SUMMARY AND CONCLUSIONS

CHAPTER VI

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Food safety has emerged as an important global issue with international trade and public health implications. Food borne illnesses are a widespread public health problem globally. Developing countries bear the brunt of the problem due to the presence of a wide range of food-borne diseases. In India an estimated 4,00,000 children below five years age die each year due to diarrhoea. Several millions more suffer from multiple episodes of diarrhoea and still others fall ill on account of hepatitis A, enteric fever, etc. caused by poor hygiene and unsafe drinking water. In view of this fact, it was thought to study the food safety scenario of Vadodara city as well as to educate the street food vendors and restaurants owners and food handlers on food safety. Imparting food safety education is the first step towards combating the problem of food safety. Many more such efforts need to be done in order to completely eradicate food borne illness from its root.

7.1 Phase I –Situational analysis of 153 Food Service Providers (FSPs)

Under this phase, 90 structured and 63 unstructured units were surveyed for their knowledge and practices on food safety. The structured units comprised of small and medium restaurants, Fast food joints, Bus stand food outlets, Railway food outlets and *Dhabas*. The unstructured units comprised of the street food units. Majority of the structured units owned their units, were between the age group of 25 – 50 years and were literate. More number of the street food vendors had employees below 16 years of age as compared to structured units. Majority of the respondents in the structured units were licensed, earned more wages as compared to street food vendor that were not licensed. Difference was seen in the mode of lighting, where majority of the structured units had electricity and 65 per cent of the street vending units had provision of battery operated lights. None of the street food vendors had running water facility or a water purifier and used stored water procured from the Municipal Corporation tanks.

Majority of the street vendors expressed their willingness to undergo food safety training as compared to only 39 per cent of the respondents of the structured units. Almost all the units had smokeless fire and fuel for cooking and made use of packed and labeled spices condiments, oil and ghee.

With regards to knowledge on personal hygiene, all the establishments had mean per cent scores above 80 per cent. In the area of food hygiene, the street food vendors as well restaurant owners had poor mean per cent scores (< 50%) as compared to the other categories that had scores above 80 per cent. The restaurant owners and street food vendors had poor scores (< 38%) for nutrition and health. It can be therefore concluded that, the restaurants owners and street food vendors had poor knowledge on food safety. It was observed that, respondents having education above the higher secondary level had good knowledge and practices on food safety and this association was found to be statistically significant.

For practices related to food hygiene, the restaurant scored the highest (64%), as compared to *dhabas* that had scores < 45 per cent. For practices related to unit hygiene and environmental hygiene, the *dhabas* scored < 40 per cent as compared to the restaurant that had higher scores. Chi square analysis indicated no association between the ownership of the establishment and the practice scores.

In case of structured units (N=90), availability of exhaust fan, ventilation and chimney had an association with the income of the respondents. It was observed that the establishments having income >₹1000/- had made provisions for exhaust fan, ventilator and chimney. Willingness to undergo training was strongly associated with educational status, age of the respondents, their daily wages and years of experience in food service. Respondents receiving education up to the higher secondary level and earning >₹1000/- showed willingness for attending the training program. More experienced respondents also expressed their willingness to undergo the training program. Educational status was positively correlated with daily income as well as years of experience. There was a positive correlation between the knowledge and practice of the respondents belonging to the

structured food service establishments. However, in the case of street food vendors their food safety knowledge was negatively correlated with practices. When the age of the food handlers was associated with their practice ranks, it was observed that the handlers of the younger age group had fair practices as compared to the older ones. Age had no association with the knowledge scores of the food handlers.

