Journal of Population Therapeutics & Clinical Pharmacology

RESEARCH ARTICLE
DOI: 10.53555/tqy75719

# A MIXED-METHOD STUDY TO ASSESS THE FOOD SAFETY IN RESTAURANTS IN TWO DISTRICTS OF KERALA, SOUTH INDIA

**Dr. Unnineeli Nair[1], Dr. Prakash Narayanan[2*]**

[1]Second Year MPH Student, Department of Health Policy, Prasanna School of Public Health, Manipal Academy of Higher Education, Manipal, Karnataka, India.
Orcid Id - https://orcid.org/0009-0008-6409-5674
[2*]Professor, Department of Health Policy, Prasanna School of Public Health, Manipal Academy of Higher Education, Manipal, Karnataka, India.

***Corresponding Author:** Dr. Prakash Narayanan
*Professor, Department of Health Policy, Prasanna School of Public Health, Manipal Academy of Higher Education, Manipal, Karnataka, India.

**ABSTRACT**

**Background:** One in ten people fall ill every year because of consuming unsafe food. Contaminated food contains harmful organisms like bacteria, viruses, and parasites that can cause more than 200 distinct illnesses which can range from diarrhea to cancer. Food handlers' hygiene, health, knowledge, and application of food safety directly impact the likelihood of food contamination. Some of the reasons why food becomes contaminated and unfit to eat are bacteria and the toxins they produce, food encountering contaminants from other surfaces, improper safeguarding techniques, unsanitary food handling procedures, and contamination from people who harbor the harmful microbes in their skin and nails. To prevent foodborne illnesses, food handlers must follow food safety guidelines. To dodge the potential hazards of consuming unsafe food, it is very important to understand and implement these food safety guidelines.

**Methods:** A cross-sectional mixed-method study was conducted among the food handlers in restaurants in Alappuzha and Thiruvananthapuram districts of Kerala state in south India, over a duration of six months, from January to June 2024. A two-stage random sampling method was employed.

**Results:** A total of 203 respondents from 151 restaurants participated in the assessment of their attitude, knowledge, and practice levels in safe food handling. More than three-fifths (60%) of the participants had a positive attitude, and more than half of the participants had sufficient knowledge (56.2%) and correct practice levels (50.2%) towards safe food handling.

**Conclusion:** The main challenges faced in restaurants included labor/staffing issues, waste management challenges, and competition from street food shops. This study highlighted that food safety training should be provided for the younger and inexperienced food handlers.

**Keywords:** Food Safety; Knowledge; Attitude; Practices; Kerala.

## INTRODUCTION

One in ten people falls ill every year because of consuming unsafe food. Contaminated food contains harmful organisms like bacteria, viruses, and parasites that can cause more than 200 distinct illnesses ranging from diarrhea to cancer.[1] Illness and malnourishment are the results if contaminated food is consumed especially by children, the elderly, and the sick. Since foodborne illnesses are underreported, and the exact cause of contamination of food is difficult to determine, there is a general underestimation of the impact of foodborne illnesses on the world economy and public health.[1] About 12,000 children under the age of five are affected by foodborne illnesses worldwide and about forty percent of them die annually because of this and food safety must always be ensured to preserve the health and well-being of human beings.[1]

Unsafe food causes 600 million/ 60 crore cases of foodborne illnesses annually and 56 million/5.6 crore people die every year due to this.[2] Out of the many causative agents for foodborne illnesses, norovirus infection was one of the most common, causing the highest annual number of cases globally.[2] It infects people through consuming fruits, vegetables, raw oysters, and processed meat.[2] Food establishments like restaurants and homes have had the most reported incidence of foodborne illnesses.[3] To prevent foodborne illnesses, food handlers must follow food safety guidelines.[3]

