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Investigation of Mid- Day Meal Scheme and Food Safety Practices in Government Schools of Telangana State

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Abstract—*The conducted investigation summarizes the methods and results of studies carried out in primary and secondary schools of "Gundlapochampalli, Kompally, and Alwal" mandals of Telangana State on the effectiveness of food safety, food hygiene along with the implementation of Mid-Day-Meal (MDM) scheme in schools. In particular, this particular investigation focuses on the implementation of food safety and food hygiene training in primary and secondary schools of Telangana State. Due to the conducted short-term study limited the majority of studies. The need for the development of food safety parameters and training in schools and MDM scheme is discussed.*
Key Words: Mid-Day Meals, Telangana State, Food Safety, Food Hygiene, Training Program, Gundlapochampalli, Kompally, Alwal.

1. INTRODUCTION

Education is one of the most significant and important elements of every stage of human life, especially at the childhood stage and the societal fabric of a country. With an average literacy rate of 80 percent, the developing countries still lag behind on this crucial parameter. The common denominator for low literacy rates in developing countries is the prevalence of poverty. Due to poverty, one-third of school children are malnourished in developing countries. Malnourished children are underdeveloped bothphysically and cognitively, which makes schooling difficult for them**.**

To mitigate the impacts of poverty and improve school participation among thesechildren, various interventions have been introduced across the globe. Schoolparticipation includes enrolment, attendance, and retention of the beneficiary children. The Mid Day Meal scheme is the popular name for school meal programme in India. It involvesprovision of lunch free ofcost to school-children on all working days. The key objectivesof the programme are: protecting children from classroomhunger, increasing school enrolment and attendance, retentionand simultaneously, take care of the nutritional health ofschool going children, improved socialization among childrenbelonging to all castes, addressing malnutrition and social empowermentthrough provision of employment to women. Thecontribution of MDM has been of great significance to schoolslocated in deprived and disadvantaged areas. Today no child in the schools remains hungry and undernourished. The scheme has a long history and has been expanded to all parts of India after a landmark direction by the Supreme Court of India onNovember28, 2001.

The mid-day meal should contain required nutrients and should be, hygienic, palatable, and operationally convenient. These guidelines of food safety are for school level kitchens, where the mid-day meal is cooked for children. Quality control and assurance of mid -day meal and food security should be an integral part of food handling procedures at the school kitchen. The food provided through these kitchens should be nutritious, free from contamination pathogens, food adulterants, artificial nonfood-grade colors, and additives and adhere to food safety and quality norms **(1)**.

Food safety encompasses grading, handling, preparation, and storage of food in ways that prevent foodborne illness and contamination. Food security measures include some routines that should be followed to avoid potentially severe health hazards.

2. METHODOLOGY:

For the present study, the population constitutes students,teacher/ Incharges of Mid-Day Meal from Primary and ElementaryGovernment schools of Gundlapochampalli, Kompally, and Alwal regions of Telangana State.This present investigation was a cross-sessional survey among the school pupil, teachers, and parents. This research deals with the mid-day meals scheme standard implementation and the food safety parameters training to the pupil, educators and parents of three different government schools in Telangana State.

The investigation was undertaken in three different government schools in Telangana state. The data was collected from three government school. The present research study was based on the observations of three government schools in Telangana in which Mid- Day Meal Scheme was functional. Investigation research consisted of unannounced visits to the schools to observe the mid-day meal preparation and distribution, and informal discussions with government school

staff, cooks, non-teaching staff, parents, pupils, and block officers. Primary data was collected by using interview schedule, observation schedule and focus group discussions. School management committee members, community members, parents, teachers, and students were involved in the focus group discussion. Furthermore, observation method was also adopted to investigate the condition of kitchen-shed, availability of the drinking water facility, availability of potable water for cooking and sanitation, preparation and distribution of meal, manners of the pupil during the time of serving mid-day meals and hygienic conditions in the kitchen and school premises. School data on weekly menu, the number of cooks, the infrastructure of the kitchen, etc. were collected from the headmasters and teachers. The questionnaire was conducted in a non-suggestive manner, and whenever possible, the accuracy of response was cross-examined by asking the same questions to several people and comparing them with first-hand observations.