7.2 Phase II – Establishment of food court

In the next phase of the study, Program Implementation Monitoring Committee (PIMC) was formed with the major objecting of developing a food court and placing street food vendors trained food safety. For serving safe street foods to the public it is necessary to develop a street food court that would have all the necessary facilities and trained personnel for preparation and serving of safe food. The first step towards establishment of street food court was the formation of Program Implementation Monitoring Committee (PIMC). An orientation meeting was arranged for all the stakeholders for formation of PIMC as well as to discuss about the plans for establishment of the food court. The first meeting with the members of PIMC was carried on 17th January, 2007. Training as well as non training needs were discussed in the meeting. Some of the issues discussed were identification of vending zone for the street food vendors, making available well-designed, economically constructed food cart to the street food vendors as well as low cost, food grade disposable serving ware to the vendors. The food inspectors/ sanitary officers were also asked to carry out regular inspection for food quality, conducting routine medical check-ups of the vendors. Lastly it was also discussed that the vendors be provided with provisional license/formal registration on completion of the training program.

The proceedings of the meeting revealed that the Corporation could provide support for mobilizing vendors from two zones of the city. Partial support was obtained from PIMC for identification of vendors and only few officials were present during the training. In rest of the areas no support was provided by the PIMC. The committee decided that the establishment of food court would be thought upon later.

7.3 Phase III – Imparting food safety education to street food vendors, along with follow up training

Under this phase of study, 41 street food vendors were imparted food safety education. After a period of one year the same vendors were again imparted follow up training on 20 desirable food safety practices.

The baseline information revealed that, majority of the units were licensed and all street vending units had electric lamps as mode of lighting. Majority of the vendors were literate, had below 10yrs of experience in street food service and did not have employees below 16 y of age. In most cases, the average number of customers visiting the units during weekdays and weekends ranged from 30 –120. All the street-vending units procured drinking water from the municipal corporation.

Majority of the vendors purchased packed and labeled oil, butter. As high as 70 percent of the vendors kept their pushcart, working surface, chili powder and salt sprinklers uncovered and dirty.

At baseline, the street food vendors had poor scores for knowledge (14%) on food safety, but had good food handling practices (65%). After the intervention, the knowledge of the vendors increased on various aspects of food hygiene such as names of food borne illness (25%), symptoms of food borne diseases (28%), characteristics of spoiled food (14%), factors that contaminate food (14%) and sources of food contamination (14.12). The street food vendors gained knowledge on personal hygiene and nutrition and health like, names of protective clothes to be worn by food handler (33%), activities after which hand washing with soap is must (12.5), names of food sources rich in vitamins (21%), minerals (7%), protein (28%), names of food adulterants (22%) and harmful effects of excessively reheating oil (9%). Knowledge of the street food vendors also increased for unit and environmental hygiene on aspects like, names of sanitizers to be used by food handlers (17%), names of safe disposables available in market (24%), and ideal way of serving drinking water (24.5%).

Post intervention, the practices of the vendors improved with regards to food hygiene (1%) and personal hygiene (2%). The training made a little but a non

significant improvement in the practices related to unit hygiene (1%) as the street food vendors had already high scores prior to the intervention. The practices of the street food vendors had no association with their income level and the average number of consumers visiting their units.

Follow up training was conducted for 40 street food vendors who were already trained. This training was based on distribution, demonstration and a checklist of 20 most desirable points for preparing and serving safe food at vending site. The training brought about a positive impact on all the practices related to food hygiene (6.87%), personal hygiene (11.72%) and environmental hygiene (13.5%). A significant increase in the mean scores for practices of the street food vendors was observed for keeping a separate tank for hand washing, made a provision for a big covered and clean dustbin, wearing of apron and head cap. Prior to the training, only 35 per cent of the vendors had the habit of keeping cut fruits and vegetables uncovered, however after the intervention, 50 per cent of them discontinued the practice and this increase was statistically significant. None of the street food vendors had the habit of dipping their knife (when not in use) in a disinfectant solution, however a majority (32.5%) of them began to do so after the education. Thus, food safety follow up training brought about a positive impact on majority of the practices of the street food vendors.

7.4 Phase IV – Imparting food safety education to restaurant owners and handlers

In this phase, 30 restaurants owners and 30 food handlers were imparted food safety education. Baseline data revealed that, majority of the restaurants under study were licensed, had availability of running water for 24 h and had more than 5 employees working in their units.

