

# Level of food safety knowledge among hospitality professionals: an empirical investigation from India

Patita Paban Mohanty<sup>1\*</sup>, Sunil Tiwari<sup>2</sup>, Hiran Roy<sup>3</sup> & Rupesh Bhavsar<sup>4</sup>

<sup>1</sup>Faculty of Hospitality and Tourism Management, Siksha' O' Anusandhan University, Odisha, India

<sup>2</sup>Department of Tourism Studies, School of Business Studies, Central University of Kerala, India

<sup>3</sup>International School of Hospitality and Tourism Management, Fairleigh Dickinson University, Vancouver, Canada

<sup>4</sup>Department of Food Production, Institute of Hotel Management, MGM University, Maharashtra, India

\*Correspondence: richhmohanty@gmail.com

**ABSTRACT:** Hospitality professionals with insufficient food safety knowledge (FSK) poses a major risk to food safety in their respective organisations. This study aims to investigate the level of food safety knowledge of hospitality professionals, as well as the attributes influencing food safety knowledge and their corresponding relationships. A total of 862 hospitality professionals working in hotels, restaurants, cafés, universities and colleges located in two different cities in India participated in a cross-sectional study between July 2022 and August 2022. A self-administered questionnaire consisting of 20 items related to food safety knowledge was used to collect the data. Both descriptive (frequency distribution, central tendency, norms) and inferential statistics (Pearson correlation coefficient) were conducted in this study to investigate the level of food safety knowledge and measure the association between food safety and educational qualification, age, experience and adoption of training related to food safety. The findings of this study contribute to the current literature about mitigating food-borne illnesses through creating a level of knowledge with proper education, experience and training among hospitality professionals.

**KEYWORDS:** chef perspective, coefficient, correlation, food, innovation, safety measures

## Introduction

Food safety has emerged as a significant threat to public health on a global scale over the past decades (Bloomfield et al., 2016). Food safety (FS) is the assurance that food will not cause any harm to the consumer when it is prepared or consumed according to its intended use (World Health Organization [WHO], 2020). Food safety is crucial to reducing the risk of food-borne illness, and contributes to human health, wellness and quality of life (Kambhampati, 2013). Consumption of unsafe food causes food-borne diseases leading to death and morbidity (WHO, 2015). Approximately 600 million individuals endanger their lives annually through food-borne diseases (WHO, 2020).

Food-borne diseases are considered a growing public health issue that results in morbidity worldwide (Hassan & Dimassi, 2014; Luo et al., 2019). Food-borne illness has escalated globally over the years, threatening the health and socio-economic stability of many developing and industrialised countries (Admasu & Kelbessa, 2018). There is mounting evidence that food safety in underdeveloped nations has been neglected (Grace, 2015).

Food safety is also a critical concern in developing countries such as India where food-borne illnesses are predicted to rise from 100 million in 2011 to 150–177 million in 2030 (Hasan et al., 2021). Food-borne diseases are more prevalent in developing countries compared to developed countries. Abdullah Sani and Siow (2014) indicate that food-borne illnesses caused by harmful

microorganisms affect approximately one-third of the world's population in developing countries (Rahman et al., 2018).

Globally, catering and food service facilities are associated with a high incidence of food-borne diseases (Al Banna et al., 2022). It is undeniable that erroneous practices in food service establishments have a significant influence on the spread of food-borne illness. Food safety risk factors are vulnerable to foods normally prepared in hospitality establishments (Almansouri et al., 2022). As a result, food handlers working in the hospitality sector are more prone to becoming ill from pathogenic microbes (Egan et al., 2007; Rebouças et al., 2017). According to the Centres for Disease Control and Prevention (CDC), food handlers are responsible for up to 20% of food-borne illnesses that occur across the food supply chain (Assefa et al., 2015). Furthermore, food-borne illness among food handlers is linked to food produced both at and away from home (Azanaw et al., 2021; Redmond et al., 2022).

To reduce the food safety risks, different stakeholders at national and global levels are incorporating artificial intelligence (AI) and machine learning across multiple domains across the food value chain (Liu et al., 2023). AI can benefit food safety and hospitality professionals working in organised and unorganised sectors. Larger benefits can be drawn when applied to the farm-to-fork concept. Additionally, the application of AI will be perceived as "watchdog" where rigorous food preparation is performed to identify sources of hazards and critical control

points (Qian et al., 2023). Therefore, many developing and developed nations are adopting the knowledge of AI to rapidly mitigate food-borne diseases.

Food-borne disease outbreaks in hospitality establishments have been pinned to the improper cooking and storage of food, as well as cross-contamination of food due to unhygienic handling procedures (Bender et al., 2022). Substandard personal hygiene and obtaining food from untrustworthy sources have also been linked to contributing to food-borne disease outbreaks in food service establishments (Azanaw et al., 2019). In sum, a lack of food safety knowledge, unhygienic habits of food handlers, insufficient infrastructure and inaccurate food handling practices related to food production and storage are the root causes of food-borne disease outbreaks in developing countries (Osaili et al., 2011; Sanlier & Konaklioglu, 2012; Sayuti et al., 2020; Mshelia et al., 2022).

In the context of India, major numbers of hospitality professionals comprise trained, experienced and even inexperienced individuals working in both organised and unorganised sectors. It incorporates a group of professionals from various food service businesses, including cooks, chefs, stewards and managers, as well as academics from the fields of hospitality and culinary arts who train and instruct students. Today's hospitality professionals are skilled food handlers who regularly prepare and serve a range of food offerings (Aluh et al., 2021).

A previous study done by Young et al. (2020) states that food handlers' poor health and hygiene and unsafe raw materials practices are solely responsible for 77% of the food-borne illness outbreaks in food service facilities. Food handlers working in hospitality establishments are unable to maintain the proper safety and sanitary measures, effective personal hygiene knowledge and the upholding of the time-temperature gap (Odeyemi et al., 2019; Mun, 2020).

