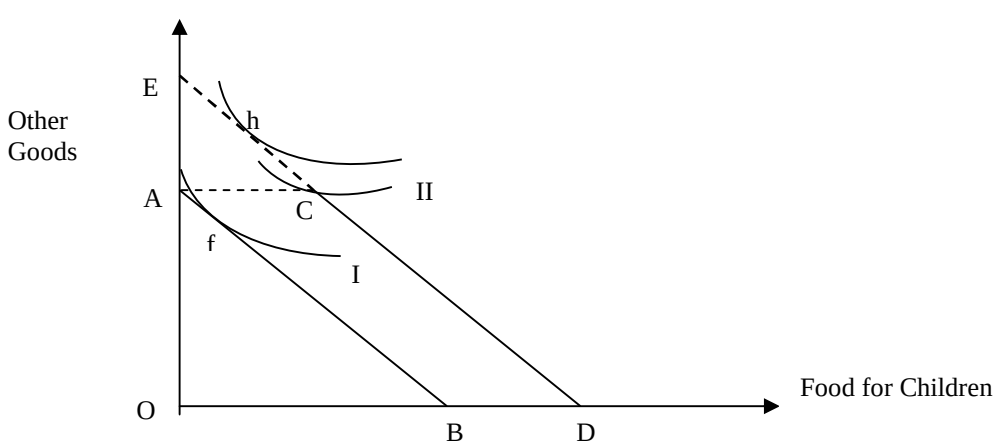
household is shown by an indifference curve I as shown in Figure 1. At the same time, the household has its budget constraint given by the line segment AB. Given the preferences and the budget constraint, a household chooses a bundle of two goods such that the utility is maximised at the equilibrium point f on the indifference curve I.

**Figure 1. Household Consumption of Food for Children and Other Goods**




Now consider a situation where support is provided to households of the eligible children through distribution of food stamps, which they can exchange for food items in the grocery shops. When the food stamps are distributed to the households of the eligible children, what is aimed at is the shift of the budget constraint from segment AB to ACD (see Figure 2). It is hoped that households will exchange food stamps for food for children and the food consumption of the children in the households will increase. If households are inclined to sell the food stamps in secondary market, additional cost will be incurred by government to prevent this from happening. This forced choice is depicted in the figure at point, C, a corner solution, where the utility level II is higher than before and consumption of food for children has increased. However, consumption of food by children does not increase by the full equivalent quantity of food that could have been purchased using food stamps (distance AC). This means that although food stamps are being used fully, there is some reduction in direct market purchase of food (for children).

**Figure 2. Household Consumption under Food Stamp Programme.**



More importantly, the preference structure of the household may be such that the household may do even better (but worse for the children). There is a distinct possibility that the food stamps can be sold in the secondary (legal or illegal) market.[2] In such a case, as shown in Figure 2, the segment CD gets extended to point E and ED becomes the effective budget constraint which now is tangent to the indifference curve III at point h. By selling some food stamps in the market, household has increased consumption of other goods, and, therefore, the increase in the consumption of food for children is even lower. Further, one also cannot rule out the possibility of food for children becoming an inferior good. The tangency point h could very well be to the left of the initial tangency point f. In this case, the consumption of food for children is lower than what it was in the absence of the food stamp programme. Thus, in the best case scenario, where food stamps cannot be sold in the secondary market, food consumption by children will not increase by the full equivalent quantity of food that could have been purchased using food stamps. And, in the worst case scenario, introduction of food stamp programme may lead to reduction in the food consumption by children.

The above choices result because disadvantaged households may not have full information about the importance of nutritional aspects and the long term benefits of healthy child upbringing, and, as we describe below, there may be other important things in households' lives than food. This household preference is captured in the nature of their indifference curve mapping (I, II, and III). The marginal rate of substitution between food for children and other goods could turn out to be very low, *i.e.,* the indifference curves are quite flat, and, therefore, the tangency point may occur on line segment EC, the secondary market part of the budget constraint. This may result in very low increase or sometimes decrease in the food consumption for children. Therefore, such food stamp programme may not have its desired impact although it may be administratively easier to implement. The likely adverse impact of the food stamps programme would certainly get replicated if government or an NGOs were to make direct income transfers to the targeted households. In this case, the line segment AB denoting the budget constraint would shift outwards to line segment ED and the utility maximising bundle would get chosen at an equilibrium point such as h. In fact, the very idea of introducing food stamps over direct income transfers suggests that institutions and authorities are not sure whether or not the poor will use the transferred income for food consumption.[3] And, the same argument gets extended to food stamps, for there will be a secondary market for food stamps. Of course, similar argument may be extended to MDM scheme itself - the children eat less at home, therefore, total increase in consumption by children is not equal to the amount of food given in school. Important difference, however, is that increase in consumption by children is ensured through MDM scheme.