Food can become contaminated at any time from production to consumption. A faulty handling of food during preparation, processing, or storage manifests as food contamination (Sani & Siow, n.d). Contaminated equipment, improper or inadequate cooking, inadequate personal hygiene, and contaminated food are some of the reasons for foodborne illnesses.[4] Studies have shown that food establishments like restaurants and homes have had the most reported incidences of foodborne illnesses.[3] It is evident from previous studies that those handling food have an important part to play when it comes to safe food handling.[3] The food handlers' hygiene, health, understanding of food safety, and most of all their application of this information play a significant role in the probability that food will become contaminated. [5] One of the reasons why food becomes contaminated is due to contamination from people who harbor the harmful microbes in their skin and nails. [5] Studies on the practices, attitudes, and knowledge levels of food handlers have shown that the most significant sources of germs entering food are from food workers' skin, nose, gut, as well as from contaminated food they have prepared and served. [6] Few published studies have been done in Kerala. The present study had two objectives, to evaluate food safety in restaurants in the Alappuzha and Thiruvananthapuram districts of Kerala, and to explore the challenges faced in complying with the food safety guidelines and regulations.

## MATERIALS & METHODS

This study was a cross-sectional mixed-method study, with a duration of six months from January to June 2024. Restaurant food handlers in Alappuzha Municipality and Thiruvananthapuram Corporation were the study population. A two-stage random sampling method was employed, in which the first and second stages were the selection of zones, and the selection of restaurants from the selected zones respectively. Three zones were selected randomly from six zones of the Thiruvananthapuram corporation and four zones of Alappuzha Municipality areas. About 23-25 restaurants were selected from the selected zones. A total of 151 restaurants were visited from which 203 samples were collected during the data collection period (time-bound enumeration).

For the first objective, to assess the attitude, knowledge, and practice of food handlers, the manager/main cooks and assistant cooks in the study area who gave consent and were willing to participate and the restaurants where food was made on a regular basis were included in the study. Bars and takeaway restaurants were excluded. Other food handlers like cleaners and kitchen helpers were excluded from the study, as they were not directly involved in handling food. An interviewer-administered validated questionnaire was used. The questionnaire was developed based on researcher knowledge, similar studies conducted in the past,[5] official food safety websites, [7,8] and consultation with experts. The questionnaire was validated by subject matter experts and had four sections which were socio-demographic details of the food handlers, and sections for assessment of the practices, attitude, and knowledge. A total of seven, ten, and twelve questions were used for the assessment of

knowledge, attitude, and practices, respectively. The questions assessed their knowledge of the importance of separating raw and cooked food, keeping food at the correct temperature, whether it was safe to reheat cooked food for consumption, and the refrigeration of cooked food. The questions on attitude were based on the participant's attitude towards wearing protective equipment (like head cap, gloves, etc.) while handling food, the importance of hand hygiene, the necessity of removing watches and jewelry while handling food, the importance of having a separate pair of footwear while working in the kitchen and the necessity of not handling food when one was ill. A four-point Likert scale with responses 'strongly agree', 'agree', 'not sure', and 'disagree' was used for the knowledge and attitude sections. The correct answer was given a score of four, and the other options were given scores of three, two, and one, respectively. The mean and median scores were calculated based on the total score calculated. The median score was used to categorize the respondents as having sufficient or insufficient knowledge and a positive or negative attitude toward safe food handling. The questions on practices were based on keeping a clean kitchen and work area, clean and hygienic cutting boards, and equipment, conducting pest control, keeping food items as per temperature requirement, and the importance of keeping separate equipment for vegetarian and non-vegetarian food. Scores of one and zero were assigned to the correct and incorrect answers, respectively. The median score was calculated based on which the respondents were then categorized as having correct or incorrect practice levels. Microsoft Excel was used for quantitative data visualization. Using JAMOVI 2.3.28 software, differential and inferential statistical analysis of the quantitative data was done. To find the association between sociodemographic characteristics and knowledge, attitude, and practice levels, the chi-square test was employed. A p-value of less than or equal to 0.05 was considered statistically significant.