Food handlers possessing insufficient food safety knowledge pose a serious risk to food safety where food is prepared and served, such as hotels, restaurants, cafes, institutions and hospitals (Nyalo, 2020). To handle food hygienically during preparation, and to guarantee that food is safe by the time it reaches the customers, all food handlers must possess the necessary food safety knowledge and skills (Dewi et al., 2021; Limon, 2021). Additionally, microbiological contamination of food is hazardous, hence all food handlers must maintain stringent guidelines of food hygiene and sanitation practices (Maragoni-Santos et al., 2022).

To prevent the hazards of food-borne diseases, an exhaustive knowledge of food safety is necessary (Green & Knechtges, 2015; Odeyemi et al., 2019). Food-borne illness remains an imminent threat in many developing nations, despite intensive training at all levels. Hence, knowledge of food safety is highly desired and recommended among hospitality professionals. Evidence from different countries, like Slovenia (Jevšnik et al., 2023), Turkey (Abdelwahed et al., 2022), Kenya (Wambui et al., 2017), Portugal (Gomes-Neves et al., 2011), South Africa (Nyamakwere et al., 2017) and Saudi Arabia (Al-Shabib et al., 2016; Halwani et al., 2023) reveal that food safety knowledge determines better food safety practices among hospitality professionals. Similarly, Nyamakwere et al. (2016) stress that the educational level and training of food handlers are significantly associated with their level of knowledge and food safety practices.

In the past, numerous studies have also investigated the level of knowledge and the attitudes and practices among hotel

staff, students and other food handlers in various developed and developing countries, such as Japan (Takeda et al., 2011), China (Luo et al., 2019), Canada (Courtney et al., 2016), Lebanon (Hassan & Dimassi, 2014), Malaysia (Mshelia et al., 2022) and India (Rakshna et al., 2021). However, the level of food safety knowledge among hospitality professionals in developing countries, especially in India, is extremely limited. Therefore, there is a major gap in the research on the level of food safety knowledge among hospitality professionals in India, and the current research fills this important knowledge gap in the literature by examining the following two research objectives: (1) critically examine the level of food safety knowledge among hospitality professionals in India, and (2) measure the association between food safety and educational qualification, age, experience and adoption of training related to food safety among hospitality professionals in India.

## Literature review and hypotheses development

### Food safety knowledge

Food produced both in and outside of the premises potentially harbours food-borne diseases (Azanaw et al., 2021; Redmond et al., 2022). Nevertheless, outbreaks of food-borne illnesses in hotels and restaurants are more widespread compared to other establishments (Temeche et al., 2017). Food-borne diseases pose a serious threat to hospitality employees' health and well-being. Surprisingly, hospitality professionals account for approximately 75% of food-borne illness in developing nations (Bisht et al., 2021).

According to Smigic, Djekic et al. (2016), there is a significant knowledge gap in European countries regarding temperature control, contaminated food and potentially high-risk foods. The causes of this gap include insufficient food safety training leading to poor knowledge, and workplace irresponsibility among food handlers (Jevšnik et al., 2008; Pichler et al., 2014; Jevšnik & Raspor, 2020).

Knowledge affects the attitude and behaviour of food handling personnel (Lee, 2006). A higher level of knowledge positively influences the attitude towards food safety practices (Lin, 2001; Li, 2002; Lee, 2006). Food-borne diseases are primarily caused by a dearth of knowledge about food safety, poor sanitation, insufficient facilities, mishandling of food, unsuitable water, deteriorating conditions for preparing and storing food, unsatisfactory food safety laws and risky household preparation (Osaili et al., 2011; Sanlier & Konaklioglu, 2012; Sayuti et al., 2020; Mshelia et al., 2022).

Food contamination is one of the critical elements driving food-borne illness (Kota et al., 2022) due to a lack of understanding among food handlers (Stratev et al., 2017). As a result, comprehending food safety knowledge is critical for eradicating food-borne illnesses (Nivethitha et al., 2019; Sayuti et al., 2020). Therefore, to combat and eliminate food-borne illnesses, it is vital to examine the level of knowledge of food service employees in the hospitality sector (Al-Shabib et al., 2016). Thus, this study hypothesised that

- H1: Hospitality professionals in India are positively associated with a high level of knowledge related to food safety.

### Education, training and experience

Though food safety knowledge affects food handlers' attitudes and behaviours, it does not ensure the maintenance of food safety practices. As a result, fundamental education is required

to acquire and comprehend food safety knowledge. A previous study reported that food handlers with an education above the high school level exhibit poor food handling practices (Ali et al., 2019). The problem persists in the hospitality industry where the majority of the food handlers do not have a proper education background but work consistently for a long period, obtaining decades of experience (Ali et al., 2019). Thus, education serves as the foundation for resolving current food safety challenges through attitudes and understanding (Cheng et al., 2017).

Food safety training is a widely used strategy to improve food safety knowledge (Addo-Tham et al., 2020) and is recognised as one of the most critical interventions in preventing food-borne disease outbreaks (WHO, 2020). Thus, training plays a vital role in developing good hygiene practices and enhances the food handlers' knowledge (Yu et al., 2020). Soon et al. (2012) discovered that training at regular intervals is necessary to ensure the intended level of food safety knowledge. In addition to this, food safety education and individual awareness among food handlers in hospitality organisations is critical. Well-organised training by an expert is more effective in the understanding, practices and hygienic attentiveness of FSK (Akabanda et al., 2017; Dudeja et al., 2017; Odeyemi et al., 2019). In the same vein, it has been shown that pragmatic and focused training can contribute to boosting both the safety and quality of food (Akabanda et al., 2017; Dudeja et al., 2017; Sayuti et al., 2020).

Therefore, it is critical to improve food safety education, experience and training for safe food handling among hospitality personnel (Luo et al., 2019; Odeyemi et al., 2019; Ellinda-Patra et al., 2020). Therefore, this study further hypothesised that

- H2: Hospitality professionals in India are positively associated with a high level of education, experience and training related to food safety.

## Materials and methods

### Research design

Multistage and cross-sectional research designs were used to conduct the present study on the food safety knowledge of different hospitality professionals working in Odisha and Maharashtra, states in the eastern and western parts of the country.