Examples of topics covered in the trainings included the following: food-borne illness, personal hygiene and hand washing, cleaning and sanitizing, handling and serving food, food storage, transporting food safely, cleaning and inspecting fruits and vegetables, and HACCP.

To maintain the quality of food and to maintain good health of the pupil, training classes were conducted in the schools to the pupil, teachers, cooking staff, along with parents regarding the food safety parameters and standards, good hygiene practices, and good manufacturing practices.

The proposed research study used a two-part experimental design. The first part of the experimental design used a pretest posttest knowledge design which measured participants' food safety knowledge before and after a food safety education program. This part of the design was also known as the One Group Pretest-Posttest Design and involved collecting baseline data from the subjects at the beginning of the program, that is before the intervention, and again shortly after the intervention (**2**). The posttest was administered to the participants immediately after the training using the safe food handler curriculum developed for the project. The second part of the experimental design used a post-plan to adopt and a post-delayed adoption of behaviors design to measure the participants' willingness to adopt and their adoption of recommended food safety practices as a result of participating in the training. The delayed data collection using a behavior survey was given to the participants 3-6 months after participating in the training.

Evaluation provides important information about the impact and benefits of any program. The pretest-posttest design, also known as the before-and-after design, has been used for many education programs and is a simple design that can provide valid results. The before-and-after design is practical for evaluating Extension Programs and allows for much stronger conclusions than using the after-only design (**3**).

The food safety curriculum was developed by the project faculty and then reviewed by other faculty of University College of Technology (A), Osmania University, Hyderabad. The researcher reviewed the safe food handler curriculum and then prepared the evaluation instruments. Increased knowledge and adoption of safe food handling practices was measured using a test and a survey instrument. The evaluation instruments included the following: (1) Food Safety Knowledge Pretest, (2) Food Safety Knowledge Posttest (identical to the pretest), (3) Food Safety Practices Survey, and (4) Food Safety Practices Delayed Survey. The training program was designed so that its beneficial effects are continued even with frequent staff and volunteer turnover. For example, trained food recovery agency personnel and volunteers were provided safe food handler curriculum materials to use for training other personnel and volunteers in the organization. In addition, the Extension agents are available for providing additional training.

The pretest measured baseline knowledge, and the posttest measured knowledge gained by the participants immediately after instruction using the food safety curriculum. The Food Safety Knowledge Pre- and Posttests were the same.

The Food Safety Practices Survey was administered immediately after the presentation of the curriculum and measured the participants' willingness to follow recommended food safety practices. The Food Safety Practices Delayed Survey determined if the participants were following (those that did not indicate "already doing") or continued to follow (those that indicated "already doing") recommended food safety practices. The Food Safety Practices Survey used the same statements as the Food Safety Practices Delayed Survey, but the Food Safety Practices Survey statements were phrased as "planning to" and the Food Safety Practices Delayed Survey statements were phrased as "currently doing." For example, the questions on the Food Safety Practices Survey asked participants if they would consider changing their behavior by asking if they, as a result of participating in the training, "plan to follow recommended food safety practices," whereas, on the Food Safety Practices Delayed Survey, the questions asked if the participant currently "follows recommended food safety practices." The Food Safety Practices Survey consisted of questions with three responses: "yes," "no," and "already doing." The Food Safety Practices Delayed Survey consisted of questions with four possible responses: "always," "most of the time," "sometimes," and "never." Scores from the surveys were tabulated.

3. PROCEDURES

Participants completed the Food Safety Knowledge Pretest immediately before the safe food handler training. After taking part in the training, the participants completed the Food Safety Knowledge Posttest and the Food Safety Practices Survey. The Food Safety Practices Delayed Survey was administered

to the participants 3-6 months following their participation in the training.