For the second objective i.e., to understand the challenges faced in restaurants in adhering to the food safety guidelines and regulations, ten in-depth interviews were conducted. Restaurant owners or managers were interviewed to understand the challenges. Other food handlers like cooks, helpers, cleaners, etc. were excluded. Audio-recording of the interviews was done with their consent. An in-depth interview guide was used in the study. The challenges faced in restaurants in adhering to the food safety guidelines and the participants' suggestions to authorities to ensure food safety in restaurants were the main areas of focus. Each interview lasted for an average of 15 to 25 minutes. Qualitative data analysis was done manually and using Microsoft Excel.

The Institutional Ethics Committee of Kasturba Medical College, Manipal approved the protocol of the study. The IEC number of the study is IEC 668/2023. Permissions for the study were provided by the Alleppey Municipality, Thiruvananthapuram Municipal Corporation, and the Kerala Hotels and Restaurants Association (KHRA). Informed consent was obtained from all the participants for the study. Maintenance of confidentiality and privacy was ensured.

## RESULTS

Table-1 shows the background characteristics of the study participants. More than four-fifths (85.2%) of the food handlers were males and more than half of the participants (53.7%) had completed high school or higher secondary education and 43.3% had completed graduation or higher levels of education. About 3.0% of the respondents had a monthly income below 10,000 rupees, 40.3% had a monthly income between 11,000 to 40,000 rupees, and about 2.0% had a monthly income above 40,000 rupees. More than half of them, about 53.2% of the food handlers were below the poverty line (BPL). About 58.9% of the participants had received food safety training. When probed further as to where they had received training from, some of them denied having received training. Table-1 shows details of the monthly income and educational status of the food handlers. The mean age and experience in food handling of the respondents were 36 (median age) and 9.12 years respectively. The median experience in food handling of the respondents was 8 years. [t]Table-1 near here[/t]

Table-2 shows that 56.2% of the respondents had sufficient knowledge levels, 60.6% had a positive attitude level and 50.2% of them had a correct level of practice. [t]Table-2 near here[/t]

Table-3 shows the different factors and their association with the knowledge, attitude, and practice levels of the food handlers. There were associations between experience with the knowledge ($p<0.001$) and attitude levels ($p=0.019$), age and knowledge level ($p<0.001$), and food safety training

with the knowledge ($p=0.025$) and practice ($p<0.001$) levels. Those food handlers (71%) who had more than eight years of experience had better levels of knowledge than those with less experience and 68.2% of them had a positive attitude towards safe food handling. The respondents who were more than thirty-six years of age (69%) had sufficient levels of knowledge compared to those younger than 36 years of age. Those who had received food safety training (50.4%) had better knowledge and practice levels compared to those who did not. There were associations between knowledge and attitude levels ($p<0.001$) and attitude and practice levels ($p<0.001$). Those respondents who had sufficient levels of knowledge (72%) also had positive attitude levels. Those food handlers (65%) with positive attitudes had correct practice levels. [t]Table-3 near here[/t]

Among the restaurant owners who participated in the in-depth interviews for the second objective, three were females and seven were males. Looking at their educational qualifications, three were postgraduates, four were graduates, one was a diploma holder, one had completed schooling till SSLC (Senior School Leaving Certificate), and another till higher secondary education. The participants were between 30 and 58 years of age. The qualitative data analysis identified eight themes, which included the major challenges, the nature of challenges faced, awareness on food-borne illnesses, the documents kept in the restaurants, methods adopted to ensure food safety, methods adopted to ensure the quality of food, the systems in place to ensure food safety by the authorities, and suggestions to authorities to ensure food safety in restaurants. The challenges faced by the restaurant industry included staffing/labor challenges, waste management challenges, competition from street food shops, challenges in the renewal of licenses, challenges in adhering to food safety guidelines, pest menace, how middle-class hotel employees were at more risk, and parceling and delivering challenges. Most participants said that labor and waste management issues were the most challenging.