### Questionnaire development

Based on previous studies on food safety (Baş et al., 2006; Giritlioglu et al., 2011; Osaili et al., 2011; Shafie & Azman, 2015; Smigic, Antic et al., 2016), the constructs for this investigation were developed. The reliability coefficient of the constructed tool was measured using Cronbach's alpha test (0.832) and fell under the acceptance category (Santos, 1999). The questionnaire was then checked for content validity and piloted by ten professional hoteliers and six food safety experts to ascertain the transparency of the questions and statements, monitor additional response options, and calculate the time required to complete the survey. Based on the results of the pre-test, the questionnaire was amended, and some changes were made to the food safety knowledge section. The first section of the questionnaire consisted of demographic details of the hotel professionals, such as gender, age, professional experience, education level, knowledge of food safety, self-confidence in handling food-related issues, habit of updating knowledge and

work location. The second part of the questionnaire comprised 20 specific test items related to the studied variables based on the proposed theoretical groundings. Items are in the order of food hygiene (five items), knowledge of personal hygiene (five items), cross-contamination (five items) and health problems (five items). Both sections were designed on a nominal and five-point Likert scale.

### Questionnaire survey

A self-administered questionnaire consisting of 20 items related to food safety knowledge was used to collect the data. A sample of 900 hospitality professionals was collected from July 2022 to August 2022 using both online and offline modes in a five-point Likert scale and a two-point nominal scale approach. While uploading the data manually, it was found that 38 samples were incomplete; therefore, 862 samples were considered for the final analysis of the data.

### Data analysis

The quantitative data collected for the proposed items were analysed using SPSS (25.0) and R-application (4.2.2) through frequency distribution, percentiles, norms, mean, mode, median, standard deviation, Pearson correlation coefficient and regression analysis. Furthermore, the collected data were analysed with the help of both descriptive (frequency distribution, central tendency, norms) to investigate the food safety knowledge of hospitality professionals, and inferential statistics (Pearson correlation coefficient) to measure the association between food safety and educational qualification, age, experience and adoption of training related to food safety. The standard procedure of the research study was examined and authorised by the institutional review board of Siksha "O" Anusandhan University, Odisha, India. After a brief description of the goal and scope of the research, verbal permission was obtained from the hospitality professionals. The importance of answer anonymity and confidentiality, voluntary involvement and the freedom to refuse participation in the study were highlighted to the hospitality professionals, and we explained the study's aims to the participants.

## Results

### Knowledge level of hospitality professionals in food safety and its various attributes

The food safety knowledge (FSK) level of hospitality professionals towards overall food safety and its various attributes such as handling and managing of food items, personal hygiene, sanitation and prevention of cross-contamination, safe storage, cooking, thawing and reheating and health problems that affect food safety, symptoms of food-borne diseases and food-borne pathogens, etc. was studied to test the proposed objective, "To measure the food safety knowledge level of hospitality professionals", and hypothesis, "H<sub>1</sub> Hospitality professionals in India have a high level of knowledge about food safety". Frequency distribution and gap analysis were performed and results are shown in Table 1.

Table 1 shows the knowledge and awareness level of hospitality professionals regarding food safety and its various attributes; in terms of overall food safety, only 102 (11.83%) hospitality professionals had a high level of awareness and knowledge, followed by moderate 225 (26.10%), low 379

TABLE 1: Hospitality professionals' knowledge level of food safety and its various attributes

Food safety	Level	F-value	%
Overall food safety	High	102	11.83
	Moderate	225	26.10
	Low	379	43.96
	Very low	156	18.09
Handling and managing of food items	High	97	11.25
	Moderate	321	37.23
	Low	209	24.24
	Very low	235	27.26
Personal hygiene	High	167	19.37
	Moderate	345	40.02
	Low	264	30.69
	Very low	86	09.97
Sanitation and prevention of cross-contamination	High	143	16.58
	Moderate	421	48.83
	Low	265	30.74
	Very low	33	03.82
Safe storage, cooking, thawing and reheating	High	227	26.33
	Moderate	411	47.67
	Low	201	23.31
	Very low	23	02.66
Health problems that affect food safety	High	102	11.83
	Moderate	289	33.52
	Low	402	46.63
	Very low	69	8.00
Symptoms of food-borne diseases	High	92	10.67
	Moderate	298	34.57
	Low	454	52.66
	Very low	18	02.08
Food-borne pathogens	High	88	10.20
	Moderate	271	31.43
	Low	409	47.44
	Very low	94	10.90

(43.96%) and very low 156 (18.09%). 97 (11.25%) hospitality professionals were highly aware of and knowledgeable about handling and managing food items, processes and services, followed by 321 (37.23%), 209 (24.24%), and 235 (27.26%) respectively.

Regarding personal hygiene, 167 (19.37%) professionals were highly knowledgeable, followed by 45 (40.02%), 264 (30.69%) and 86 (09.97%). Regarding sanitation and prevention of cross-contamination, 143(16.58%) professionals were fully knowledgeable, followed by moderate 421 (48.83%), low 265 (30.74%), and very low 33 (03.82%). In terms of safe storage, cooking, thawing and reheating, 227 (26.33%) hospitality professionals were highly knowledgeable, followed by moderate 411 (47.67%), low 201 (23.31%) and very low 23 (02.66%). 102 (11.83%) professionals had appropriate knowledge about the health problems that affect food safety, followed by a moderate 289 (33.52%), a low 402 (46.63%) and a very low level of awareness 69 (8.00%).

Regarding symptoms of food-borne diseases, only 92 (10.67%) hospitality professionals had a high level of knowledge, followed by 298 (34.57%) with moderate, 454 (52.66%) with low and 18 (02.08 %) with very low-level knowledge. In terms of knowledge

about food-borne pathogens, only 88 (10.20%) hospitality professionals were aware and knowledgeable, followed by 271 (31.43 %) with moderate, 409 (47.44 %) with low, and 94 (10.90 %) with very low levels of awareness.

