ORIGINAL ARTICLE

Factors associated with food safety practices among food-handlers: a facility-based cross-sectional study

Anwesa Roy, Jyotishka Mukherjee, Ipsa Mohapatra, Sai Chandan Das
Department of Community Medicine, Kalinga Institute Of Medical Sciences, Bhubaneswar

CORRESPONDING AUTHOR
Dr.Sai Chandan Das, Associate Professor, Department of Community Medicine, Kalinga Institute Of Medical Sciences
Email: saichandan.das@kims.ac.in
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ABSTRACT

Background: Foodborne diseases remain a major public health concern globally and contribute substantially to morbidity and mortality, particularly in developing countries like India where food hygiene infrastructure and awareness remain suboptimal. Food handlers play a crucial role in preventing contamination during food preparation and serving. Assessing their knowledge, attitudes, and practices (KAP) is essential for strengthening food safety interventions in institutional settings. **Aim and Objective:** To asess the knowledge, attitude, and practices regarding food hygiene and safety among food handlers in a private university of Eastern India and to determine their association with selected socio-demographic factors. **Methods:** A facility-based cross-sectional study was conducted from December 2025 to February 2026 among food handlers working in hostel kitchens of a private university in Eastern India. Universal sampling was adopted and 150 eligible food handlers were included. Data were collected using a pre-tested semi-structured questionnaire assessing socio-demographic characteristics and KAP related to food hygiene. Data were analyzed using Epi Info version 7.3.2. Descriptive statistics were calculated, and associations were assessed using the Chi-square test and the F-test, with $p < 0.05$ considered statistically significant. Results: Among the 150 participants, the mean age was 39.4 ± 13.28 years. Females constituted 45.3%, and 57.3% were married. The mean scores for knowledge, attitude and practice were 11.65 ± 3.57, 9.55 ± 2.28, and 24.46 ± 2.78, respectively. Higher educational status ($p<0.0001$) and higher socio-economic class ($p<0.001$) were significantly associated with better knowledge scores. Female participants demonstrated significantly better attitude scores ($p=0.04$), while male food handlers had significantly higher practice scores ($p=0.003$). **Conclusion:** Although food handlers demonstrated moderate knowledge and attitudes toward food hygiene, their practical adherence to food safety measures was relatively better. Strengthening structured food safety training programs and continuous monitoring can further improve compliance and reduce the risk of foodborne diseases in institutional settings.

KEYWORDS

Food safety; Food handlers; Food hygiene

INTRODUCTION

Food safety is a major global public health concern and remains a significant challenge in both developed and developing countries. Consuming contaminated food contaminated with bacteria, viruses, parasites, or harmful chemicals can lead to a wide range of foodborne diseases, contributing substantially to global morbidity and mortality (1,2). According to the World Health Organisation, approximately 600 million people suffer from foodborne illnesses each year, resulting in nearly 420,000 deaths worldwide (3).

The burden of foodborne diseases is particularly high in developing countries due to poor sanitation, inadequate food safety infrastructure, and limited awareness of safe food-handling practices (4). Factors such as improper food handling, cross-contamination, inadequate cooking, and poor personal hygiene among food handlers are common causes of food contamination and outbreaks (5,6). Studies have reported that about 10–20% of foodborne disease outbreaks are associated with improper food handling practices (7).

Food handlers play a critical role in maintaining food safety because they are directly involved in food preparation, storage, and serving. Their knowledge, attitude, and practices regarding food hygiene are essential for preventing contamination and protecting consumers from foodborne illnesses (8–10). Therefore, assessing these factors can help identify gaps in food safety awareness and guide the development of effective training and preventive strategies (11–15).

In India, foodborne illnesses continue to be a major public health challenge due to rapid urbanization, growing demand for mass catering services, and gaps in food safety awareness among food handlers. Studies conducted in institutional settings such as hospitals, universities, and food establishments in India have reported inadequate knowledge and inconsistent hygienic practices among food handlers, increasing the

risk of food contamination and disease outbreaks. Despite regulatory frameworks established by the Food Safety and Standards Authority of India (FSSAI), the implementation of food safety practices varies widely across institutions. However, evidence on food hygiene practices among food handlers in university hostel settings remains limited, particularly in Eastern India.

Aim & Objective(s)

Primary Objective: To assess the knowledge, attitude, and practices regarding food hygiene and safety among food-handlers in a private university of eastern India

Secondary Objective: To assess the association of these factors with selected socio-demographic variables.

MATERIAL & METHODS

Study type & study design: This was a quantitative observational study using a facility-based cross-sectional design.