There are plenty of instances where the monthly wage of housemaids is captured by their husbands to buy expensive liquor which they could not buy before. With the additional supplementary income there is a discrete switch in favour of such consumption which may lead to fall in consumption of food for children. And, importantly, it is not just the stereotypical liquor story. This happens in case of gadgets such as cellphones, televisions, and many other similar goods. Indeed, if food for children is an inferior good, then the MDM scheme which provides more food than what the children consume in the absence of it would be necessary and it would be better than the provision of an equivalent income supplement or food stamps. In this context, Banerjee and Duflo [2011] address issues on matters such as whether or not the poor really eat well and enough, why do they eat so little, and, importantly, is there a nutrition based poverty trap? Their studies across eighteen countries over

the last fifteen years show that other things are more important in the lives of the poor than food. Things that make life less boring become a priority. In their study conducted in Udaipur, they find that a typical poor household could spend up to thirty percent more on food if it completely cut expenditures on festivals, tobacco, and alcohol. Even among food items, poor tend to spend extra income on better-tasting, more expensive calories, which are not only more expensive than grains calories but bereft of nutritional content (e.g. sugar & sweetmeats). The lack of understanding of the importance of foods with critical micronutrient and macronutrient contents makes the issue even more difficult. That poverty may make people impatient and future pleasures seem quite remote is also borne by Becker and Mulligan [1997, Pp. 729-58]. While addressing the issue of inter-temporal choices for utility, they conclude that wealth seems to introduce patience in consumption and that education seems to reduce the remoteness of future pleasures.

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. Basically, this amounts to altering the household preference mapping in favour of food consumption by the children. If this is achieved through adult education and extension activities by health ministries and departments at various governmental levels and by NGOs, then one can think of implementing food stamps programme or direct income support to disadvantaged households. As depicted in Figure 3, such a change in the household preference is captured by the higher sloped indifference curves $U_1$ and $U_2$, where the marginal rate of substitution of food-for-children for other goods is much higher. Now, the tangency point of indifference curve $U_2$ with the budget line CD at g is also the tangency point of that indifference curve with the budget line ED. In the long run, the desired effect in terms of food and nutritional security for children will be achieved irrespective of the policy choices - *i.e.*, have MDM or food stamps or direct income transfers. However, since income transfer simplifies logistics and is cost effective, that could be the preferred policy in the long run.

One is quite uncertain, however, 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 children to school and which results in increased nutritious food consumption by the children. The only way to do this is to provide lunch in (mostly) government run schools where children of the disadvantage households get enrolled. Since, no food stamps are distributed or direct income support is provided, and children are offered lunch only at school (parents cannot resell the lunch), the EC part of the spending option is just not available to the households anymore (see Figure 4). Households are forced to settle for point C on the indifference curve II, a corner solution. Of course, as pointed out earlier, here the increase in food consumption of children is less than the food provided in MDM, but MDM guarantees the best case scenario of the food stamps programme; *i.e.*, a corner solution such as at point C on indifference curve II in Fig. 4 or an equilibrium point with larger consumption of food for children than at point C. It also avoids cost of preventing black-market sale of food stamps, offers nutritious food to the children, and, incentivises children to attend school. There would be costs, however, of supplying material to schools, and of preparing, distributing and inspecting the cooked food. A rough estimate of such a cost, based on secondary sources, is provided little later.