From the above results, it is concluded the majority of hospitality professionals have a moderate or low level of knowledge about food safety and its different attributes such as overall food safety, handling and managing of food items, personal hygiene, sanitation and prevention of cross-contamination, safe storage, cooking, thawing and reheating, health problems that affect food safety, symptoms of food-borne diseases and food-borne pathogens, therefore the proposed alternative hypothesis "H1 Hospitality professionals have a high level of knowledge about food safety" has been rejected and its corresponding objective "To measure the food safety knowledge level of hospitality professionals" has been achieved. Figures 1 to 4 illustrate the conceptual framework, Knowledge level of hospitality professionals towards food safety and its various attributes, Knowledge level of hospitality professionals towards food safety and its various attributes and Relationship between food safety and various attributes of hospitality professionals, respectively.

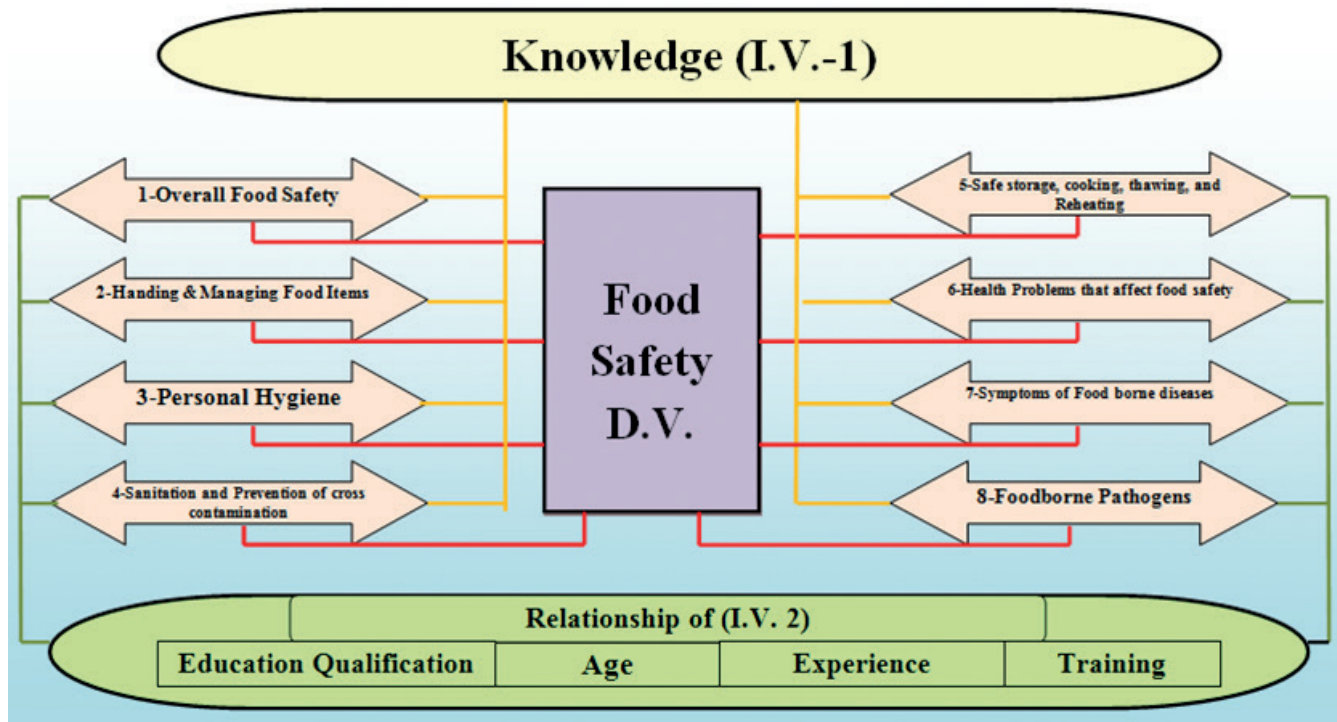


FIGURE 1: Conceptual framework of the study

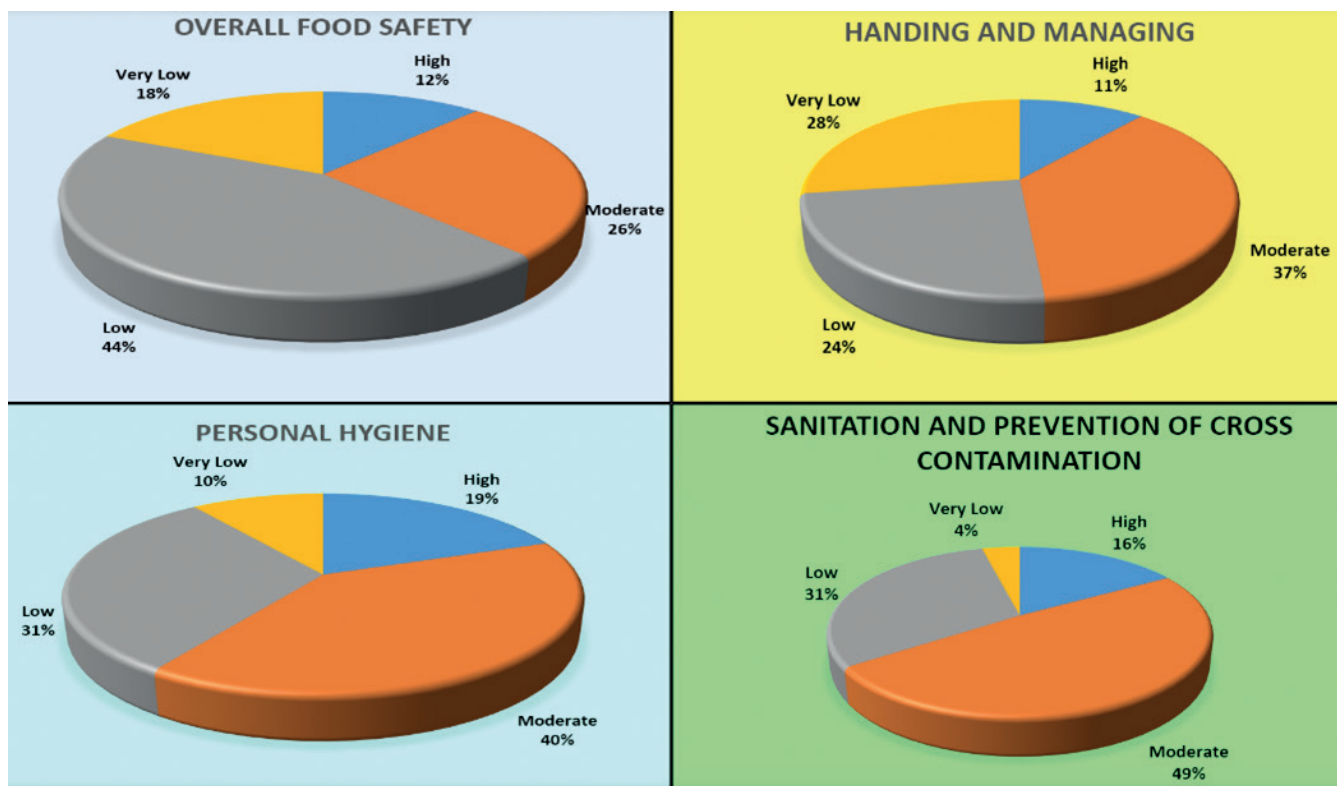


FIGURE 2: Knowledge level of Hospitality Professionals towards food safety and its various attributes

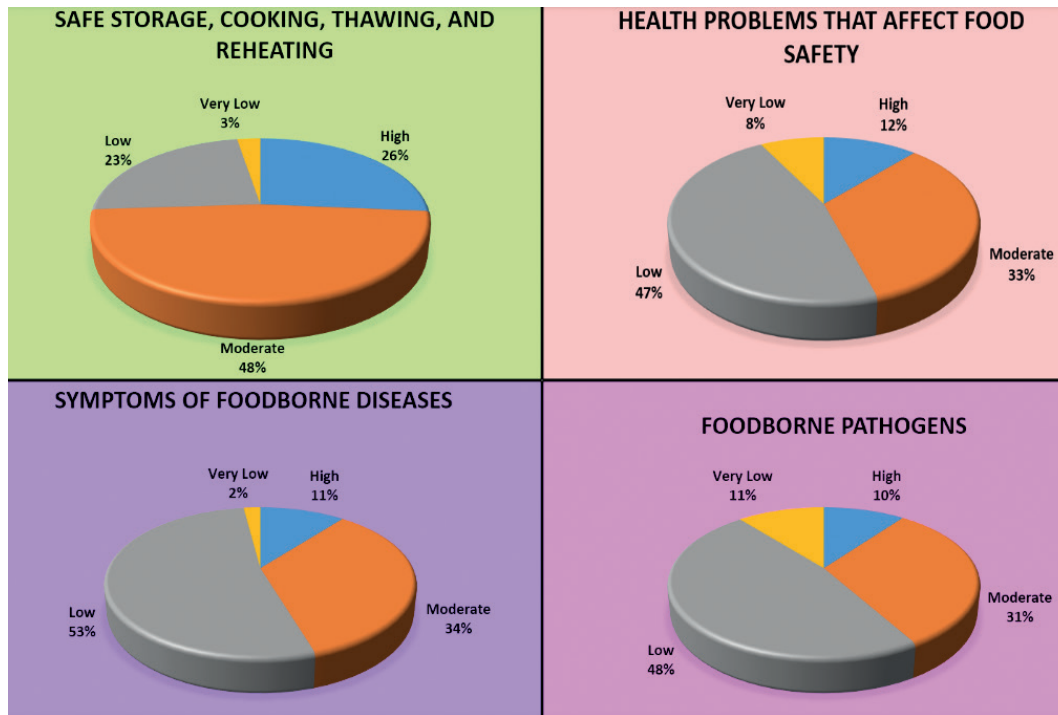


FIGURE 3: Knowledge level of Hospitality Professionals towards food safety and its various attributes