4. STATISTICAL ANALYSIS:

Paired t-tests were used to analyze the results from the Food Safety Knowledge Pre- and Posttests. The data from the Food Safety Practices Survey and the Food Safety Practices Delayed Survey were analyzed qualitatively. If the Food Safety Knowledge Pre- and Posttest differences were significantly ($p< 0.05$) different from zero, and the scores for the Food Safety Knowledge Posttest were greater than for the Food Safety Knowledge Pre-Test, then the conclusion was that the instruction with the food safety curriculum was successful. A lack of a significant difference between Food Safety Knowledge Pre- and Posttests with scores below 100% indicated a lack of success. No significant difference between Food Safety Knowledge Pre- and Posttest scores 90-100% indicated an inability on our part to assess the effectiveness of participating in the safe food handler training. Responses on the Food Safety Practices Survey indicated if the workers were already performing good food safety practices or were planning to as a result of the program. On the Food Safety Practices Survey, 90-100% of participants indicating on all 10 items that they were “already doing” or “planning to do” determined success. Responses on the Food Safety Practices Delayed Survey indicated if proper food handling practices were being used. On the Food Safety Practices Delayed Survey, success was determined by 90-100% of participants indicating on all 10 items that they “always” practice the recommended behaviors.

5. RESULTS AND DISCUSSION:

In all the schools visited in Telangana state, the cooks were appointed by the school development management committee members (SDMC). The menu of the mid-day meal is the same in all the schools. The calorific value of the food is about 450 calories. However, in addition to daily food, once a week additional item in the form of fruit is given to the pupil.

The principal of all the schools under SDMC scheme kept meticulous records of the receipt of food ingredients and funding, daily attendance and a number of meals prepared. The principal was also responsible for ensuring that the cook was supplied with calculated amount of food ingredients as per the attendance of the children and that the food was cooked properly. The presence of pupil along with the food ingredients utilized was also recorded in the report.

The teachers were monitoring the mid-day meal distribution. One of the teachers in the entire school under SDMC was entrusted with the responsibility of buying fruits for the pupil which were provided once in a week. The teachers were also taking the help of pupil in picking up the fruit basket. The teachers responsible for arranging the fruits for pupil said that buying fruits was not much burdensome, and did not disrupt classroom activities. Meal breaks typically began around 1:00 pm. Teachers in all of the three schools felt that by introducing MDM scheme, helped a lot of pupils to get good food and strength and brought an overall improvement in their schools in respective of both the pupil's strength and their health. In all the schools, the pupil’s were taught the basic hygiene practices like hand wash before and after having food. There were either taps or hand pumps in the schools.

In all the schools the equipment for cooking was provided with the funds released by the government. In all the schools there were kitchen rooms.

Cooks reported that it would take two hours to complete the meal preparation. The cooks were getting enough firewood to cook meals from adjoining areas. The workers were satisfied with the salaries given to them. The cooks were interviewed separately from the teachers and confirmed the information teachers had provided about the management of the meal program at their schools.

The cooks in the schools owned by the SDMC were appointed by the school development management committee in which the parents, community members nad the headmasters are also members. The headmaster would be giving the money to the cook to get vegetables and other required ingredients for the preparation of the mid-day meal. The cook uses a part of the money for buying the cooking ingredients such as spices, and the remaining money is the salary of the cook. In all of the schools under the SDMC, the cooks were responsible for purchasing extra ingredients such as vegetables and spices.

The interviewed school teachers claimed that the school meals had an effect on the school attendance. Some younger siblings of the pupil were being sent to the school for having meals. The teacher in three schools said that the mid-day meal scheme not only boosted daily attendance among his students but also helped to keep them in class for the duration of the school day. One of the teachers reported that some of the students were also attending the school just for having mid-day meals and returned home after having them.

The field research indicates that cooked mid- day meals have now become a permanent part of the daily routine of government schools in Telangana. The government is continuing to increase both the funding and quality requirements for the Mid- Day Meal scheme. The center is providing Rs. 6.13 per student per day as cooking conversion cost against 0.50 paise per student per day from the state government for primary students and the center is giving Rs. 8.15 per student per day as cooking conversion 0.50 paise per student per day from the state government for the upper primary student.

In all the schools the cooks were appointed for cooking the food. The cooks were ensured that the preparation of mid- day meal does not disrupt the classroom activities. In the selection of the cook, the state government issued the guidelines whereby destitute women from the village were to be given priority.

Mid- Day Meal Scheme improved the student's academic performance. Close supervision and regular inspections are essential to achieving higher quality standards.