***Challenges faced in restaurants***

***Staffing/labor challenges***

This was one of the major challenges they were facing. Retaining the right staff was a very difficult task for most of the hotel owners. There was a general lack of skilled workforce too and some of the workers left work without prior notice. The workers required constant instructions from their employers to adhere to the food safety guidelines and another problem was the lack of 'fear factor' from the employees' side. Many of them were also unable to understand the importance of food safety and there was also difficulty in educating/training the staff members as most of them were non-Keralites because of which there were language and cultural barriers.

***Competition from street food shops ("thattukada")***

The respondents also mentioned the "ugly competition" the hotel industry was facing because of the uncontrolled increase in the number of street food shops locally known as "thattukada". The conventional rules and guidelines (like getting a food safety and local body license) did not apply to them, and the customers had no complaints too. A boom in street food shops meant a loss in business for the restaurant industry.

***Waste management challenges***

Most respondents said that waste management was one of the major challenges they faced. There was a lack of facilities and space constraints for setting up their treatment plants and a lack of drainage facilities. Setting up wastewater treatment plants had specifications to be met.

***Challenges in renewal of license***

Renewal of license was another challenge they were facing. The respondents said that the process was very expensive and involved multiple fees. Obtaining a Pollution Control Board (PCB) certificate was another issue they faced. They also stressed the lack of knowledgeable authorities who could guide them on how to renew licenses.

***Challenges in adhering to food safety guidelines and pest menace***

Most of the respondents also said that there was a lack of stringent rules to ensure food safety and the process of implementing and following rules was not uniform. Another major challenge concerning food safety in restaurants was pest menace. The respondents reported a big difficulty in warding off pests, especially rats. The source of the pests was usually the common drainage on the roads. So, the

measures (like poisoning rats and setting rat traps) taken to keep them away were useless and there was also the issue of ensuring the safety and reliability of raw materials like rice bought from the markets, as rats usually spoil these items kept there.

***Parcelling and delivering challenges***

Another challenge was that of parcelling and delivering food as there were no safe alternatives to plastic and silver foil used for parcelling food.

***Suggestions to authorities to ensure food safety in restaurants***

The respondents gave suggestions for what could be done from the government's side to solve these issues/challenges. One suggestion was to declare restaurants as MSMEs (Micro, Medium, and Small Enterprises) so that they could get affordable electricity and water bills and avail loans at better rates and subsidies. Most of them also said that the government could support them by providing waste disposal/management solutions, controlling adulterated food items, providing a pension or welfare scheme to hotel employees, and improving employment opportunities. One respondent also suggested setting up a "food street" exclusively for the street food shops, so that they do not interfere with restaurant business. Many of them stressed the necessity of providing training programs regularly, by conducting certified hotel management classes, theory classes/ campaigns, certificate courses, and seminars in food safety, and spreading awareness of hygiene and sanitation in the food industry.

| | **Variable** | **n (%)** |
|---|---|---|
| Gender | Male | 173 (85.2) |
| | Female | 30 (14.8) |
| Education | Primary school | 6 (3) |
| | High school- Higher Secondary | 109(53.7) |
| | Graduate- Above graduate | 88(43.3) |
| Monthly income (in rupees) | Up to 10,000 | 6 (3.0) |
| | 11,000 - 40,000 | 82 (40.3) |
| | Above 41,000 | 4 (2.0) |
| | Not Disclosed | 111 (54.7) |
| Socio-economic status | APL | 95 (46.8) |
| | BPL | 108 (53.2) |
| Received food safety training or not | Yes | 119 (58.9) |
| | No | 83 (41.1) |
| Received food safety training from | KHRA | 31 (15.3) |
| | Other | 83 (40.9) |
| | Nil | 89 (43.8) |
| APL stands for Above the Poverty Line and BPL stands for Below the Poverty Line. | | |
| ***Table 1: Background characteristics of the respondents*** | | |