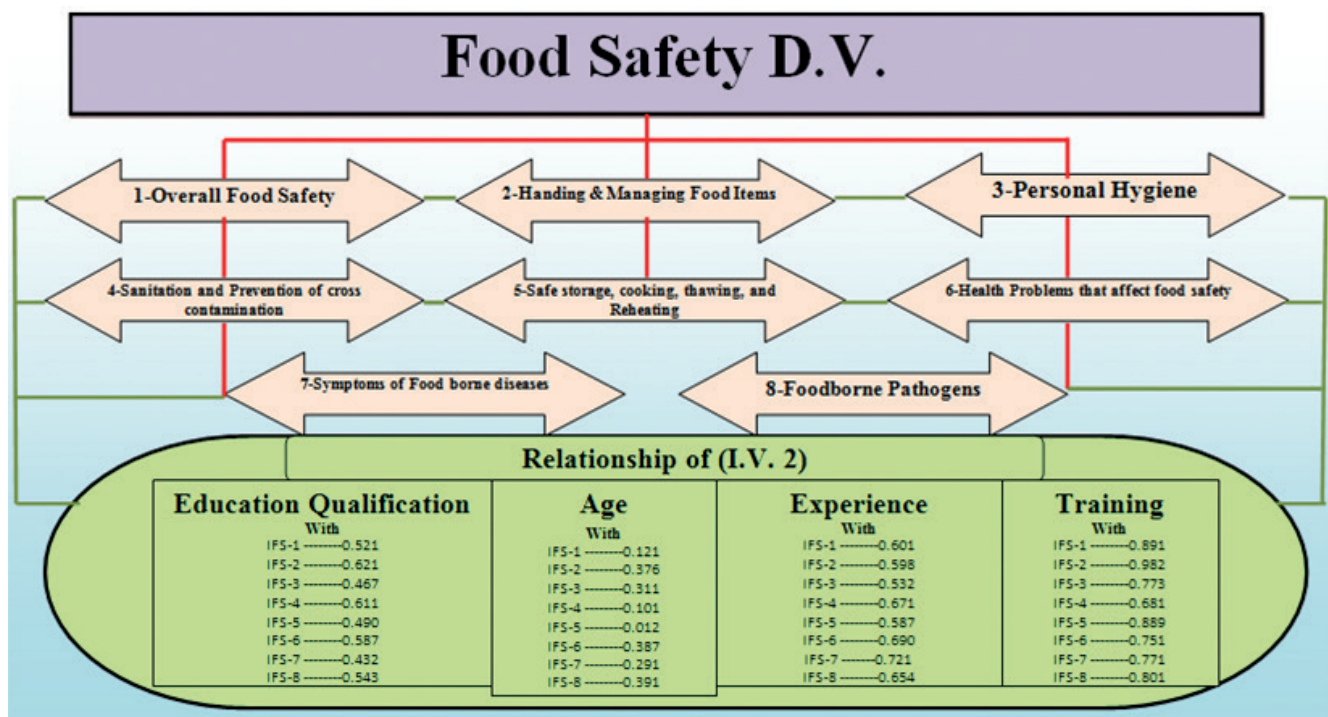


FIGURE 4 Relationship between food safety and various attributes of hospitality professionals

### Relationship between food safety and different attributes of hospitality professionals

To measure the association between food safety and educational qualification, age, experience and adoption of training related to food safety by the hospitality professionals, and to achieve and test the proposed objective "To measure the association between food safety and educational qualification, age, experience and adoption of training related to food safety" and hypothesis "H<sub>2</sub> There is a high positive association between food safety and educational qualification, age, experience and adoption of training related to food safety", the multiple correlation coefficient has been tested and results are shown in Tables 2, 3 and 4.

Pearson correlation coefficient  $r$  was calculated between overall food safety and educational qualification of hospitality professionals ( $N = 862$ ) working in different hotels and restaurants in the western and eastern parts of India. Table 2 shows that values of correlation coefficient  $r$  are 0.521, 0.621, 0.467, 0.611, 0.490, 0.587, 0.432, and 0.543 between overall food safety, handling and managing, personal hygiene, sanitation

and prevention of cross-contamination, safe storage, cooking, thawing, and reheating, health problems that affect food safety, symptoms of food-borne diseases, food-borne pathogens and education qualifications of hospitality professionals respectively.

The values of the coefficient of determination  $R^2$  (square of the correlation coefficient) are 0.271, 0.385, 0.218, 0.373, 0.240, 0.344, 0.186, and 0.294, respectively, which shows the amount of variability in food safety knowledge due to education qualifications. After converting these values into percentages, it was concluded that educational qualifications of hospitality professionals share 27.1%, 38.5%, 21.8%, 37.3%, 24%, 34.4%, 18.6%, and 29.4% of the variances in overall food safety, handling and managing, personal hygiene, sanitation, and prevention of cross-contamination, safe storage, cooking, thawing, and reheating, health problems that affect food safety, symptoms of food-borne diseases and food-borne pathogens. Furthermore, the correlation between the educational qualifications of hospitality professionals and different attributes of food safety is significant at the 0.01 level of significance ( $p = 0.000 < 0.01$ ).

TABLE 2: Relationship between food safety and education qualification of hospitality professionals

Variable	Correlation	$R^2$	Share of I.V. %	$p$ -value
Overall food safety & education qualification	0.521	0.271	27.1	<0.001**
Handling and managing & education qualification	0.621	0.385	38.5	<0.001**
Personal hygiene & education qualification	0.467	0.218	21.8	<0.001**
Sanitation and prevention of cross-contamination & education qualification	0.611	0.373	37.3	<0.001**
Safe storage, cooking, thawing and reheating & education qualification	0.490	0.240	24.0	<0.001**
Health problems that affect food safety & education qualification	0.587	0.344	34.4	<0.001**
Symptoms of food-borne diseases & education qualification	0.432	0.186	18.6	<0.001**
Food-borne pathogens & education qualification	0.543	0.294	29.4	<0.001**

\*\*Significant at 0.01 level

TABLE 3: Relationship between food safety and age of hospitality professionals

Variable	Correlation	$R^2$	Share of I.V. %	$p$ -value
Overall food safety & age	0.121	0.014	01	0.141
Handling and managing & age	0.376	0.141	14	0.252
Personal hygiene & age	0.311	0.096	09	0.784
Sanitation and prevention of cross-contamination & age	0.101	0.010	01	0.893
Safe storage, cooking, thawing and reheating & age	0.012	0.000	00	0.816
Health problems that affect food safety & age	0.387	0.149	14	0.651
Symptoms of food-borne diseases & age	0.291	0.084	08	0.710
Food-borne pathogens & age	0.391	0.152	15	0.426

TABLE 4: Relationship between food safety and experiences of hospitality professionals

Variable	Correlation	$R^2$	Share of I.V. %	$p$ -value
Overall food safety & experience	0.601	0.361	36.1	<0.001**
Handling and managing qualification	0.598	0.357	35.5	<0.001**
Personal hygiene & experience	0.532	0.283	28.8	<0.001**
Sanitation and prevention of cross contamination & experience	0.671	0.450	45	<0.001**
Safe storage, cooking, thawing and reheating & experience	0.587	0.344	34	<0.001**
Health problems that affect food safety & experience	0.690	0.467	46	<0.001**
Symptoms of food-borne diseases & experience	0.721	0.519	51	<0.001**
Food-borne pathogens & experience	0.654	0.427	42	<0.001**

\*\*Significant at 0.01 level

Pearson correlation coefficient *r* was calculated between overall food safety and age of the hospitality professionals (*N* = 862) working in different hotels and restaurants in the western and eastern parts of India. Table 5 shows that values of correlation coefficient *r* are 0.121, 0.376, 0.311, 0.101, 0.012, 0.387, 0.291, and 0.391 between overall food safety, handling and managing, personal hygiene, sanitation, and prevention of cross-contamination, safe storage, cooking, thawing and reheating, health problems that affect food safety, symptoms of food-borne diseases, food-borne pathogens and age of the hospitality professionals respectively. The values of the coefficient of determination *R*<sup>2</sup> are 0.014, 0.141, 0.096, 0.010, 0.000, 0.149, 0.084, and 0.152, respectively, which shows the amount of variability in food safety knowledge due to age.

