



ABSTRACT

Food service establishments (FSE) have come to stay in today's contemporary world, due to increased need for food outside home, be it for people who are migrating for educational purpose or for other purposes. FSE such as restaurants, street food vendors, *dhabas*, fast food joints, railway and bus stand food outlets are considered an important source of foodborne outbreaks. In view of this, the broad objective of the study was to carry out action research in order to bring about sustainable changes in food service industry for supplying safe food to public at large. In order to fulfill this objective, the study was divided into five phases.

In the first phase, respondents belonging to 90 structured and 63 unstructured units (Total N=153) were surveyed from 6 food service establishments for their knowledge and practices on food safety. Survey method was used to elicit information using a structured pre coded questionnaire from the owners and food handlers. Survey results revealed that more number of respondents of unstructured units (21%) were illiterate as compared to respondents of the structured units (5%). Majority of the respondents in the structured units were licensed, earned more wages as compared to street food vendors that were not licensed. None of the street food vendors had running water facility or a water purifier and used stored water procured from the Municipal Corporation. Almost all the structured units had smokeless fire and fuel for cooking, 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. It was observed that, respondents having education above the higher secondary level had good knowledge on food safety and this association was found to be statistically significant. For practices related to food hygiene, the restaurant scored the highest, as compared to *dhabas* that had scores < 45 per cent. Educational status was positively correlated with knowledge, practices, daily income as well as years of experience. No association existed between the ownership and the practice scores.

First phase of the study revealed that, street food vendors and restaurants had poor knowledge and practices on food safety. Therefore, it was thought to impart food safety training to street food vendors (SFVs) (41), restaurant owners (30) and restaurant handlers (30) for a period of 15 days for 2 hrs each using the IEC materials developed in vernacular language. For this purpose, PIMC (Program Implementation Monitoring Committee) was formulated in order to seek help from the government officials as well as other non governing bodies for the successful implementation of the food safety messages as well as development of street food court. PIMC would also help in ensuring complete participation and cooperation from the beneficiaries during the training program.

The baseline data of 41 SFVs revealed that none of them had education above the higher secondary level. About 15 per cent of the vendors were found to be illiterate. Only 35% of the street food-vending units were licensed. Food safety education intervention made a positive impact on the knowledge of the SFVs in terms of Food hygiene (23.04%), Personal hygiene (26%), Nutrition and Health (16%) and Unit and Environmental hygiene (23%). Food safety education made a little but a significant increase in the practices of the vendors with regards to Food hygiene (1%) and Personal hygiene (2%). There was a non significant improvement in the practices related to Unit hygiene (1%). No change in the practices was observed for Environmental hygiene. As not much improvement was noticed in the practices, follow up training was imparted to the street food vendors on 20 desirable food safety practices after a period of one year. About 32.5 per cent of the street food vendors were observed dipping their knife (when not in use) in a disinfectant solution after the intervention. The training made a positive impact for the practices related to food hygiene (0.6), unit (0.17) and environmental hygiene (0.27). The training made a significant impact on the practices related to nail cutting, wearing of aprons and head gear ($P<0.001$).

Baseline data of 30 restaurant owners and food handlers revealed that, all the owners were literate; whereas 13 per cent of the food handlers were illiterate.

Most owners felt that training of the staff is essential for food safety and is essential for rendering better service to the customers. Of these, a majority (94%) were willing to pay more to the trained staff. None of the food handlers of the small and medium restaurants ever received any kind of job related training in the past; however, 60 per cent of them agreed to attend training if given a chance. Prior to the food safety education intervention, the owners and food handlers had poor knowledge in all the areas of food safety. Owners had better knowledge on nutrition and health as compared to food handlers ($P < 0.05$).

Post intervention, a highly significant improvement was seen in the knowledge scores of the owners with regards to food hygiene (20%), personal hygiene (26%), nutrition and health (19%) and unit and environmental hygiene (21%) ($P < 0.001$). The restaurants had already good practice scores ($> 70\%$ mean percent scores) prior to the intervention with regards to purchase of good quality ingredients (82%), use of potable water for cooking and drinking (83%), use of proper fuel for cooking (97.5%), adequate height of the platform for food preparation (97.5%), availability of exhaust fans and ventilators in the kitchen (77%) and location of unit at clean place away from logged drains (94%). The intervention made 1% – 2% non significant improvement in the infrastructure facilities of the restaurant.

The intervention was successful in bringing about a statistical significant improvement in the knowledge scores of the food handlers only in the area of nutrition and health and total knowledge scores. 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.

During the discussion sessions of the training program, it was revealed that, raw unwashed coriander leaves are used by the food service providers for

garnishing various cooked products. An attempt was made to test the efficacy of two different disinfectants namely sodium hypochlorite (NaOCl) and potassium permanganate (KMnO₄) to reduce the pathogenic load of the coriander leaves. For this, coriander leaves were brought from 5 different markets of Vadodara city and were treated with the disinfectants at two different levels and were analyzed for Total Plate Count (TPC), *Salmonella*, *Shigella*, Total coliforms, *E coli*, *S aureus* using ready to use Hi media pre plated plates (Hi Media Lab, Pvt. Ltd., Mumbai). Unwashed fresh coriander leaves procured from various markets were found to have TPC beyond the acceptable limits of 10⁵ CFU/g. Bulk washing (10 g of sample dipped in 1 litre tap water for 5 mins) did not significantly reduce the microbial load. TPC decreased significantly by 1 log cycle when the samples were treated with 200 ppm NaOCl and 100 ppm KMnO₄. NaOCl was effective in significantly reducing the counts for coliforms at both levels. *Staphylococcus aureus* could be reduced more effectively with 100 ppm of KMnO₄ as compared to both levels of NaOCl; whereas *Listeria monocytogenes* and *Salmonella* could be reduced effectively using both sanitizers. *Shigella* decreased by more than 1 log cycle when treated with 100 ppm KMnO₄.

To conclude, situational analysis showed that of all the 6 food service establishments, street food vendors and restaurant handlers had poorest scores for knowledge and practices on food safety. The objective of the study to establish food courts with food handlers trained in food safety could not be achieved as the support from the government authority was lacking. The food safety education intervention was successful in bringing about a significant gain in knowledge scores on food safety, with little improvement in the practices. However, follow up training to the street food vendors brought about better improvement in food safety practices. In an attempt to test the efficacy of the disinfectant for reducing the microbial load of coriander leaves, it was revealed that both the disinfectants (100 ppm NaOCl and 50 ppm KMnO₄) were successful in reducing the pathogenic load by 1 log cycle.