This review particularly focused on studies that attempted to evaluate the effectiveness of food safety and hygiene followed in government schools where MDM scheme is implemented. Some of the reviews (**4, 5**) undertook critically appraisals of the literature relating to Mid- Day Meal scheme in India, focusing on government schools and education of food handlers.

6. RESULTS OF TRAINING:

Overall (n=190), i.e. combining the data from all three schools in Telangana, the absolute mean difference between Food Safety Knowledge Pre- and Posttest scores was 2.2 ± 0.2, and this difference was significantly different ($p<0.000$) from zero. The mean Food Safety Knowledge Posttest score was 19.0 ± 0.1 out of 20 and greater than the mean score of 16.4 ± 0.2 out of 20 for the Food Safety Knowledge Pretest. Results from the Food Safety Practices Survey overall (n=184) indicated that most participants were "already doing" proper food safety practices (5.5 ± 0.2 out of 10 statements), or that "yes" they plan to use proper food safety practices (4.2 ± 0.2 out of 10 statements). Results from the Delayed Food Safety Practices Survey are only available from one school. Overall the participants (n=82) indicated that they "always" (8.6 ± 0.2 out of 10 statements) or "most of the time" (0.7 ± 0.1 out of 10 statements) follow proper food safety practices.

Participants were asked to indicate on their tests and surveys if he/she was a volunteer or a staff member. Similar to overall results, the absolute mean differences between the Food Safety Knowledge Pre- and Posttest scores were significantly ($p<0.000$) different from zero for both volunteers (2.2 ± 0.4) and staff (2.1 ± 0.2). Volunteer (n=49, 18.6 ± 0.3 vs. 16.2 ± 0.5) and staff (n=142, 19.0 ± 0.1 vs. 16.6 ± 0.2) Food Safety Knowledge Posttest scores were greater than Food Safety Knowledge Pretest scores. The majority of the volunteers (n=49, 6.4 ± 0.4 out of 10 statements) and staff (n=134, 5.4 ± 0.3 out of 10 statements) indicated on the Food Safety Practices Survey that they were "already doing" or that "yes" they planned to use proper food safety practices (volunteer 3.2 ± 0.4 and staff 4.2 ± 0.3). Responses on the Food Safety Practices Delayed Survey indicated that the majority of the volunteers (n=17, 8.6 ± 0.4 out of 10 statements) and staff (n=60, 8.8 ± 0.2 out of 10 statements) "always" or "most of the time" (volunteer 0.8 ± 0.2, staff 0.8 ± 0.1) followed proper food safety practices.

In addition, participants were asked to indicate whether their agency was in an urban or rural community. Similar to overall results, the absolute mean differences between the participants' Food Safety Knowledge Pre- and Posttest scores were significantly ($p<0.000$) different from zero for both urban (2.4 ± 0.2) and rural communities (2.3 ± 0.2). Urban (n=113, 19.0 ± 0.2 vs. 16.7 ± 0.3) and rural (n=78, 18.8 ± 0.2 vs. 16.6 ± 0.3) Food Safety Knowledge Posttest scores were greater then Food Safety Knowledge Pretest scores. The majority of the participants in urban (n=113, 5.4 ± 0.3 out of 10 statements) and rural communities (n=70, 6.4 ± 0.4 out of 10 statements) indicated on the Food Safety Practices Survey that they were "already doing" or that "yes" they planned to use proper food safety practices (urban 4.3 ± 0.3 and rural 3.4 ± 0.4). The results from the Food Safety Practices Delayed Survey showed that the majority of participants from urban (n=30, 8.8 ± 0.3 out of 10 statements) and rural (n=59, 8.6 ± 0.2 out of 10 statements) communities "always" or "most of the time" (urban 0.9 ± 0.2, rural 0.8 ± 0.2) followed proper food safety practices. A summary of these results are shown in Table 1.

