Red meat handlers’ food safety knowledge, attitudes, and practices in the Dhaka megacity of Bangladesh

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ABSTRACT
Foodborne disease is a major health problem worldwide and unhealthy food handling practices are a cause of foodborne disease (FBD) transmission among populations. Red meat handlers play an important role in ensuring food safety throughout production, processing, transportation, and preparation. This study investigates the food safety knowledge, attitudes, and practices (KAP) of red meat handlers in the Dhaka megacity of Bangladesh (DMCB). Four hundred cross-sectional samples were collected from the DMCB using a pretested survey-structured questionnaire. Descriptive, and inferential statistics, and the KAP model were applied using partial least square structural equation modeling (PLS-SEM) with the help of SmartPLS 0.3 software to achieve objectives. All factor loading scores (>0.5) and Cronbach’s alpha (α ≥ 0.69) were greater than the reference value, which means that indicators of reliability and internal consistency measure latent variables. The results found a significant positive association between red meat handling practice and knowledge and attitude. Red meat handlers’ knowledge has a moderating effect on the relationship between attitude and practice, where attitude positively affects practices toward food safety. The findings revealed that the KAP model met the goodness-of-fit criteria (HTMT<1, SRMR<0.08, NFI>0.90) and was acceptable (AVF≤0.50). The estimated model for food safety knowledge, attitude, and practices is well-suited and deemed acceptable. The findings also reveal that food safety knowledge has a significant and beneficial impact on food safety attitudes. Furthermore, attitudes regarding food safety and its measures are linked in a significant way. The findings could aid public health professionals and practitioners in developing focused initiatives to improve meat handlers’ food safety knowledge and practices and prevent FBD. The government should pay special attention to improving food safety knowledge and ensuring quality handling practices to protect FBD transmission in the DMCB.

Introduction
Foodborne diseases (FBD) occur in developing countries, and each year 420,000 people die, and 10% of the population gets sick from eating contaminated food.¹ in Bangladesh, FBDs are prevalent due to poor food handling practices, inadequate sanitation facilities, insufficient food safety legislation, weak regulatory systems, lack of financial resources to invest in food safety equipment, and lack of food handlers’ education and knowledge. Microbiological agents cause infections, and biotoxins,
and chemical pollutants in food, pose significant health risks to millions of people.\textsuperscript{[2]} Most FBDs are caused by animal-based foods.\textsuperscript{[3,4]} Worldwide, food safety is a great concern to public health, especially when food is handled in a highly contaminated environment.\textsuperscript{[4,5]} The food handlers should have solid food safety knowledge to prevent FBDs. Good knowledge and a positive attitude among food handlers, and proper food handling practices can help control FBDs.\textsuperscript{[3–5]} In Bangladesh, food handler KAP concerning food safety and FBDs are essential in promoting food safety and safeguarding humans from FBDs. It is an appropriate substrate for the growth of a wide variety of microorganisms in the red meat that are high in nutrients.\textsuperscript{[6,7]} Food contamination is mostly caused by a food handler’s health and hygiene standards, according to.\textsuperscript{[8]} A KAP study is a representative study of a single community that uses questionnaires to collect data on what people know, believe, and do about a certain topic.\textsuperscript{[9]} In Bangladesh, there has been little research on vendors’ awareness, attitudes, and experience in detecting hazardous bacteria in red meat, such as E. coli, Salmonella sp., and Staphylococcus aureus, which can cause food poisoning and spread FBD to humans.\textsuperscript{[5]} Evidence from\textsuperscript{[4,14–16]} found that meat handlers with a greater understanding of food safety and suitable food handling methods had better food safety practices. However, there is also evidence of variations in food safety knowledge and practices among meat handlers. In a study similar to,\textsuperscript{[16]} meat handlers’ educational level and professional training were positively associated with their knowledge and procedures pertaining to food safety.\textsuperscript{[4]} Food handler training has been connected to food safety knowledge and practices, as well as sanitary and hygienic qualities, and product microbiological quality.\textsuperscript{[17,18]} There are gaps in regular food safety training for handlers, notably for under-supervised meat handlers in butcher shops, according to Bangladesh’s Food Safety Act-2013, which emphasizes knowledge-based food safety management systems.

However, few studies have been conducted on the essential criteria that determine red meat handlers’ food safety KAP. These findings will support a better understanding of how the food safety KAP of handlers interacts across the country, as the study’s purpose is to examine the factors related to the food safety KAP of red meat handler practices in the Dhaka Megacity, Bangladesh (DMCB). These factors could hinder governments’ abilities to accurately apply measures to address food contamination problems that affect public health. Therefore, this study was designed to assess food safety KAPs in meat handling and determine the impact on health in the DMCB.