Study setting: The study was conducted in the **mess and kitchen facilities of a private university in Eastern India**. These kitchens are responsible for preparing and serving meals to hostel residents and are operated by designated food handlers.

Study population: The study population consisted of food handlers directly involved in food preparation, cooking, and serving in the university's hostel kitchens. Kitchen workers aged 18–60 years who had been employed for at least one year were eligible to participate. Study duration The study was conducted over three months, from December 2025 to February 2026.

Sample size calculation: A total of 171 food handlers worked in the hostel kitchens during the study period. Among them, 150 fulfilled the eligibility criteria and agreed to participate, while the rest were excluded due to working for less than a year or being absent during the survey. Therefore, 150 food handlers were included through universal sampling. (Figure-1)

Inclusion criteria

All kitchen workers employed by the university kitchens. Food handlers aged **18–60 years**.

Exclusion criteria

Contractual staff who had been employed for **less than one year**.

Data collection tool and procedure: Data were collected using a pre-tested semi-structured questionnaire administered through face-to-face interviews. The tool comprised sections on socio-demographic characteristics and on the knowledge, attitudes, and practices domains related to food hygiene and safety. Domain-wise scores were calculated separately.

Working definition:

Food handling practice: food handlers will be asked fifteen questions, and those who score less than or equal to the mean value will be considered as having poor practice, and those who score greater than the mean value will be considered as having good practice [16.17].

Knowledge: Respondents will be asked nine questions, and those who score less than or equal to the mean value will be considered as having poor knowledge [18.19].

Attitude: Respondents will be asked six questions, and those who score less than or equal to the mean value will be considered as having a poor attitude

Ethical issues & informed consent: Ethical approval (IEC/2361/2025) was obtained from the Institutional Ethics Committee of the Operational Institution. Written informed consent was obtained from all participants before enrolment, and confidentiality was maintained throughout the study.

Data analysis – software: Data were entered and analyzed using Epi Info version 7.3.2. Descriptive statistics such as mean, standard deviation, frequency, and percentage were computed. Chi-square and F-tests were performed to assess associations between socio-demographic variables and various domain scores. A p-value <0.05 was considered statistically significant. Domain scores ≤ mean were categorized as "poor" and scores > mean as "good."

RESULTS

Of the total of 150 food handlers who participated in the study, the mean age of the participants was 39.4 years ±13.28 (SD), with an age range of 18 to 60 years, 45.33% (n=68) were females and 57.33% (n=86) were married. The majority (38.67%, n=58) belonged to the upper socio-economic class as per Modified Kuppuswamy scale.

The mean knowledge domain score was 11.65 ± 3.57 SD (range: 3–18); 77 participants had a poor knowledge score, and 73 participants had a good knowledge score. (Table 1) Literacy (p<0.0001) and higher socio-economic class (p<0.001) showed statistically significant association with knowledge scores. Other variables such as age (p=0.42), gender (p=0.88), and marital status (p=) did not show a statistically significant association with knowledge scores (Figure 2, Figure 3).

The mean attitude domain score was 9.55 ±2.28 (range: 6–16). 102 participants had a poor attitude score, and 48 participants had a good attitude score. Female food handlers exhibited significantly better attitude scores compared to their male counterparts (p < 0.04) (Table no. 2). However, no significant association was observed between attitude scores and other socio-demographic variables such as age (p<.068), literacy(p<.002), or socio-economic class (p<.05).(Figure 4)

The mean practice score was 24.46 ± 2.78 (range: 18–30). Male food handlers demonstrated significantly better practice scores than females (p < 0.003) (Table no 3). Additionally, literacy (p<.0001)and higher socio-economic status (p<.0001)were significantly associated with better food safety practices (p < 0.0001). This reflects the fact that while females had a more positive attitude, males were more likely to translate food safety knowledge into actual practice.