Table 2 summarizes the participants' responses for the questions on the Food Safety Knowledge Pre- and Posttests. When each question was analyzed individually, questions 10, 14, 15, 17, and 19 showed a large qualitative improvement (> 18.9 %) from Food Safety Knowledge Pre- to Posttest. The topics for these questions included the following: HACCP, calibrating food thermometers, hand washing, cooking foods to the correct internal temperature, and cooling methods for leftovers, respectively. Questions 4, 6, 7, 9, 11, and 20 showed little qualitative improvement (< 2.1%) from Food Safety Knowledge Pre- to Posttests. The topics addressed in these questions were hand washing, personal hygiene, and cleaning and sanitizing. Participants missed question 19 (64.2% correct) most often on the Food Safety Knowledge Pretest. This question asked methods of cooling large quantities of food more quickly.

Table 1 Summary of evaluations of the food safety curriculum (Means ± SEM)

	Food Safety Know. Pretest		Food Safety Knowledge Protest
Overall (n=190)	16.4±0.2		19.0±0.1*
Gundlapochampalli (n=103)	16.0±0.3		18.6±0.2*
Kompally (n=58)	17.2±0.3		19.0±0.2*
Alwal (n= 29)	17.2±0.6		19.4±0.2*
Volunteer (n= 49)	16.5±0.5		18.8±0.3*
Staff (n=142)	16.6±0.3		19.0±0.1*
Urban (n= 113)	16.6±0.3		19.0±0.2*
Rural (n= 78)	16.5±0.3		18.8±0.2*
Food Safety Practices Survey			
	Already Doing	Yes	No
Overall (n=182)	5.8±0.2	4.0±0.2	0.2±0.0
Gundlapochampalli (n=95)	5.4±0.4	4.2±0.3	0.3±0.1
Kompally (n=58)	6.1±0.4	3.6±0.4	0.1±0.1
Alwal (n= 29)	6.0±0.6	3.7±0.6	0.1±0.1
Volunteer (n= 49)	6.4±0.4	3.3±0.4	0.1±0.1
Staff (n=134)	5.5±0.3	4.1±0.3	0.3±0.1
Urban (n= 113)	5.3±0.3	4.2±0.3	0.3±0.1
Rural (n= 70)	6.3±0.4	3.3±0.4	0.1±0.1

Food Safety Practices Delayed Survey				
	Already	Most of the time	Sometimes	Never
Overall (n=82)	8.7±0.2	0.7±0.1	0.2±0.1	0.1±0.1
Gundlapochampalli (n=48)	8.6±0.2	1.0±0.2	0.3±0.1	0.1±0.0
Kompally (n=34)	9.0±0.3	0.5±0.2	0.2±0.1	0.1±0.1
Volunteer (n= 17)	8.8±0.4	0.8±0.2	0.3±0.1	0.1±0.1
Staff (n=60)	8.9±0.2	0.8±0.1	0.2±0.1	0.1±0.1
Urban (n= 30)	8.9±0.3	0.9±0.2	0.2±0.1	0.1±0.0
Rural (n= 59)	8.7±0.2	0.8±0.2	0.3±0.1	0.2±0.1

* Differences between Food Safety Knowledge Pre- and Posttest were significantly ($p<0.05$) different from zero.

Food Safety Practices Survey was administered immediately after curricular instruction.

Food Safety Practices Delayed Survey was administered by mail 3-6 months after curricular instruction.

Table 2: Summary of all participants' responses to individual questions on Food Safety

Knowledge Pre- and Posttest

	Food Safety Knowledge Pretest		**Food Safety Knowledge Posttest**	
Question	**Number Correct***	**% Correct****	**Number Correct***	**% Correct****
1	162	85.3	182	94.3
2	158	82.7	172	90.8
3	136	71.6	162	84.8
4	183	95.8	185	96.9
5	170	89.5	185	96.9
6	182	96.3	184	96.4
7	180	94.8	180	94.3
8	160	83.7	178	93.2
9	184	96.4	185	96.9
10	140	72.7	174	91.6
11	188	98.5	188	100.0
12	180	93.7	185	97.4
13	146	75.8	168	87.9
14	92	46.9	172	90.5
15	142	75.3	186	98.4
16	165	86.8	184	96.8
17	132	69.5	180	94.7
18	148	76.4	170	90.0
19	120	63.2	182	94.8
20	182	96.2	186	96.4

*Number of Participants with correct answers

** Percent of Participants with correct answers

Table 3 shows a summary of the participants' responses for each question on the Food Safety Practices Survey. The items with the most "yes" responses (> 58.3%) were items 6 and 7 which inquired about calibrating food thermometers and cooling foods more quickly. Participants responded "no" most often (> 4.8%) to items 6 and 10 regarding calibrating food thermometers and storing raw meat and ready to- eat foods in the refrigerator. The Food Safety Practices Survey showed that participants were already washing fruits and vegetables thoroughly, cleaning and sanitizing cooking utensils, and washing their hands before preparing food and after handling raw meat or poultry by most often (> 66.8%) responding "already doing" to items 3, 4, and 5 respectively.