Materials and methods

Study area

Dhaka is the 7th largest populated city in the world and the fastest growing megacity in Bangladesh. It is situated between 23.4676° latitude and 90.399452° longitude and is located centrally in Bangladesh. It is an economic hub that has grown chaotically outwards and upwards to absorb the 20 million people who live there, and 400,000 people are added to the population each year. Dhaka megacity was chosen for its high urban population because a considerable amount of commercial red meat (live animals) comes from all over the country. There are many slaughterhouses in the DMCB. Butchers come from outside the city to work in the slaughterhouses and temporary workers handle the carcasses. The target respondents, including red meat handlers and roadside butcher shops, were easy to find.

Sampling technique, sample size and data collection

A systematic random sampling technique was applied to collect data from 400 red meat handlers (including slaughterhouses, butcher shops, roadside butcher stands, wet markets, mobile markets, supper shops, etc.) from the Dhaka Megacity from March to May 2020.
The written close-ended questionnaire was developed in the following ways: First, a two-round Delphi method was conducted to identify the key statements regarding the KAPs of the meat handlers to prevent FBDs and ensure food safety. Second, the study adopted and modified the statements with using previously published studies\(^{[18–23]}\) to develop a survey schedule as study’s requirements. Later, the study designed a self-administered KAP questionnaire to collect data. It was divided into socioeconomic questions and food safety questions regarding knowledge (13 items), attitude (11 items), and practices (11 items).

**Data analytical technique**

Descriptive and inferential statistics were used to summarize variables of interest, while structured equations were used to summarize variables of interest (the multicollinearity among independent variables was checked using a variance inflation factor and tolerance; Shapiro–Wilk test for normality; Cronbach’s alpha for data reliability and correction of the relationship between variables; Kaiser–Meyer–Olkin test for validity, etc.). The KAP model was applied by using partial least square structural equation modeling (PLS-SEM) with the help of SmartPLS 0.3 (Figure 1).

SmartPLS Procedure: A partial least square (PLS) that is used in this research. According to,\(^{[24]}\) PLS is simultaneous modeling (SEM) technique capable of analyzing latent variables, indicators, and measurement errors in real time. PLS can be used with few samples and applied to all data scales.\(^{[25]}\) We have summarized the process for calculating PLS-SEM in SmartPLS in five stages, as shown in Figure 1.

**Construction of latent variables**

The red meat handlers’ KAP question patterns are divided into several points: personal hygiene, prevention of cross-contamination and sanitation, food handling, and health problems. The following latent variables are constructed based on the meat handler KAP questionnaire’s in Table 1.
Table 1. Food safety KAPs of red meat handlers in the Dhaka megacity of Bangladesh.