Table 1: Association between socio-demographic characteristics and knowledge scores among food handlers (n=150)

Variables	Poor (n=77)	Good (n=73)	p-value
Age group			
<20 (n=11)	5 (6.49%)	6 (8.2%)	
21–30 (n=33)	15 (19.4%)	18 (24.65%)	
31–40 (n=35)	19 (24.6%)	16 (20.77%)	.42
41–50 (n=27)	18 (23.37%)	9 (12.32%)	

51–60 (n=44)	20 (25.97%)	24 (31.6%)	
Gender			
Male (n=82)	42 (54.5%)	40 (54.7%)	.88
Female (n=68)	35 (45.4%)	33 (45.2%)	
Education			
Illiterate (n=23)	19 (24.6%)	4 (5.47%)	
Primary (n=13)	11 (14.2%)	2 (2.73%)	
Middle (n=33)	24 (31.1%)	9 (12.3%)	
High (n=19)	7 (9.09%)	12 (16.43%)	<.0001
Intermediate (n=24)	5 (6.49%)	19 (26.02%)	
Graduate (n=35)	9 (11.68%)	26 (35.6%)	
Professional (n=3)	2 (2.5%)	1 (1.35%)	
SES			
Upper (n=51)	17 (22.07%)	34 (46.5%)	
Upper middle (n=7)	1 (1.2%)	6 (8.2%)	
Lower middle (n=35)	14 (18.1%)	21 (28.7%)	<.0001
Upper lower (n=30)	24 (31.1%)	6 (8.2%)	
Lower (n=27)	21 (27.2%)	6 (8.2%)	

Chi-square test used; p<0.05 considered statistically significant.

Table no 2: Association of Various Factors with Attitude Score

Variables	Attitude Score Poor (n=102)	Attitude Score Good (n=48)	p-value
Age Group			
<20 (n=11)	11 (10.78%)	0 (0%)	
21–30 (n=33)	23 (22.54%)	10 (20.8%)	
31–40 (n=35)	25 (24.5%)	10 (20.8%)	.068
41–50 (n=27)	14 (13.7%)	13 (27.08%)	
51–60 (n=44)	29 (28.4%)	15 (31.25%)	
Gender			
Male (n=85)	64 (62.7%)	21 (43.75%)	.04
Female (n=65)	38 (37.25%)	27 (56.25%)	
Education			
Illiterate (n=23)	13 (12.74%)	10 (20.8%)	
Primary (n=13)	4 (3.9%)	9 (18.75%)	
Middle (n=33)	18 (17.64%)	15 (31.25%)	
High (n=19)	17 (16.6%)	2 (1.9%)	.002
Intermediate (n=24)	19 (18.62%)	5 (10.41%)	
Graduate (n=35)	29 (28.43%)	6 (12.5%)	
Professional (n=3)	2 (1.9%)	1 (2.08%)	
Socioeconomic Status (SES)			
Upper (n=51)	39 (38.23%)	12 (25%)	
Upper middle (n=7)	4 (3.9%)	3 (6.25%)	
Lower middle (n=35)	26 (25.49%)	9 (18.75%)	.05
Upper lower (n=30)	14 (13.72%)	16 (33.33%)	
Lower (n=27)	19 (18.62%)	8 (16.6%)	

Table 3: Association of Various Factors with Practice Score

Variables	Practice Score Poor (n=92)	Practice Score Good (n=58)	p-value
Age Group			
<20 (n=11)	6 (6.52%)	5 (8.6%)	
21–30 (n=33)	18 (19.56%)	15 (25.8%)	
31–40 (n=35)	25 (27.17%)	10 (17.2%)	.22
41–50 (n=27)	20 (21.73%)	7 (12%)	
51–60 (n=44)	23 (25%)	21 (36.2%)	
Gender			
Male (n=85)	41 (44.56%)	44 (75%)	.003
Female (n=65)	65 (70.65%)	14 (24.13%)	
Education			
Illiterate (n=23)	23 (25%)	0 (0%)	
Primary (n=13)	11 (11.95%)	2 (3.4%)	
Middle (n=33)	30 (32.6%)	3 (5.17%)	

High (n=19)	5 (5.4%)	14 (24.13%)	<0.0001
Intermediate (n=24)	7 (7.6%)	17 (29.3%)	
Graduate (n=35)	14 (15.21%)	21 (36%)	
Professional (n=3)	2 (2.1%)	1 (1.7%)	
Socioeconomic Status (SES)			
Upper (n=51)	23 (25%)	28 (48.27%)	
Upper middle (n=7)	3 (3.2%)	4 (6.8%)	
Lower middle (n=35)	14 (15.2%)	21 (36%)	<0.0001
Upper lower (n=30)	29 (31.5%)	1 (1.7%)	
Lower (n=27)	23 (25%)	4 (6.8%)	

Figures

Figure 1:

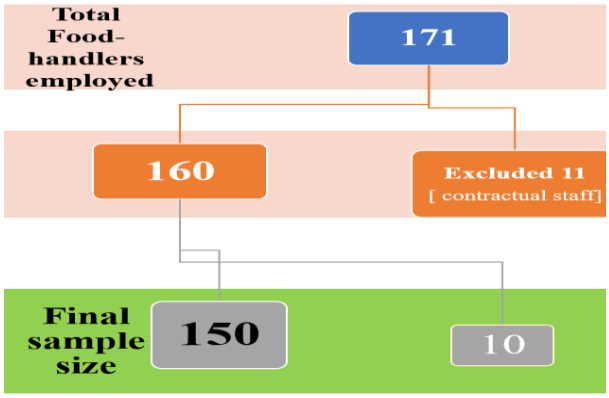


Figure 2: illustrates the distribution of knowledge scores among participants

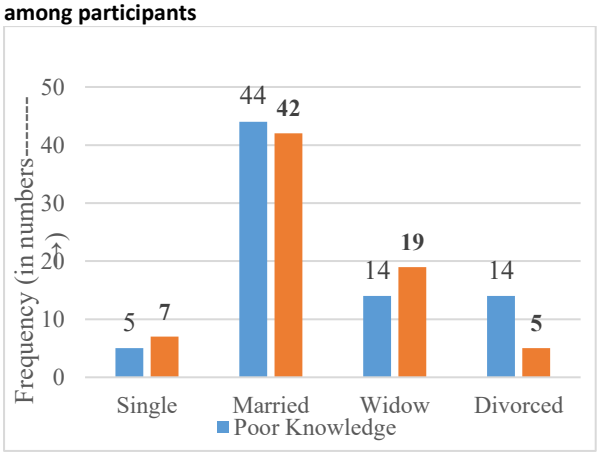


Figure 3 : Association between education and knowledge scores.

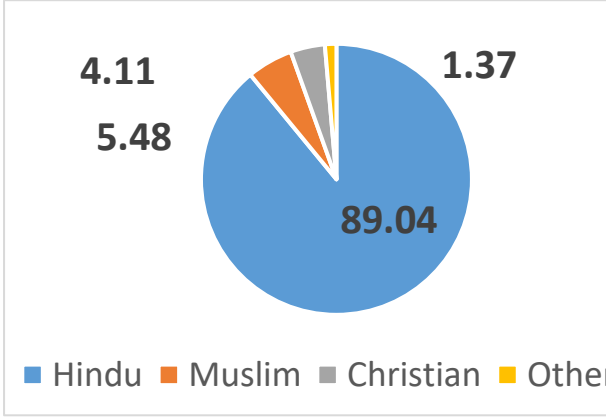
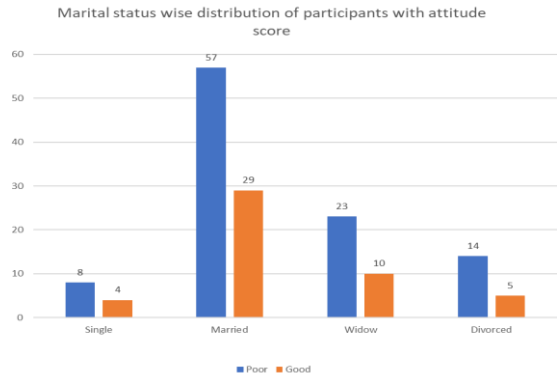


Figure 4: Distribution of attitude scores among food handlers according to marital status



DISCUSSION

Overall, the findings indicate that while knowledge and attitude scores were good, the actual practices related to food safety were better. This may be attributed to ongoing awareness programs and regular monitoring of food hygiene practices mandated by the university administration. The present study tried to find out the factors associated with the food safety practice among food handlers in a private university setting. The findings demonstrated good knowledge and attitude levels, with comparatively better performance in the practice domain. Foodborne diseases will remain a significant public health problem worldwide, particularly in developing countries, and improper food handling is a major contributing factor, as emphasized by the World Health Organization (WHO, 2015)(20). Therefore, assessing food handlers' knowledge, Attitude and Practice is critical for strengthening preventive strategies. The mean knowledge score observed in this study was good, which aligns with findings from studies conducted in institutional and hospital settings. For instance, a study by Ansari-Lari et al. (2010) in Iran reported that although food handlers had acceptable awareness of basic hygiene principles, gaps existed in specific areas of food safety(22). Similarly, Bas et al. (2006) in Turkey found insufficient knowledge among food handlers despite routine exposure to food preparation tasks(16). Comparable findings were also reported in India by Mudey et al. (2010), who documented moderate knowledge levels among food handlers in tertiary care institutions(23). These similarities suggest that mere

involvement in food preparation does not guarantee adequate theoretical understanding of food safety principles.