After converting these values into percentages, it was concluded that the age group of hospitality professionals shared 01%, 14%, 09%, 01%, 00%, 14%, 08% and 15% of the variances in overall food safety, handling and managing, personal hygiene, sanitation, and prevention of cross-contamination, safe storage, cooking, thawing and reheating, health problems that affect food safety, symptoms of food-borne diseases and food-borne pathogens. Furthermore, the correlation between the age group of hospitality professionals and different attributes of food safety is insignificant at a 0.05 level of significance.

Pearson correlation coefficient *r* was calculated between overall food safety and experience of the hospitality professionals (*N* = 862) working in different hotels and restaurants in western and eastern India. Table 4 shows that the values of correlation coefficient *r* are 0.601, 0.598, 0.532, 0.671, 0.587, 0.690, 0.721, and 0.654 between overall food safety, handling and managing, personal hygiene, sanitation and prevention of cross-contamination, safe storage, cooking, thawing and reheating, health problems that affect food safety, symptoms of food-borne diseases, food-borne pathogens and experience of the hospitality professionals respectively.

The values of the coefficient of determination *R*<sup>2</sup> are 0.361, 0.357, 0.283, 0.450, 0.344, 0.467, 0.519, and 0.427, respectively, which shows the amount of variability in food safety knowledge due to the professional experience of hospitality professionals. After converting these values into percentages, it is concluded that the professional experience of hospitality professionals share 36.1%, 35.5%, 28.8%, 45%, 34%, 46%, 51%, and 42% of the variances in overall food safety, handling, managing, personal hygiene, sanitation and prevention of cross-contamination, safe storage, cooking, thawing and reheating, health problems

that affect food safety, symptoms of food-borne diseases and food-borne pathogens. Furthermore, the correlation between the professional experience of hospitality professionals and different attributes of food safety is significant at 0.01 (*p* < 0.01).

Pearson correlation coefficient *r* was calculated between overall food safety and adoption of training by hospitality professionals (*N* = 862) working in different hotels and restaurants in western and eastern India. Table 5 shows that values of correlation coefficient *r* are 0.891, 0.982, 0.773, 0.681, 0.889, 0.751, 0.771 and 0.801 between overall food safety, handling and managing, personal hygiene, sanitation and prevention of cross-contamination, safe storage, cooking, thawing and reheating, health problems that affect food safety, symptoms of food-borne diseases, food-borne pathogens and adoption of training by the hospitality professionals respectively.

The values of the coefficient of determination *R*<sup>2</sup> are 0.793, 0.964, 0.597, 0.463, 0.790, 0.564, 0.594 and 0.641, respectively, which shows the amount of variability in food safety knowledge due to the training related to food safety adopted by hospitality professionals. After converting these values into percentages, it was concluded that training adopted by hospitality professionals shares 79.3%, 96.4%, 59.7%, 46.3%, 79%, 56.4%, 59.4%, and 64.1% of the variance in overall food safety, handling and managing, personal hygiene, sanitation and prevention of cross-contamination, safe storage, cooking, thawing and reheating, health problems that affect food safety, symptoms of food-borne diseases and food-borne pathogens. Furthermore, the correlation between the adoption of training by hospitality professionals and different attributes of food safety was significant at the 0.01 level of significance (*p* < 0.01).

Therefore, it is concluded that there is a high positive correlation between food safety and the adoption of training by hospitality professionals, followed by a moderate association between food safety, professional experience and the educational qualifications of hospitality professionals. However, there was no significant association between food safety and age of hospitality professionals. Thus, the proposed objective to measure the association between food safety and educational qualification, age, experience and adoption of training related to food safety has been achieved and its corresponding alternative hypothesis "H<sub>2</sub> There is a high positive association between food safety and educational qualification, age, experience and adoption of training related to food safety" has been rejected as there is a high positive association between food safety and adoption of training by hospitality professionals.

TABLE 5: Relationship between food safety and adoption of training by hospitality professionals

Variable	Correlation	<i>R</i> <sup>2</sup>	Share of I.V. %	<i>p</i> -value
Overall food safety & training	0.891	0.793	79.3	<0.001**
Handling and managing & training	0.982	0.964	96.4	<0.001**
Personal hygiene & training	0.773	0.597	59.7	<0.001**
Sanitation and prevention of cross-contamination & training	0.681	0.463	46.3	<0.001**
Safe storage, cooking, thawing and reheating & training	0.889	0.790	79	<0.001**
Health problems that affect food safety & training	0.751	0.564	56.4	<0.001**
Symptoms of food-borne diseases & training	0.771	0.594	59.4	<0.001**
Food-borne pathogens & training	0.801	0.641	64.1	<0.001**

\*\*Significant at 0.01 level



## Discussion and conclusion

Overall, a small proportion (11.83%) of the hospitality professionals had a high level of knowledge, followed by moderate (26.10%), low (43.96%) and very low (18.09%). Thus the current study reveals the level of FSK in the range of "moderate to low". Lack of training and education are responsible for diminishing the level of food safety knowledge among hospitality professionals. Hence, the higher the education level of hospitality professionals, the easier it becomes for them to acquire FSK and skills through training (Kwol et al., 2020 ; Ahmed et al., 2021). Consequently, education is undoubtedly important for obtaining food safety knowledge. This had a direct impact on the level of food safety knowledge. Hence, it is recommended that continuous training enhance the level of food safety knowledge among hospitality professionals (Aquino et al., 2021).

Regretfully, the very "poor" level shows that in personal hygiene (19.37%) professionals are highly knowledgeable, followed by moderate (40.02%), low (30.69%) and extremely low (09.97%). A slight improvement in sanitation and prevention of cross-contamination (16.58%) was for the fully knowledgeable, followed by moderate (48.83%), low (30.74%) and extremely low (03.82%). Only a few (10.67%) hospitality professionals had a high level of knowledge, followed by moderate (34.57%), low (52.66%) and very low (02.08%) knowledge in cases of food-borne disease and its symptoms. Thus, this study strongly suggests that most hospitality professionals lack knowledge about cross-contamination of food and food-borne pathogens, which is induced by a gap in time and temperature (Ndraha et al., 2018; Yenealem et al., 2020). Time-temperature abuse is the underlying cause of food-borne disease outbreaks in food service establishments (Gruenfeldova et al., 2019; Taha et al., 2020).