**Figure 3. Household Consumption with Changed Preferences.**

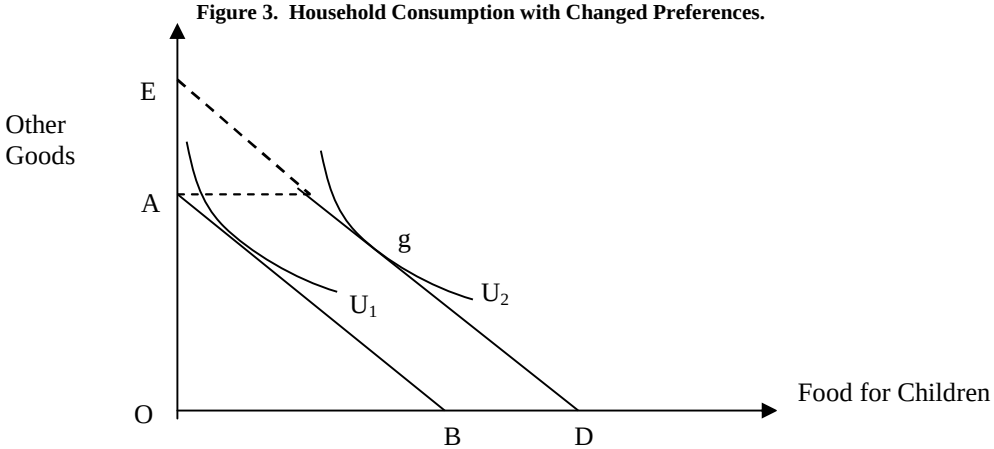
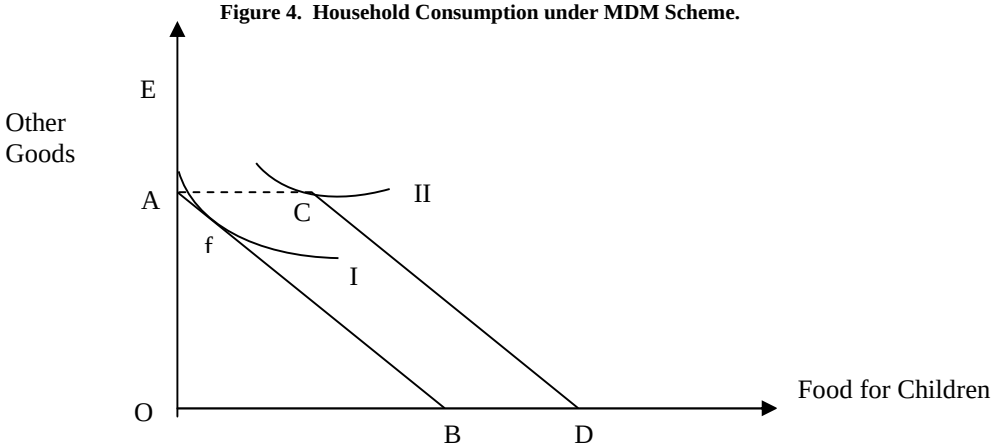



**Figure 4. Household Consumption under MDM Scheme.**




The above discussion indicates that societal welfare would be higher if we choose to implement MDM scheme over food stamps programme or direct income transfers. Of course, the efficacy of such MDM scheme is based on the premise that nutritious food gets consumed by the targeted school children. The Supreme Court of India has given clear direction in this regard. 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 [SC, 2001]. In fact, as per the Ministry of Human Resource Development (MHRD), latest norms laid down in 2008 for NP-NSPE require the scheme to provide 700 calories and 20 grams of protein per meal per day [MHRD, 2011]. Revenues generated through the recent introduction of Education Cess on union taxes are to be used for providing nutritious, cooked meal in schools. Therefore, it is important to ascertain if the lunches offered through MDM scheme are of good quality. Important quality attributes in the context of MDM scheme would be the general hygiene in the kitchen and service area of the schools and food safety, palatability, variety, and importantly, nutritional quality of the prepared

meal as has been emphasized in NP-NSPE and by the Supreme Court. We take up these aspects next.

### 3. School Visits and Observed Food Quality

We visited a few primary schools in Ahmedabad where MDM scheme is implemented. Ahmedabad Municipal Corporation (AMC) has been running the MDM scheme since 1984. Out of the total of 563 schools under MDM Scheme, 538 are covered by a centralised kitchen system. In the remaining 25, meals are prepared in the school itself. 477 schools are served by Stri Shakti, a non-governmental organisation (NGO). To get a diverse experience of the implementation of the scheme, we visited schools from three different locations out of the twenty-five where meals are prepared on site. These were the municipal schools in Gomtipur, Sabarmati and Ellis Bridge areas of Ahmedabad. We also visited the centralised kitchen complex of Stri Shakti. The visits were planned by the Centre for Management of Health Services (CMHS) at IIMA in conjunction with the municipal and school authorities. It may be noted that the municipal and school authorities knew about our visits and had time to showcase their best practices.

In Gomtipur school, the aluminium vessels used for cooking and carrying food looked pretty old, shabby, deformed and broken due to overuse. The staff had prepared Dal Dhokali that day and we had lunch with the kids. Dal Dhokali 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 compared to other preparations. In Sabarmati school kitchen infrastructure had been developed by the firm Torrent for a community project called "Sparsh". While the dining area shed was newly constructed, the floor on which students sat to have their meal was quite dirty. Spilled food liquids from earlier days were not cleaned from the floor properly. Moreover, children were required to wash their plates after the meal by rubbing the playground soil on the plates and then giving a quick rinse. Hygiene factor certainly seemed to be missing. Moreover, the teachers themselves were expected to serve the food to the children. At Ellis Bridge School (No. 6 & 7) there were too many flies in the kitchen. There was a fire extinguisher accumulating dust and rust, sporting a manufacturing year - 1987. A common feature we observed at all locations was that although MDM scheme may be offering different prepared food items each day, there was bound to be repetition of grains, seasonings, and flavours in the food.