In the present study, literacy and higher socio-economic status were significantly associated with better knowledge scores. This finding is consistent with previous research indicating that educational attainment enhances comprehension of food safety guidelines and hazard prevention measures. Studies conducted in different regions have consistently shown that education plays a pivotal role in shaping food safety awareness and compliance (Bas et al., 2006; Ansari-Lari et al., 2010). Higher socio-economic status may facilitate better access to training programs, health information, and regulatory updates.

Good attitude scores were significantly higher among female food handlers compared to males. Gender-based differences in attitudes toward hygiene have been observed in earlier studies. For example, Sanlier (2009) reported that female food handlers exhibited more positive attitudes towards hygienic practices compared to males(24). This may be attributed to traditional gender roles and greater domestic involvement in food preparation, which reinforce hygienic behaviors. However, similar to findings by Mudey et al. (2010), other socio-demographic variables such as age and socio-economic status did not significantly influence attitudes, suggesting that perception toward food hygiene may be influenced by personal beliefs and cultural norms rather than structural determinants.

Interestingly, male food handlers in the present study demonstrated significantly better practice scores compared to females. This finding contrasts with some previous studies where females reported better hygienic practices. However, in institutional settings, male food handlers may be more engaged in large-scale cooking activities and may be subjected to stricter supervision, which could explain better compliance. A study conducted in university canteens by Abdalla et al. (2009) similarly reported variability between knowledge and practice domains, emphasizing the role of monitoring systems in ensuring adherence to hygiene standards(24). An important observation in this study was that practice scores were relatively better than knowledge and attitude scores. This trend has also been documented in institutional settings where enforcement mechanisms, inspections, and food safety regulations drive compliance irrespective of individual knowledge levels. The regulatory framework established by the Food Safety and Standards Authority of India (FSSAI) mandates food safety training and certification, which may have contributed to improved practical adherence among food handlers.

No statistically significant association was observed between age and knowledge , attitude and practice domains in the present study. Similar findings were reported by Bas et al. (2006), suggesting that experience alone does not necessarily translate into improved food safety behaviour without structured training and reinforcement.

CONCLUSION

From a public health perspective, the findings underscore the need for continuous, structured, and skill-based training programs tailored to literacy levels. Periodic refresher training, behaviour change communication strategies, and strict supervisory mechanisms are essential to bridge the gap between knowledge and practice. Institutional food safety policies aligned with WHO guidelines and FSSAI standards can further strengthen compliance and minimize the risk of foodborne disease outbreaks.

RECOMMENDATION

Based on the findings of the present study, regular food safety training programs should be conducted for food handlers to improve their knowledge and attitude regarding safe food handling practices. Periodic health education and awareness sessions on personal hygiene, hand washing, and prevention of food contamination should be organized. Institutional authorities should ensure regular supervision and monitoring of food hygiene practices in kitchens and food service areas. Implementation of standard food safety guidelines and periodic health check-ups of food handlers may further help in preventing foodborne diseases and maintaining food safety in institutional settings.

LIMITATION OF THE STUDY

The present study has certain limitations that should be considered while interpreting the findings. Firstly, the cross-sectional study design limits the ability to establish causal relationships between the associated factors and food safety practices. Secondly, the study was conducted in a single university setting, which may limit the generalizability of the findings to other institutional or community food service establishments. Thirdly, the information on knowledge, attitude, and practices was collected using a self-reported questionnaire, which may be subject to social desirability and recall bias. Additionally, although the study included most eligible food handlers, the sample size was relatively small, which may have reduced the analysis's statistical power. Despite these limitations, the study provides useful insights into the food safety knowledge and practices among food handlers in an institutional setting.

RELEVANCE OF THE STUDY

Foodborne diseases remain an important public health problem, particularly in developing countries. Food handlers play a crucial role in preventing contamination during food preparation and serving. The present study highlights the knowledge, attitude, and practices related to food hygiene among food handlers in a university setting in Eastern India. The findings help identify gaps in food safety awareness and practices among food handlers. The study provides useful evidence for designing targeted training programs, strengthening food hygiene monitoring, and improving food safety practices in institutional food service establishments

AUTHORS CONTRIBUTION

All authors have contributed equally.

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Nil

Conflict of Interest
There are no conflicts of interest.

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Declaration of Generative AI and AI Assisted Technologies in the Writing Process
During the preparation of this manuscript, the author(s) used Open AI to improve language & clarity and overall readability. After using it the author(s) thoroughly reviewed and edited the content as needed. The authors take full responsibility for the content, accuracy and integrity of the final publication.

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