Table 3 Summary of all participants' responses to individual questions on Food Safety

Practices Survey

Item	**Yes**		**No**		**Already Doing**	
	Number*	**%****	**Number***	**%****	**Number***	**%****
1	60	32.5	1	0.5	120	64.9
2	70	37.5	3	1.6	108	58.9
3	54	30.1	1	0.5	126	70.2
4	58	31.8	1	0.5	122	66.6
5	39	21.3	0	0.0	142	78.5
6	132	72.4	10	5.4	42	22.6
7	108	58.3	5	2.6	68	36.9
8	78	42.4	2	1.1	101	54.5
9	56	30.6	7	3.8	118	64.4
10	61	32.5	9	4.8	112	60.5

* Number of responses

** Percent of responses

Table 4 shows a summary of all participants' responses to individual questions on the Food Safety Practices Delayed Survey. Proper cleaning and sanitizing, reheating leftovers thoroughly, and thorough hand washing were the food safety practices participants claimed they "always" followed. This was reflected in the most (> 95.3%) "Always" responses to items 1, 2, 4, and 5 on the Food Safety Practices delayed Survey. The results also showed that participants use a calibrated food thermometer to check food temperatures and cover and correctly label prepared food before storing "most of the time" (> 13.6%) by their responses to items 6 and 8. Results of the Food Safety Practices Delayed Survey showed that participants "sometimes" use a calibrated food thermometer to check food temperatures and divide larger quantities of food into smaller containers to cool more quickly by responding "sometimes" most often (> 9.6%) to items 6 and 7. Participants responded "never" (6.0%) most often to item 10 claiming they "never" store raw meat in the refrigerator below ready-to-eat or cooked foods.

Table 4 Summary of all participants' responses to individual questions on Food Safety

Practices Delayed Survey

Item	Always		Most of the time		Sometimes		Never	
	Number*	%**	Number*	%**	Number*	%**	Number*	%**
1	80	98.7	1	1.2	0	0.0	0	0.0
2	78	96.2	3	3.6	0	0.0	1	1.2
3	74	90.0	7	8.4	1	1.2	0	0.0
4	80	96.6	2	2.3	0	0.0	0	0.0
5	81	97.8	1	1.2	0	0.0	0	0.0

6	48	58.8	23	28.0	8	9.6	2	2.3
7	63	78.0	9	10.0	8	9.6	1	1.2
8	68	81.9	12	13.6	2	2.3	0	0.0
9	74	90.5	6	7.2	0	0.0	1	1.2
10	73	88.0	3	3.6	1	1.2	5	6.0

* Number of responses
** Percent of responses

7. DISCUSSION:

The goal of the project was to prevent food-borne illness in the schools. The objectives of the project were to develop a food safety curriculum, to administer it to food handlers and to determine the effectiveness of the curriculum.

Overall the results showed that the curriculum was used successfully in training the food handlers. Participants showed significant improvement from the Food Safety Knowledge Pretest to the Food Safety Knowledge Posttest, and the Food Safety Practices Delayed Survey results showed that the participants were still using proper food safety practices 3-6 months following the food safety training. Verbal feedback from all food safety trainings was positive. The participants seemed to enjoy the presentation of the curriculum, visual aids and hands-on activities. Participants especially liked the activity of emphasizing proper hand washing and the session involving questions from the food safety lessons presented to the audiences.