As mentioned earlier, we also visited the centralised kitchen of Stri Shakti, an NGO engaged in provision of food to 477 schools in Ahmedabad. 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 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 Food Corporation of India (FCI) was not good 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 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. Our observations from the school visit are corroborated by other studies. Jain and Shah [2005, Pp. 5,076-88] argue that the absence of a separate administration for meal management has placed an enormous burden on teachers, which poses a danger of further compromising the already very poor quality of primary education.

Planning Commission [2010, Pp. iv-vi] has recently brought out an evaluation report of the national MDM scheme. Quite a few 'Findings and Highlights' of the report clearly voice the concerns that have been expressed above. Some of the findings are reproduced below (verbatim):

* Except for Tamilnadu and Kerala, in rest of the states a majority of sample schools, on an average, suffer from the unavailability and poor functional condition of kitchen sheds.
* All the states, except for Bihar and Rajasthan, have reported poor availability of tumblers. Except for Rajasthan, all the states have reported a poor availability of plates.
* In most of the states teachers spend about one to two hours daily on activities related to CMDM thereby reducing precious teaching time.
* Out of the 17 sample states where the data was collected, students in 9 states reported that they were involved in washing utensils.
* It has also been observed that the programme has resulted in the diversion of the attention of teachers and students on activities related to it, rather than towards teaching and learning activities, which results in loss of studies.
* Most of the states, it was observed, did not follow the guidelines of Government of India to deliver food grains at the school point by PDS dealer, thereby resulting in the leakage of food grain. There have been instances where due to long supply chain, food grain supplied got adulterated and pilfered.

## 4. Hidden Food Quality Attributes

The documentation made above pertains to food and food service attributes that can be directly observed through school visits. This refers to the (un) hygienic food delivery practices, observations and perception regarding raw materials, the perceived lack of variety in food, and study-related inconvenience both to students and teachers. In addition, however, there are hidden attributes of food that also need to be carefully analysed. The hidden attributes of food can be divided into two - food safety and nutrition. Nutrition, of course, refers to the embodiment of energy and nutrients such as protein, carbohydrates, fats, vitamins, micronutrients, and fibre in food items. Food safety, or the lack of it, is associated with 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 pesticides, chemicals and heavy metals. The (quasi) hidden physical hazards such as infestation, hair, flint stones, may not be observable by naked eye but have potential for bodily harm.

In a repeat-consumption context, as is the case in mid-day-meal scheme, biological food contamination is generally kept in check, for its consequences are generally known immediately after the consumption. Therefore, following Nelson [1970, Pp. 311-329] and Darbi and Karni [1973, Pp. 67-88], food-products/meals may be characterised as experience goods with repeat-purchase, where market institutions seem to take

care of the contamination problem. More importantly, however, food-products/meals are also classified as credence goods, where quality of food in terms of nutrition and safety is not known to consumers and often to producers, long after the consumption of the product. Thus, in the presence of imperfect and asymmetric information, market institutions are likely fail to deliver efficient outcomes in the case of credence goods such as mid-day meal. That is, nutritional deficiencies in mid day meal and carcinogenic effects of mild contaminations would show up in the young population with a lag of at least a few years.

A few studies have indicated the problem of poor food quality of mid day meals. Dreze and Goyal [2003] conclude that with additional resources and quality safeguards, mid-day meals can play a major role in improving school attendance, eliminating classroom hunger, and fostering social equity. Another study on MDM scheme in Delhi clearly points out that quantity and quality of the mid day meal needs to be improved and that so far what is provided does not justify the term mid day meal. It suggests monitoring of school functioning which may be inhibiting proper implementation of the scheme [Samson, Noronha and De, 2007, p. 28]. Khera [2006, Pp. 4,742-50] opines that the net impact of the scheme on child's health will depend upon whether the meal is a supplement or a substitute for food intake at home both in terms of quality and quantity. If it is largely a substitute for home food, the nutritional impact may not be large. Jain and Shah [2005] study reported earlier, mentions that the enrolment in schools has gone up despite poor meal quality and inadequate infrastructure. Yet another study, based on a survey of primary schools in the state of Madhya Pradesh, concludes that the MDM scheme had a substantial effect on reducing hunger at school and protein-energy malnutrition [Afridi, 2010, Pp. 156 & 160]. Of course, while the scheme would certainly have an effect on reducing hunger, this study, however, is completely silent on how it calculated the amount of nutrition content of a mid day meal. Delivery of meal itself cannot be an indicator of sufficient delivery of nutrition.