| | **Variable** | **n (%)** |
|---|---|---|
| Knowledge Level | Sufficient | 114 (56.2%) |
| | Insufficient | 89 (43.8) |
| Attitude Level | Positive | 123 (60.6) |
| | Negative | 80 (39.4) |
| Practice Level | Correct | 102 (50.2) |
| | Incorrect | 101 (49.8) |
| ***Table 2: Knowledge, Attitude, and Practice levels of the respondents*** | | |

| **Variable N=203** | **Knowledge Level** | | **$\chi^2$, df, p value** | **Attitude Level** | | **$\chi^2$, df, p value** | **Practice Level** | | **$\chi^2$, df, p value** |
|---|---|---|---|---|---|---|---|---|---|
| **Experience** | **Sufficient** | **Insufficient** | | **Positive** | **Negative** | | **Correct** | **Incorrect** | |
| < 8 years | 38 (39.6%) | 58 (60.4%) | $\chi^2$ =20.3 df= 1 **p<0.001** | 50 (52.0%) | 46 (48.0%) | $\chi^2$ =5.52 df= 1 **p=0.019** | 47 (49%) | 49 (51%) | $\chi^2$=0.121 df=1 p=0.728 |
| >8 years | 76 (71.0%) | 31 (29.0%) | | 73 (68.2%) | 34 (31.8%) | | 55 (51.4%) | 52 (48.6%) | |
| **Age** | | | | | | | | | |
| <36 years | 45 (43.7%) | 58 (56.3%) | $\chi^2$ = 13.2 df=1 **p<0.001** | 61 (59.2%) | 42 (40.7%) | $\chi^2$=0.164 df=1 p=0.686 | 53 (51.5%) | 50 (48.5%) | $\chi^2$=0.122 df=1 p=0.726 |
| >36 years | 69 (69%) | 31 (31%) | | 62 (62%) | 38 (38%) | | 49 (49%) | 51 (51%) | |
| **Socio-economic status** | | | $\chi^2$=0.048 df=1 p=0.826 | | | $\chi^2$=0.0351 df=1 p=0.851 | | | $\chi^2$=0.409 df=1 p=0.522 |
| APL | 53 (57%) | 40 (43%) | | 57 (61.3%) | 36 (38.7%) | | 49 (52.7%) | 44 (47.3%) | |
| BPL | 61 (55.5%) | 49 (44.5%) | | 66 (60%) | 44 (40%) | | 53 (48.2%) | 57 (51.8%) | |
| **Education** | | | | | | | | | |
| Primary school | 3 (43%) | 4 (57%) | $\chi^2$=1.19 df=2 p=0.550 | 3 (42.9%) | 4 (57.1%) | $\chi^2$=1.34 df=2 p=0.511 | 1 (14.3%) | 6 (85.7%) | $\chi^2$=5.54 df=2 p=0.063 |
| High school-higher secondary | 64 (59.3%) | 44 (40.7%) | | 64 (59.3%) | 44 (40.7%) | | 51 (47.2%) | 57 (52.7%) | |
| Graduate-Above graduate | 47 (53.4%) | 41 (46.6%) | | 56 (63.6%) | 32 (36.3%) | | 50 (56.8%) | 38 (43.2%) | |
| **Gender** | | | | | | | | | |
| Male | 100 (57.8%) | 73 (42.2%) | $\chi^2$=1.29 df=1 p=0.256 | 102 (59%) | 71 (41%) | $\chi^2$=1.31 df= 1 p=0.253 | 87 (50.3%) | 86 (49.7%) | $\chi^2$=0.00085 df=1 p=0.977 |
| Female | 14 (46.7%) | 16 (53.3%) | | 21 (70%) | 9 (30%) | | 15 (50%) | 15 (50%) | |
| **Food safety training** | | | $\chi^2$=5.05 df=1 **p=0.025** | | | $\chi^2$=0.104 df=1 p=0.748 | | | $\chi^2$ =12.1 df= 1 **p<0.001** |
| Yes | 60 (50.4%) | 59 (49.6%) | | 71 (59.6%) | 48 (40.3%) | | 72 (60.5%) | 47 (39.5%) | |
| No | 29 (34.5%) | 55 (65.5%) | | 52 (62%) | 32(38%) | | 30 (35.7%) | 54 (64.3%) | |
| **Attitude Level** | | | $\chi^2$ =16.3 df= 1 **p<0.001** | | | | | | $\chi^2$ =27.3 df= 1 **p<0.001** |
| Negative | 31 (38.75) | 49 (61.25%) | | | | | 22 (27.5%) | 58 (72.5%) | |
| Positive | 83 (67.5%) | 40 (32.5%) | | | | | 80 (65.0%) | 43 (35.0%) | |
| **Practice Level** | | | $\chi^2$=0.237 df=1 p=0.627 | | | | | | |
| Correct | 59 (57.8%) | 43 (42.2%) | | | | | | | |
| Incorrect | 55 (54.5%) | 46 (45.5%) | | | | | | | |