None of the owners were found to be illiterate, and were between the age group of 25 – 50y. Majority of the food handlers were literate, and were between the age group of 31 – 45y. Majority (83%) of the owners reported not purchasing labeled and packed food grains; however, labeled and packed oil, butter and condiments were purchased by majority of the owners.

Most of the owners (53%) stored green leafy vegetables at room temperature for less than 24h, stored milk up to 12 hours at room temperature and also stored cooked food under chilling for up to 24 h.

Majority of the owners were willing to undergo the food safety training program and were ready to allow their food handlers for only 2 h for attending the training program. Majority of the food handlers agreed for training and felt that would get better job and wages after the training.

In the area of nutrition and health owners had significantly higher mean knowledge scores (17%) as compared to the food handlers (8.56%). However they had similar knowledge scores in the area of food hygiene, personal hygiene and unit and environmental hygiene.

The food safety education made a highly significant improvement in the knowledge scores of the owners in the areas of food hygiene (20%), personal hygiene (26), nutrition and health (19) and unit and environmental hygiene (21).

Prior to food safety education, majority of the restaurant had more than 70 per cent mean per cent scores for practices. The food safety education made about 1-2% non significant increase in the practices.

The knowledge of the food handlers after the education improved with respect to names and symptoms of food borne diseases (14.59%), names of immediate symptoms of food borne illness (55.87%), names of adulterants in foods (18.75) and names of activities that contaminate food with bacteria (10.75). Post intervention, the food handlers also gained knowledge on the benefits of training program; mean percent scores increased from 5 per cent to 23.25 per cent in this regard.

Food safety education showed a positive impact on the practices related to food hygiene such as covering of cooked food and display items (3%), use of potable water for drinking and cooking and its safe handling (9%), grooming of the food handlers and refraining from bad habits (4.5%) and use of clean chopping board (3.5%). The education was less effective in convincing the food handlers for wearing protective clothes while working and also making

use of spoons, forks, etc while serving of food. In some of the practices, the intervention made a non significant improvement or no improvement at all as the food handlers had very good to good practices (> 70 per cent) prior to intervention.

7.5 Phase V – Microbial load of fresh coriander after treatment with different levels of disinfectants namely sodium hypochlorite (NaOCl) and potassium permanganate ($KMnO_4$)

During the training program, the vendors revealed that the coriander leaves brought from the market are directly added to the cooked product without washing. Such a practice may pose a high risk to the consumers for contracting food borne diseases. Therefore, a need was felt to establish the type and level of disinfectant for washing coriander in order to reduce its pathogenic load. Amongst all the five markets, coriander brought from market III had the highest counts of TPC and was also found to be highly contaminated with *Salmonella*; however no statistical significant difference was noticed amongst the markets in the initial counts of coriander leaves. TPC and *Salmonella* decreased significantly when the sample was treated with 200 ppm sodium chloride and 100 ppm $KMnO_4$.

Coriander brought from Market I was found to be highly contaminated with coliform and *Listeria monocytogenes*. 100ppm of NaOCl was most effective in reducing the counts of coliforms and *Listeria monocytogenes* on fresh coriander. Sample of coriander brought from Market V was found to be highly contaminated with *Staphylococcus aureus* and maximum reduction in counts of was obtained after treatment with 100 ppm $KMnO_4$. 100ppm $KMnO_4$ was most effective in reducing the counts of *Shigella* by more than 1 log.

When the levels of sanitizers were compared for their effectiveness, it was seen that there existed no statistical significant difference between the two levels. Tap water alone was not sufficient to reduce the microbial load of fresh coriander. Either sodium hypochlorite (NaOCl) or potassium permanganate ($KMnO_4$) should be used to reduce the microbial load, but none of the disinfectants were successful to completely remove the pathogens from fresh coriander.