The taste of the pudding is in the eating. The test of nutritional quality and food safety is in its objective quantification in laboratory. For an objective, scientific assessment of the meal quality, we conducted laboratory tests in St. Xavier's laboratory, Ahmedabad, on the prepared meal samples collected from the schools and the NGO Stri Shakti. Similarly, tests were also conducted on the raw materials such as wheat, rice, and dal used in the preparation of these meals. Appendix I gives a brief description of the scientific tests we conducted on the samples. Below we provide the results of these tests pertaining both to nutritional quality and food safety.

**Nutrition**

Table 1 shows some of the Indian Council of Medical Research (ICMR) recommended nutritional daily allowances (RDA) as reported in Swaminathan [1999, p. 519]. While the Supreme Court ruling and NP-NSPE [GOI, 2004] required 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, as per the latest NP-NSPE norms posted by the MHRD, from 1 April 2008 the scheme is required to deliver minimum of 700 calories, 20 mg of protein, and a balanced and nutritious diet [MHRD, 2011]. Based on the 700 calorie diet, Table 1 also indicates the proportional quantities of micronutrients one may expect to get delivered. It must be noted, however, that NP-NSPE-2008 does not prescribe any minimum cardinal numbers for the intake for micronutrients. It only states that "balanced and nutritious diet" should be provided. The only cardinal number that is expected is the minimum protein intake of 20 gms per day. Even the earlier NP-NSPE-2006 guidelines summarized in the evaluation report by Planning Commission [2010, p. iii] only stated that "adequate quantities

of iron, folic acid, vitamin-A, etc." be provided. The main objective, therefore, seems to be to take care of hunger and provide incentive to children to come to school.

**Table 1. Recommended Daily Allowance (RDA) for Children***

| | ICMR RDA | | Meal Equivalents |
|---|---|---|---|
| | Age 7-9 | Age 10-12 | |
| (1) | (2) | (3) | (4) |
| Protein (gms/day) | 41 | 54 | 20 (NP-NSPE, 2008) |
| Fat (gms/day) | 15 | 15 | 5.46/5.15 (700 cal. equivalent) |
| Calcium (mg/day) | 400 | 600 | 146.6/206 (700 cal. equivalent) |
| Iron (mg/day) | 25 | 28* | 9.1/9.6 (700 cal. equivalent) |
| Folic Acid (mg/day) | 100 | 100 | 36.5/34.3 (700 cal. equivalent) |
| Iodine (ug/day) | 120+ | 150 | 43.7/51.5 (700 cal. equivalent) |
| Total Calories | 1925 | 2050 | 700 (NP-NSPE, 2008) |

*Average for boys and girls. + Swaminathan [1999, p. 519]. The same statistics is given by International Council for the Control of Iodine Deficiency Disorders (http://www.iccidd.org).

Because the programme does not prescribe any cardinal minimum numbers for micronutrients, perhaps, the minimum micronutrient numbers based on the ICMR norms may act as guidelines for a separate programme that may take care of that need. In this context, the estimated values for the samples from 2 locations, Ellis Bridge School 6 and the Stri Shakti Kitchen are presented in Table 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 700 calorie diet expected from the meal. In fact, children 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. Similarly, provision of fat and iron is also quite lower than the minimum expected. However, provision of calcium seems to be quite generous. Though the actual calorie values of the food samples were not calculated by the lab-team, it must be noted that between 2006 and 2008, the calorie expectation for the meal has jumped from 300 calories to 700 calories per day (more than a third of the daily requirement).

**Table 2. Nutrition Analysis of Prepared Food Samples**

| | Ellis Bridge School No. 6 | | Stri Shakti Kitchen | |
|---|---|---|---|---|
| | Khichadi | Sabji | Cooked Rice | Sabji |
| Wet Weight (gms) | 675 | | 725 | |
| 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 jeopardised. In Tables 3, 4, and 5 we present the presence of such hazards in wheat, rice, and tuar dal; and, relate them to the legal safe limits given by the Prevention of Food Adulteration Act [PFA, 2006]. 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 Sabarmati and Ellis Bridge locations. Presence of aflatoxins in food samples is a serious concern, for Aflatoxin is a carcinogen and prolonged consumption of it may lead to liver cancer. PFA allows 30 ppb intake of aflatoxin but its intake is undesirable for children. The name aflatoxin is derived from the fungi *Aspergillus flavus* which produces the toxin in moist and hot conditions. Improper pre-and-post harvest handling of agricultural commodities produces aflatoxin. Our observation regarding aflatoxins was corroborated by the laboratory isolation of this fungi.