8. FOOD SAFETY KNOWLEDGE PRE - AND POSTTEST

Results from the evaluation of the effectiveness (Food Safety Knowledge Pre- and Posttest) of the food safety curriculum demonstrated that the curriculum was used successfully to improve food safety knowledge for the participants overall (19.0 ± 0.1 vs. 16.5 ± 0.2), and for participants in each of the three participating schools (Gundlapochampalli 18.6 ± 0.2 vs. 16.0 ± 0.3, Kompally 19.0 ± 0.2 vs. 17.2 ± 0.3, and Alwal 19.4 ± 0.2 vs. 17.2 ± 0.6). Participants in urban (19.0 ± 0.2 vs. 16.6 ± 0.3) and rural (18.8 ± 0.2 vs. 16.5 ± 40 0.3) communities, as well as both volunteers (18.8 ± 0.3 vs. 16.4 ± 0.5) and staff (19.0 ± 0.1 vs. 16.6 ± 0.2), performed significantly better on the Food Safety Knowledge Posttest compared to the Pretest. This improvement in food safety knowledge is similar to results from several previous studies (**6, 7, 8, 9, 10**).

When each question was analyzed individually the results demonstrated that participants showed the greatest qualitative improvement (%) from Food Safety Knowledge Pre- to Posttests on questions concerning HACCP (18.8%), calibrating food thermometers (41.5%), cooking foods to the correct internal temperature (25.3%), and cooling methods for leftovers (31.4%). This indicates that participants had a lack of pre knowledge in these areas, and after the food safety curricular instruction the participants understood the topics and were able to demonstrate this by correctly answering questions concerning those topics on the Food Safety Knowledge Posttest. Participants' scores were already high; therefore, less improvement was noted on questions concerning hand washing (1.1%), personal hygiene (1.1%), and cleaning and sanitizing to prevent cross contamination (0.5%). This suggests that participants were already knowledgeable in these areas and answered these questions correctly on both the Food Safety Knowledge Pre- and Posttests.

9. FOOD SAFETY PRACTICES SURVEY

Results from the Food Safety Practices Survey administered immediately after the food safety curricular instruction, indicated that the majority of food recovery agency personnel and volunteers were already using (5.7 ± 0.2 out of 10 statements) or plan to use (4.0 ± 0.2 out of 10 statements) proper food safety practices in their agency or at home. The fact that responses to several statements on the Food Safety Practices Survey indicated that overall participants were "yes" planning to use proper food safety practices (4.0 ± 0.2) presumably demonstrated that the participants were not "already doing" these practices, and because of the food safety curricular instruction they would perform these safe food handling practices in the future. The results from the Food Safety Practices Survey were similar to overall results when participants were analyzed by state (Gundlapochampalli : "already doing" 5.4 ± 0.4, "yes" 4.2 ± 0.3; Kompally: "already doing" 6.2 ± 0.4, "yes" 3.76 ± 0.4; or Alwal: "already doing" 6.0 ± 0.6, "yes" 3.7 ± 0.6), position (volunteer: "already doing" 6.4 ± 0.4, "yes" 3.4 ± 0.4 or staff: "already doing" 5.6 ± 0.3, "yes" 4.2 ± 0.3), and agency location (urban: "already doing" 5.4 ± 0.3, "yes" 4.3 ± 0.3 or rural: "already doing" 6.4 ± 0.4, "yes" 3.4 ± 0.4).

When each Food Safety Practices Survey question was analyzed separately the results showed that participants were "already" properly washing fruits and vegetables (70.3%), cleaning and sanitizing cooking utensils after each use (67.6%), and washing their hands before preparing food and after handling raw meat and poultry (78.6%). These are common safe food handling practices personnel and volunteers of food recovery agencies were already performing prior to the food safety training. These topics were included in the curriculum and thoroughly emphasized during the instruction. In contrast, a study by Altekruse and colleagues reported that participants who responded to a telephone survey were not adequately washing their hands or taking precautions to prevent cross-contamination (**11**). Another study by Altekruse and colleagues reported that respondents did not properly clean cutting boards after contact with raw meat or chicken (**12**). Participants responded "yes" to items regarding using calibrated food thermometers to check food temperatures regularly (72.5%) and dividing large quantities of hot food into smaller containers to cool more quickly (59.3%). These results suggest that participants were not performing these particular food safety practices and would begin to do so as a result of the training. However, the greatest

number of participants responding "no" was most often to the same item on the use of a food thermometer (5.5%). This means some participants, although a relatively small number of respondents were not willing to check food temperatures with a calibrated thermometer. A study by the USDA's Food Safety and Inspection Service (FSIS) reported that food thermometer use has increased since 1998, but most consumers are not regularly using a food thermometer (**10**). The other item to which some participants responded "no" was to the item suggesting storing raw meat in the refrigerator below cooked or ready-to-eat foods (4.9%). Some participants may have been confused by this item or it may not have been clearly communicated during the food safety training. These results are similar to those reported in the USDA's FSIS HACCP evaluation report released in September of 2002 (**10**).