***Table 3: Factors associated with knowledge, attitude, and practice***

## DISCUSSION

About three-fifths of the food handlers (58.9%) had received some training in food safety, similar to studies done in Brazil, and Hyderabad.[9,10] This finding contradicts the finding from another study done in Ghana.[11] In this study, the sources of food safety training were the KHRA or other sources. The least number of correct responses were obtained for the practice block, where almost half of the respondents did not have correct practices, similar to a study done in Ghana.[11] More than four-fifths (89.7%) of the respondents agreed that all cooked food should be kept in a container with a closed lid. About four-fifths (83.3%) of the food handlers were aware of the importance of wearing protective equipment while handling food, similar to a previous study in Pakistan.[12] It was reported by the restaurant owners who were interviewed in this study that it was the duty of the owners to ensure that their employees followed the food safety guidelines. They also said that every staff member must adhere to the guidelines of food safety to ensure safe food. The owners stressed that every worker had to stick to certain guidelines to ensure safe food, which included following the rules and norms of food safety, attending food safety programs, wearing protective equipment (gloves, caps, clean apron), maintaining personal hygiene and cleanliness, keeping food covered, blood examination, getting regular health checkups and getting vaccinated. About four-fifths (84.2%) of the respondents were familiar with the term food-borne diseases, which is contradictory to a study done by Kubde et al. (2016), where only less than a quarter of the participants had heard about it.[5] A little less than three-fifths (56.2%) of the food handlers responded correctly to the knowledge section, which indicated a sufficient knowledge level of the food handlers similar to previous studies.[5] More than four-fifths (89.7%) of the food handlers were aware that one must not handle food when ill, similar to a study by Ahmed et al. (2021).[12]

A little over a quarter (26.1%) of the respondents were unsure whether they could wear the same pair of footwear as outside, when working in the kitchen, similar to findings in previous studies.[5,12] More than four-fifths (87.2%) of the food handlers were aware of the importance of washing hands before handling food, similar to previous studies.[5,12] About four-fifths (83.3%) of the respondents knew the importance of wearing clean gloves, clean aprons, and head caps/covers, which is similar to a previous study in Pakistan.[12] About three-fifths (60.6%) of the food handlers correctly responded to the questions in the attitude section, which implies that most of them had a satisfactory attitude towards safe food handling. These findings are almost identical to similar studies in the past.[3,10]

All the respondents gave correct responses to the question whether maintaining the cleanliness of the kitchen area was important and all of them were also aware of using only clean utensils when working in the kitchen, similar to findings from previous studies.[10,13] Almost all the participants knew the importance of using clean equipment for ensuring the safe handling of food and the importance of keeping a clean work area. Previous studies also reported similar findings.[10,13] A little less than two-fifths (35.5%) of the food handlers were not aware of the correct way of using food items i.e. utilizing those that would expire first. The restaurant owners who participated in this study also stated the importance of not keeping balance food i.e., finishing the food for each day and minimizing storage. Almost all the food handlers, about (95.6%) of them knew that food items needed to be stored at the right temperature. This is also supported by the findings from the qualitative component of this study, that workers must maintain the temperature requirements of food, separate the cooked and raw food, and not store fish and meat in the freezer for long durations. All except one (99.5%) participant was aware of the importance of keeping the storage area ventilated and clean. Overall, the participants in this study had a correct level of practice, a finding that is similar to a study in the past[14] and contradictory to some other studies.[5,11]