**Table 3. Test Results for Hidden and Quasi Hidden Attributes in Wheat**

| PFA Rules | Uric Acid NMT* 100mg/kg, *i.e.*< 1% | Infestation Weevilled NMT 10% by count | Moisture NMT 14% by weight | Aflatoxin NMT 30mg/kg | Broken % count |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| 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 |

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

**Table 4. Test Results for Hidden and Quasi Hidden Attributes in Rice**

| PFA Rules | Uric Acid NMT* 100mg/kg, *i.e.*< 1% | Infestation Weevilled NMT 10% by count | Moisture NMT 14% by weight | Aflatoxin NMT 30mg/kg | Broken % count |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| Type | | | Sabarmati | | |
| Cleaned | 1.2* | 8.5 | 3.8 | + | 65 |
| Uncleaned | 1.2 | 12.5 | 5.1 | + | 65 |
| | | | Ellis Bridge | | |
| 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 5. Test Results for Hidden and Quasi Hidden Attributes in Tuar Dal**

| PFA Rules | Uric Acid NMT* 100mg/kg, *i.e.*< 1% | Infestation Weevilled NMT 10% by count | Moisture NMT 14% by weight | Aflatoxin NMT 30mg/kg | Broken % count |
|---|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) | (6) |
| 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.

## 5. Specific Suggestions

Some of the observations made in Sections 3 and 4 above may be discounted by the fact that in a developing country like India, the general level of awareness and cleanliness is low and it is not specific to MDM scheme alone. Nonetheless, in our opinion, there is a potential for general increase in hygiene and cleanliness at the schools and kitchens. Introducing private enterprises like Stri Shakti 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. Private incentive structure to generate market efficiency is generally absent in government sector, especially when the core competence of schools is to deliver education and not to prepare meals. Of course, as observed during our visits, private organisations and NGOs like Stri Shakti may have their own lacuna, however, the threat of non-renewal or cancellation of contract should act as a disciplining mechanism. In this context, to increase efficiency and quality of the prepared meal service, contracted private parties may be required to follow formal food quality management system called HACCP or the Hazard Analysis and Critical Control Points [Deodhar, 2004]. 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. Partnering with private agencies will also reduce the non-teaching commitments of the teachers. Currently, while separate cooks are assigned for meal preparation, we observed that 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. Therefore, provision of meals to students is taking place at the cost of study-time meant for student-teacher engagement. Engaging private parties such as Stri Shakti may save this valuable time.

It must be noted that the mandated mid day meals are supposed to provide only a minimum of 700 calories out of the total requirement of about 2000 calories per day. Thus, at best, a massive MDM exercise may contribute to, if required nutrients are present in sufficient quantities, about a third of the daily requirement of a child. Therefore, efficacy of the nutrition delivery could be increased by offering fortified packaged foods. Such initiatives have been taken-up in other developing countries. For example, at the behest of Ministry of Health, triple fortified

(Iodine, Iron, Vitamin A) noodle-seasonings and soya sauce have been commercially introduced in Thailand and China. Other fortified foods such as fortified sugar, milk and edible oil have been launched in Latin American countries (IE, 2010). India could do the same. In fact, menu could include local ready-to-eat *chikki* and *sukhdi* or an occasional nutrition bar.

An estimate based on the reference cooking cost, grain delivery cost, and additional cook-cum-helper cost [MHRD, 2011] shows that government spends at least Rs. 6.50 per day on each child.[4] However, as per the MDM evaluation report by the Planning Commission (2010, p. 5) government is also expected to incur additional costs of Rs. 60,000 on kitchen infrastructure and Rs. 5000 per year (year 2006 figures) on kitchen devices. Moreover, the same report (p. vi) also claims that pilferage and adulteration of grains occurs since grains are supplied and distributed in loose form to schools. There is also no control or standardisation on the quantity of pulses that get added to the prepared *dal.* Watered-down *dal* is a sure recipe for a low protein diet. While the yearly actual budget and the apportioned amounts for various types of expenses are not available, for various reasons mentioned above, allocation of funds gets used-up entirely. Complementary food items such as *sukhdi* which are supplied to *Anganwadis* by the government of Gujarat under the Integrated Child Development Service (ICDS) costs Rs. 72 per kilogram and retail price of a fancy 40 gram nutrition bar is Rs. 15. With assured MDM demand for *sukhdi, chikki,* and an occasional nutrition bar, economies of scale are bound to lower their cost of production. A sukhdi or a chikki on a particular day may cost about Rs. 2 for a 50 gm packet and a nutrition bar of about 40 gms would cost at least Rs. 7. If corporate involvement is sought, then such nutritional bars may be offered to the children and probably FMCG firms could partly foot the bill as a gesture of corporate social responsibility. Therefore, supply of packaged food items, at least on a few days, may help maintain accountability in the chain and offer standardised nutritional amounts as it is easy to count delivery of packaged food items.