Without actually going into the facility and observing the workers' food handling behaviors, it is hard to determine if, as a result of the food safety training, the participants will adopt safe food handling behaviors. This is a limitation to our study as we used self - reported data from the Food safety Practices Surveys to evaluate food handlers' behaviors. A study by Meer and associates (**7**) showed that food safety knowledge scores had a small, positive effect on food safety practices scores in Expanded Food and Nutrition Education Program participants, but the participants' food safety practices were not observed by the researchers. In a review of food safety studies, Redmond and colleagues (**13**) showed that food safety knowledge, attitudes, intentions, and self-reported practices did not correspond to observed behaviors, suggesting that observational studies provide a more accurate indication of the food safety practices actually used in food preparation (**13**).

On the initial Food Safety Practices Surveys the mean response for "already doing" proper food safety practices was 5.8 ± 0.2 out of 10 statements. The Food Safety Knowledge Pretest scores were also relatively high (overall 16.6 ± 0.2 out of 20 questions). These results demonstrated an appreciable level of pre-knowledge.

10. FOOD SAFETY PRACTICES DELAYED SURVEY

The results of the Food Safety Practices Delayed Survey (only Gundlapochampalli and Kompally data available) administered 3-6 months following the training using the food safety curriculum demonstrated a qualitative indication of improvement in food safety practices. A majority of the participants indicated a response of "always" (8.8 ± 0.2 out of 10 statements) or "most of the time" (0.8 ± 0.1 out of 10 statements) using proper food safety practices on the Delayed Food Safety Practices Survey as compared to the number of participants that indicated that they were "already doing" proper food safety practices (5.8 ± 0.2 out of 10 statements) on the Food Safety Practices Survey. These results indicated the participants had retained the food safety knowledge for the 3-6 month period and were continuing to carry out safe food handling behaviors at the time of the survey. When analyzed in schools, both Gundlapochampalli School (8.7 ± 0.2) and Kompally school (9.0 ± 0.3) had results similar to the overall results with a majority of the participants "always" following proper food safe ty practices. These results were similar for volunteers (8.8 ± 0.4) and staff (8.9 ± 0.2) as well as participants in both urban (8.9 ± 0.3) and rural (8.7 ± 0.2) communities. A study by Lynch and colleagues showed similar results in that the time elapsed since safe food handler training did not significantly affect the level of food safety knowledge among participants (**14**).

When each Food Safety Practices Delayed Survey question was analyzed individually participants reported "always" cleaning and sanitizing cutting surfaces (98.8%) and cooking utensils (97.6%) after cutting up raw meat or when there is a chance they may have become contaminated, reheating leftovers thoroughly before serving (96.3%), and washing their hands thoroughly before preparing food and after handling raw meat or poultry (98.8%). These are essential safe food handling practices and were thoroughly emphasized throughout the food safety training.

11. CONCLUSIONS

Some of the observations made during the study 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 unique to MDM scheme alone. Nonetheless, in our opinion, there is a potential for a general increase in hygiene and cleanliness at the schools and kitchens. The overall goal of the project was to develop a strategy for preventing food-borne illness by promoting food safety practices in personnel and volunteers providing food to the pupil. Introducing training programs to the kitchen staff, students & school/meal management team running the MDM scheme may be a better idea than just depending on the governmental agencies involved in the operational delivery of the scheme. A partial achievement was observed.MDM scheme implementation at schools in India is also one of the instruments to encourage children to attend school. Therefore, it becomes imperative that the program efficiency evaluation is undertaken. Hence, the quality of the delivered food should be considered under MDM. It is suggested to include the regular training and awareness as part of MDM.

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