In the long run, the study of the "good" in terms of safe storage, cooking, thawing and reheating showed that highly knowledgeable hospitality professionals (26.33%), followed by moderate (47.67%), low (23.31%) and very low (02.66%) support that food safety training is mandatory. Deviation leads to inadequate FSK and could result in unsafe food handling practices (Ko, 2011; Her et al., 2019; Amegah et al., 2020). Hence, food safety training is extremely important for all levels of hospitality professionals regardless of their educational background and experience.

All hospitality professionals require food safety training not only to improve their FSK, but also to increase their self-efficacy in safe food handling practices (Osaili et al., 2011; Lazou et al., 2012; Azanaw et al., 2021). The present study outcome also focuses on the personal hygiene that is highly essential for hospitality professionals and may contribute to the prevention of food-borne pathogens being transmitted from the hospitality staff to food (Hassan & Dimassi, 2014; Ncube et al., 2020). The current study's findings thus suggest that improving the level of hospitality professionals' current food safety knowledge, food safety training and its implementation are required.

According to the current study's findings, it has been understood that food safety training and education lead to improved food safety knowledge levels among hospitality professionals. Hence training and education are the effective tools to enhance food safety knowledge. Similarly, work experience also determines the food safety knowledge level in the hospitality industry. There is broad consensus that educated food handlers are necessary to prevent and control food-borne

illnesses. Thus, hospitality professionals should have regular food safety training.

This particular study recommends the importance of the Food Safety and Standards Authority of India (FSSAI), formed in 2011, through the Food Safety and Standards Act 2006, to sensitise food handlers to knowledge concerning food safety and hazards. FSSAI with the help of food safety training and certification is offering training at both basic and advanced levels to the different food handlers working in different industries.

## Implications

### *Theoretical implications*

Theoretically, the present study contributes to the existing literature in several ways. First, a conceptual model was designed by our study for the measurement of food safety knowledge of hospitality professionals using a conceptual and theoretical framework with different and distinct constructs: overall food safety, handling and managing, personal hygiene, sanitation and prevention of cross-contamination, safe storage, cooking, thawing and reheating, health problems that affect food safety, symptoms of food-borne diseases and food-borne pathogens in line with age, education, experience and training.

Current research posits that food safety knowledge is most needed and must be rooted in the minds, behaviours, attitudes and culture of hotel professionals and hotels by using prior studies (e.g. Rebouças et al., 2017; Odonkor & Odonkor, 2020; Al-Akash et al., 2022). Second, this study also demystifies the process and association of overall food safety, handling and managing, personal hygiene, sanitation and prevention of cross-contamination, safe storage, cooking, thawing and reheating, health problems that affect food safety, symptoms of food-borne diseases and food-borne pathogens with age, education, experience and training. This is a response to Mohanty et al.'s (2022) call to measure the food safety awareness of hotel professionals and how it has been associated with their personality traits. The proposed model in this study addressed the "food safety and service quality gap" between hotel staff and visitors' satisfaction.

This present study concludes that handling and managing personal hygiene, sanitation and prevention of cross-contamination, safe storage, cooking, thawing and reheating are the core determinants and components for overall food safety and quality standards in the hotel industry. Hotel personnel with high food safety knowledge and efficacy will most likely respond to the challenges hotels and visitors face when they perceive high health and hygienic benefits.

Further, this study will pave the way for identifying food business operators functioning without valid food safety licences or registration. Particularly, various food value chains working in rural areas are more prone to food safety hazards. Therefore, the law and monitoring system needs to be reinforced to minimise food safety-related risks.

### *Practical implications*

Food-borne disease will continue to be a matter of major concern around the world in the foreseeable future if appropriate education and awareness are not shared widely. As most hospitality establishments are vulnerable to potential hazards, it is imperative to identify the food safety knowledge level among hospitality professionals in the prevention of

food-borne disease outbreaks. The present study findings can contribute to the expanding body of literature and provide fundamental information on hospitality professionals and their existing levels of food safety knowledge in India, which can be used for government's and stakeholders' policy formulation, and provide direction for future research. Through this study, hotel managers, chefs, cooks and other food handlers can benefit by enhancing knowledge and further creating a hygienic ambience by providing safe, quality food. This study will be a torchbearer to augment the approach of farm-to-plate through a nationwide food safety awareness campaign.

### Limitations of the study

Being that numerous hospitality sectors in India are divided into organised and unorganised segments, as previously mentioned at the outset of the study, data were collected from two sides of the country: the eastern side and western side, using some of the country's top-rated hospitality universities as well as restaurants, hotels and other foodservice establishments to conduct this research study. As a result, the researchers believe that the 862 respondents do not accurately represent the authenticity and real attitude toward the research. Therefore, if an empirical study were to be undertaken, the number of respondents could be higher to provide a more accurate representation of the population as a whole, which could amplify the ideal scenario that the survey was intended to deliver at the commencement of the experiment.

Another factor that contributes to the limitation of the current study is that most employees in the unorganised sectors have a low educational background, which prevented us from distributing the questionnaire in digital mode, which may have caused ambiguity throughout the entire research process. Almost 73% of these individuals do not have an eighth-grade education and do not have a fundamental understanding of food safety. To provide an accurate image of food safety in India, the next study may take the form of food safety knowledge levels by segmenting students, kitchen professionals and hospitality managers, as well as food handlers operating in unorganised sectors, among other groups.

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### ORCID iDs

Patita Paban Mohanty – <https://orcid.org/0000-0002-3318-5377>

Sunil Tiwari – <https://orcid.org/0000-0002-0180-9237>

Hiran Roy – <https://orcid.org/0000-0002-6924-7090>

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