There exists a significant association between food safety training and practice level and food safety training and knowledge level. This implies that those who received food safety training had better practice levels than those who did not. This emphasizes the importance of regularly conducting food safety training sessions and awareness programs for all food handlers which was emphasized in other studies.[5,10,13] It was also implied from the qualitative component of this study that regular food safety training in the form of certified hotel management classes, theory classes/campaigns, certificate courses, and seminars in food safety could help spread awareness of hygiene and sanitation in the

food industry. It was found that food handlers who had more work experience (more than 8 years) had better knowledge and attitude levels than those who did not have much experience (less than 8 years), which is similar to findings in previous studies.[10,12] The qualitative component of this study reemphasized that the experience of the owners helped them a lot in ensuring the quality and reliability of the raw materials bought from the markets. They could identify the low-quality items from the good-quality ones and ensure reliability. This study also showed an association between age and knowledge levels, i.e. those who had a better level of knowledge belonged to the older age group, which is contradictory to other studies done in the past.[12] The older age group (36 years and above) was reported to have better levels of knowledge than their younger counterparts. A previous study has reported an association between age and attitude level, but no association between age and knowledge level.[13] In a study done in Ghana, older individuals were found to have better hygiene practices than younger individuals.[11] This study showed that there were associations between knowledge and attitude levels and attitude and practices levels. The findings were consistent with a similar study done among the food handlers in Maharashtra, where knowledge and attitude, attitude and practices were associated with each other.[14]

The challenges faced in the restaurants were because of a change in the overall scenario due to the pandemic, which led to the rising expectations of the staff and the customers. Sourcing goods as well as a shift in the culture of the people were the reasons for the major challenges. Most participants stated that labor and waste management challenges were the most challenging. Staffing or labor issues faced were similar to a previous study done in Jamaica.[15] A study done in Puerto Rico showed that the major challenge they faced in complying with the food safety guidelines and regulations was a lack of resources for conducting food safety inspections.[16]

The staffing issues reported were due to many reasons. One reason was due to a lack of skilled manpower, and another reason was that the workers used to leave work without prior notice. Leaving work without prior notice left the restaurant owners in a difficult situation as they found it almost impossible to meet the customers' needs. Educating them would take an ample amount of time, as most of the workers did not have a background in hotel management. So, educating and training the staff itself was a tedious task for the owners.

Another challenge the restaurant industry faced was from the street food shops, locally known as "thattukada". The street food shops or carts used to be parked in front of the restaurants. This led to a loss of business for the restaurants. The respondents said that they feared 'extinction' because of the competition from street food shops. Disposing of the waste was another challenge. Building a wastewater treatment plant for each restaurant was a difficult task as it required the support of local self-governing bodies. It also required space to accommodate the treatment plant. The respondents stated that it was difficult even for the local bodies to dispose of the waste.

Renewing the license was a big challenge as there was a lack of knowledgeable authorities who could guide them. They were charged large sums of money for the renewal process. The middle-class restaurant owners found it barely affordable. They also said that the authorities made unscientific rules which were not possible for the common man to follow and that the rules were difficult to implement too. Pest menace was another issue as finding rat-proof raw material was itself a challenge. The common drainage on the roadside served as the never-ending source of pests, especially rats. The respondents said of the need to find a solution for the pest problem like installing drain covers and mesh over drains which were not in use. Most of the restaurant employers and employees belonged to the middle-class society. They were affected more severely by these challenges. A few of the respondents suggested benefits in the form of pension or certain schemes could be brought about with support from the government to help them survive. One of the limitations of this study was that the food handlers' responses were relied on for assessing the practice level, when observing their actual practice in the kitchen would have given more precise responses. Another limitation was that owing to the busy schedule of the food handlers, some of them could not spend enough time on the interviews.