Offering *sukhdi, chikki,* and nutrition bar may serve many purposes. As described earlier, MDM scheme may be offering different prepared food items each day but there is bound to be repetition of flavours and seasonings. Therefore, offering *sukhdi, chikki,* and nutritional bar twice a week and a seasonal fruit (usually banana is the cheapest) once a week will bring variety to the menu. In addition, this will provide convenience both to children and the authorities in serving the food and they could focus more attention to studies. And, in doing so, one would also ensure that hygienically packed (a banana has a natural hygienic packing!) and nutritious food is delivered and consumed by the recipients. Of course, while packaged fortified bar and fruit can complement the regular meal, nutritional quality of the warm, prepared meal itself can be improved. Better storage and quicker turnover of food grains from FCI godowns may provide better grain quality in terms of safety and nutrition. MDM scheme does mention establishing quality checks. While food inspectors can be employed to check quality of existing meals, policymakers may give a serious consideration to introducing package food. Moreover, looking into future, there is a distinct possibility of introduction of genetically modified (GM) foods in the market. We understand that Golden Rice, a GM variety of rice, is expected to be released in India by 2011 [IRRI, 2009]. Such rice is naturally fortified in terms of nutrients such as beta-carotene. Use of such rice in MDM scheme may improve nutritional delivery to the targeted children. Early studies in India show that knowing the pros and cons of GM foods, consumers are willing to accept such GM foods [Deodhar, Ganesh, and Chern, 2008, Pp. 570-87].

## 6. Concluding Observations

The concept of implementing mid day meal is almost a century old in India. With early beginnings in Madras Presidency and followed by its introduction in Gujarat and Delhi, in that order, in the post-independence period, today the scheme is being implemented in most states. In fact, the 2007-2008 budget of the central government had allocated about Rs. 7324 crore 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 taxpayer's money. In fact, it is also an important instrument to encourage children to attend school. Therefore, it becomes imperative that a comprehensive evaluation of the programme efficacy be undertaken. With this objective, we considered the likely impact of the scheme and its alternatives on children's food consumption as also the quality of the delivered food under MDM. It would also have been an interesting proposition to test the impact of MDM scheme on school attendance and enrolment. However, it would be ideal to gather data on pre and post MDM scheme attendance, enrolment, and drop-out rates. Moreover, since food supply allocation will be linked to attendance, one will have to be circumspect about the moral hazard issue of inflated attendance reporting. To avoid anecdotal impressions from visits to a few schools, one may collect and sift through data on the above parameters from a much larger set of schools for a statistically meaningful exercise.

Using indifference curve analysis we demonstrated that the food stamps alternative or the direct income support is not feasible, for it may lead to adverse consumption choices by the targeted households. This would happen, particularly in countries like India, where educational and awareness levels of the targeted households are low. To address the food quality aspects, we conducted field visits to some of the participating schools from different wards in Ahmedabad. These included visits to three 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 analyse 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 delivery, food safety, variety, and the study-time meant for student-teacher engagement.

We suggest certain changes to address the above issues. One option is to engage private agencies which would be expected to follow certain hygiene norms for food preparation. Food inspectors may be deployed to periodically check quality of prepared meals. Moreover, meals could be complemented by giving *chikki, sukhdi,* an occasional nutrition bar, and/or fruits like banana on some days. This will add variety and assured nutrition to the children. Public-Private partnership may be considered for delivery of nutrition bars through food giants such as ITC. Partial substitution of delivery of loose grains by packaged items may also improve accountability in the supply chain. In the near future, possibilities of using nutritionally fortified GM food grains such as Golden Rice may be considered for the mid day meals.

### Appendix I
### Laboratory Tests[5]

*Quasi Hidden Food Safety 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.

*Hidden Food Safety Attributes:* To estimate presence of uric acid on the surface of grains, which indicated rodent activity, 1 gram grains were soaked in 10 ml de-mineralised 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 ultra violate (UV) light (366 nm). Presence of blue and green fluorescent bands indicated the presence 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 ($25 \pm 2$°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.

*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 phenyl methane sulfonyl fluoride (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 solubilised, *i.e.*, made soluble in water by the action of a detergent or similar agent, 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 Cynate), which was read at 478 nm spectrophotometrically. Known concentrations of $FeCl_3$ 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 Cerric Ammounium Sulphate and Arseneous acid. Absorbance was taken at 363 nm. The readings were taken on a spectrophotometer and the contents were calculated in mg%.

**NOTES**

1. Now this programme is referred to as Supplemental Nutritional Assistance Program (SNAP, 2010). US also has the National School Lunch Program (NSLP), where targeted children in participating schools get priced, reduced-priced, and free lunches depending upon the family income.

2. While the Telgi scam of printing and selling counterfeit revenue stamps and stamp papers may not get repeated, sale of food stamps in secondary market is certainly possible.

3. In case of fuel and fertilisers, the benefits of the existing subsidies on prices are being cornered by non-poor farmers who make substantive use of these inputs. If the government is able to identify the poor, and the subsidy is given in the form of direct income transfers, it will go to the intended beneficiaries. However, having said this, the question remains as to whether or not the poor will use the direct income transfers for its intended use.

4. As per MHRD information, cost of cooking the meal is revised at Rs. 4.33 from April 2011. Three cooks-cum-helpers are provisioned for 100 students for 200 days a year at a salary of Rs. 1000 each. This amounts to Rs. 1.80 per meal per day. The provision for grain delivery is Rs. 75 per quintal which amounts to 37.5 paisa per 500 gm. grain delivery per meal.

All this adds up to Rs. 6.50 per meal.

5. 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.

## REFERENCES

Afridi, F., 2010; 'Child welfare programs and child nutrition: Evidence from a mandated school meal program in India,' *Journal of Development Economics.*, Vol. 92, Issue 2, July.

Becker, G. and C. Mulligan, 1997; 'The Endogenous Determination of Time Preference,' *Quarterly Journal of Economics*, 112 (3).

Banerjee, A. and E. Duflo, 2011; *Poor Economics: Rethinking Poverty and the Ways to End it*, Random House India, Noida.

Darbi, M.R. and E. Karni, 1973; 'Free Competition and the Optimal Amount of Fraud,' *Journal of Law and Economics.*, 16.

Deodhar, S.Y., 2004; 'Strategic Food Quality Management: Analysis of Issues and Policy Options,' Oxford IBH, New Delhi.

Deodhar, S., S. Ganesh, and W. Chern, 2008; 'Emerging Markets for GM Foods: An Indian Perspective on Consumer Understanding and the Willingness to Pay,' *International Journal of Biotechnology*, Vol. 10, No. 6.

Dreze, J. and A. Goyal, 2003; 'Future of Mid-day Meals,' *Economic and Political Weekly*, Vo. 38, No. 44.

FE, 2010; 'FICCI proposes food stamps for poor as PDS fails to deliver,' *Financial Express*, http://www.financialexpress.com/news/ficci-proposes-food-stamps-for-poor-as-pds-fails-to-deliver/622628/, posted online, 24 May.

GOI, 1995; 'Guidelines of National Programme of Nutritional Support to Primary Education [Mid Day Meal Scheme],' http://education.nic.in/, accessed in 2007.

GOI, 2004; 'Guidelines of Revised National Programme of Nutritional Support to Primary Education [Mid Day Meal Scheme],' http://education.nic.in/, accessed in 2007.

GOI, 1996; 'Task Force Report on Micronutrients,' D/WCD.

GNCTD, 2000; 'Evaluation Study Report on Mid Day Meal Programme,' Government of N.C.T. of Delhi (GNCTD), Planning Department, March.

IE, 2010; 'Fortified Noodles for Thailand, Fortified Soya Sauce for China,' *Indian Express* (IE), Ahmedabad edition, 2 September 2010. P. 2.

IRRI, 2009; 'Golden Rice to Hit Market by 2011,' International Rice Research Institute (IRRI) website, dated Friday, 4 September, 2009, http://beta.irri.org/news/index.php/rice-news/golden-rice-to-hit-market-by 2011.html

Jain, J. and M. Shah, 2005; 'Antyodaya Anna Yojana and Mid-day Meals in MP,' *Economic and Political Weekly*, Vol. 40, No 48.

Khera, R., 2006; 'Mid Day Meals in Primary Schools,' *Economic and Political Weekly*, Vol. 41, No. 46.

MHRD, 2011; "Mid Day Meal Scheme," http://education-.nic.in/elementary/mdm/index.htm, accessed on 12-12-2011.

Nelson, P., 1970; 'Information and Consumer Behaviour,' *Journal of Political Economy.*, Vol. 78.

PFA, 2006; 'The Prevention of Food Adulteration (PFA) act, 1954', and PFA Rules 1955, as amended up to 9 May 2006, Commercial Law Publishers (India) Pvt. Ltd., Delhi.

Planning Commission, 2010; 'Performance Evaluation of Cooked Mid Day Meal,' Programme Evaluation Organization, PEO Report No. 202, Planning Commission, GOI.

Samson, M., C. Noronha, and A. De, 2007; 'Towards more benefits from Delhi's midday meal scheme,' Collaborative Research & Dissemination (CORD), New Delhi.

SNAP, 2010; Supplemental Nutritional Assistance Programme, accessed on 29/6/2010 (Error! Hyperlink reference not valid.).

SC, 2001; 'People's Union for Civil Liberties vs. Union of India', Judgement of the Writ Petition (Civil No. 196 of 2001), Supreme Court (SC).

Swaminathan, M., 1999; 'Food and Nutrition,' Vol. 2, and Appendix 1.