## CONCLUSION

The participants in this study had an overall good level of knowledge, attitude, and practice. Almost half of the respondents were unsure of the correct practice they needed to follow to ensure proper food handling. This shows the importance of regularly conducting training and awareness sessions for all individuals who handle food. The food handlers who had received food safety training had better knowledge and practice levels compared to those who did not. This study highlights that food safety training should be provided to all food handlers, especially for those belonging to the younger age group (<36 years) and those with fewer years of experience (<8 years).

**Disclosure Statement:** The author(s) reported no potential conflict of interest.

**Funding:** There was no funding for the work featured in this article.

## REFERENCES

[1] World Food Safety Day 2022 theme highlights the role that safe, nutritional food plays in ensuring human health. WHO 2022.
[2] Lee H, Yoon Y. Etiological agents implicated in foodborne illness world wide. Food Science of Animal Resources 2021;41(1):1-7.
[3] Aljasir SF. Food safety knowledge and practices among food handlers and consumers in Gulf countries: An integrative review. Global Public Health 2023;18(1):2287584.
[4] Sani NA, Siow ON. Knowledge, attitudes and practices of food handlers on food safety in food service operations at the Universiti Kebangsaan Malaysia. Elsevier 2014;37:210-7.
[5] Roy N, Nath M, Mallick AK. A study of knowledge, attitude & practice on food safety among the food handlers in the restaurants of Kalyani, District: Nadia. International Journal of Advanced Research 2021.
[6] Zanin LM, Cunha DT da, Rosso VV de, et al. Knowledge, attitudes and practices of food handlers in food safety: An integrative review. Food Research International 2017;100(1):53-62.
[7] Food Safety and Standards Authority of India. FSSAI [Internet]. 2023;
[8] WHO, Food Safety [Internet]. World Health Organization.
[9] Kubde SR, Pattankar J, Kokiwar PR. Knowledge and food hygiene practices among food handlers in food establishments. International Journal of Community Medicine and Public Health 2016;3(1):251–6.
[10] Vitória AG da, Oliveira J de SC, Pereira LC de A, et al. Food safety knowledge, attitudes and practices of food handlers: A cross-sectional study in school kitchens in Espírito Santo, Brazil. BMC Public Health 2021;21(349).
[11] Akabanda F, Hlortsi EH, Owusu-Kwarteng J. Food safety knowledge, attitudes and practices of institutional food-handlers in Ghana. BMC 2017;17:1-9.
[12] Ahmed MH, Akbar A, Sadiq MB. Cross sectional study on food safety knowledge, attitudes, and practices of food handlers in Lahore district, Pakistan 2021;7(11).
[13] Al-Shabib NA, Mosilhey SH, Husain FM. Cross-sectional study on food safety knowledge, attitude and practices of male food handlers employed in restaurants of King Saud University, Saudi Arabia. Elsevier 2016;59:212–7.
[14] Sakore DN, Parande MA, Bhattacharya S. Knowledge, Attitude, and Practice Regarding Food Hygiene among Food Handlers of Eating Establishments of a Medical College, Pune, Maharashtra: A Cross-Sectional Study. Medical Journal of Dr D Y Patil Vidyapeeth 2022;16(2).
[15] McNeil RH. Investigating Regulatory Compliance: Key Issues in the Management of Food Safety Risk in the Fast Food Industry in Jamaica [Internet]. Edinburgh Napier University 2019.
[16] Calcador C. Restaurant Management Strategies to Comply with Food Safety Regulations [Internet]. Walden University ProQuest Dissertations Publishing 2017.