| KAP                        | Items                                                                 | Question statements regarding food safety | Mean | S. D | Loading | Cronbach’s alpha |
|---------------------------|----------------------------------------------------------------------|-------------------------------------------|------|------|---------|------------------|
| **Food safety knowledge** | K<sub>1</sub> Are you aware of Foodborne diseases/pathogens (Diarrhea, E.coli, Hepatitis, Staphylococcus, Clostridium botulinum, Salmonella, Anthrax, etc.) or food poisoning? | 1420 Food safety knowledge                | 0.78 | 0.96 | 0.765   | 0.69             |
| K<sub>2</sub> Are you aware that insects, such as cockroaches and flies, might transmit food borne pathogens? | 0.40 1.10 0.801 | | | |
| K<sub>3</sub> Did you know that healthy food handlers may still carry food borne pathogens? | 0.56 1.03 0.673 | | | |
| K<sub>4</sub> Did you know that unhygienic red meat handling is a cause of disease? | 0.67 0.95 0.734 | | | |
| K<sub>5</sub> Are you aware that eating and drinking in the workplace increases the risk of meat contamination? | 0.65 0.96 0.2 | | | |
| K<sub>6</sub> Have you fallen ill with infectious diseases of the skin and eye during meat handling and thought it was necessary to take leave from work? | 0.55 1.27 0.579 | | | |
| K<sub>7</sub> Do you believe that routine medical checkups are necessary? | 0.26 1.01 0.590 | | | |
| K<sub>8</sub> Did you know that cross-contamination is when microorganisms from contaminated food are transferred by the food handler’s hands or utensils to another person? | 0.97 0.99 0.584 | | | |
| K<sub>9</sub> Did you know unclean sanitization, knives, hooks, cutting tools, instruments, and working surfaces cause red meat contamination and poisoning? | 0.96 1.15 0.850 | | | |
| K<sub>10</sub> Did you wash your hands using tap water with soap before touching red meat to get rid of bacteria? | 0.58 1.16 0.852 | | | |
| K<sub>11</sub> Do you follow the food safety guidelines during meat handling? | 0.76 0.78 0.801 | | | |
| K<sub>12</sub> Did you receive any formal and informal training before or during red meat handling? | 0.36 0.96 0.885 | | | |
| K<sub>13</sub> Did you know that food poisoning could cause severe diseases that end in hospitalization and sometimes death? | 0.55 1.27 0.830 | | | |
| **Food safety attitude**  | A<sub>1</sub> I believe being medically examined every six months is important for a red meat handler’s health | I believe being medically examined every six months is important for a red meat handler’s health | 3.91 | 1.10 | 0.754 | 0.77 |
| A<sub>2</sub> Improper/unhygienic meat storage is dangerous to health | 3.27 1.37 0.800 | | | |
| A<sub>3</sub> Wearing watches, earrings, and rings will increase the risk of red meat contamination | 3.58 1.31 0.861 | | | |
| A<sub>4</sub> Wearing protective clothing/aprons, gloves, caps, shoes, and masks for safe meat handling to avoid contamination and diseases is a prerequisite of meat handlers’ job responsibilities | 3.88 1.17 0.815 | | | |
| A<sub>5</sub> It is important to use potable water to wash working surfaces, cutting tools, knives, and hooks after disinfection | 4.06 1.34 0.807 | | | |
| A<sub>6</sub> I think that it is my responsibility as a food handler to ensure that the meat I sell is safe | 3.72 1.11 0.768 | | | |
| A<sub>7</sub> Raw meat is stored at the bottom of the refrigerator shelf | 1.06 0.93 0.810 | | | |
| A<sub>8</sub> Washing hands with soap can reduce meat contamination or food poisoning | 2.69 1.52 0.527 | | | |
| A<sub>9</sub> Hands should be washed with water and soap after using toilet | 3.25 1.61 0.861 | | | |
| A<sub>10</sub> I am willing to change my food handling behaviors when I know they are incorrect | 2.83 1.53 0.816 | | | |
| A<sub>11</sub> Regular training and awareness programme improve meat safety and hygiene practices | 2.75 1.55 0.806 | | | |
| **Food safety practices** | P<sub>1</sub> I wash my hands with soap and wear apron, gloves, cap, shoes, and masks during meat handling | I wash my hands with soap and wear apron, gloves, cap, shoes, and masks during meat handling | 2.80 1.60 0.754 | | 0.83 |
| P<sub>2</sub> I always use sanitizer when washing service utensils (knives, hooks, cutting tools, etc.) | 3.12 1.59 0.799 | | | |
| P<sub>3</sub> I remove personal items such as rings, necklaces, and watches during the meat handling period. | 3.03 1.55 0.799 | | | |
| P<sub>4</sub> I am aware of the shelf life of red meat | 2.88 1.70 0.458 | | | |
| P<sub>5</sub> I wash raw meat before cutting or preparing it | 2.83 1.57 0.767 | | | |
| P<sub>6</sub> Cleaning food contacting and after surfaces before processing | 3.46 1.52 0.512 | | | |
| P<sub>7</sub> Proper cleaning and handling of instruments reduces the risk of food contamination. | 3.34 1.65 0.806 | | | |
| P<sub>8</sub> Washing and disinfecting working surfaces and tools are important practices for safely handling meat. | 3.14 1.65 0.767 | | | |
| P<sub>9</sub> Putting a hair cover on the head is a good practice in the meat industry | 2.56 1.47 0.771 | | | |
| P<sub>10</sub> I always attend training and awareness programmes regarding food safety | 2.46 1.62 0.484 | | | |
| P<sub>11</sub> I wash hands and equipment after handling waste/garbage | 2.10 1.64 0.812 | | | |
Food safety knowledge

The food safety knowledge variables in Table 2 were generated based on thirteen observations (K1-K13). Most respondents were aware of handling procedures (personal hygiene and sanitary) to ensure food safety. So, we used a binary (yes/no) response for each indicator. All standard factor loadings were >0.40 and Cronbach’s alpha was (α = 0.69). All observation reliability and internal consistency contract latent variable knowledge (K).

Food safety attitude

The attitudes of food handlers were constructed based on eleven indicators (A1-A11). Food safety attitudes and self-reported practices were evaluated using a 5-point Likert scale. Each indicator was scaled as follows: strongly agree (4), agree (3), neutral (2), disagree (1), and strongly disagree (0). In contrast, for negatively worded items, the lowest point (0) was given to “strongly agree,” and the highest (4) was given to “strongly disagree.” All standard loadings were >0.527, and Cronbach’s alpha (α = 0.77) determines indicator reliability and internal consistency to measure the latent variable attitude (A).
Practices

The meat handlers’ practices are constructed based on eleven indicators (P1–P11). This questionnaire comprises eleven items rated based on a 5-point Likert scale (1 = very low to 5 = very high). Each indicator was scaled according to the previous steps (b). The results showed that the loading factor scores were >0.484, and Cronbach’s alpha (α = 0.83) designated that most of the indicators were consistent and reliable in measuring latent variable practices (P). A total of thirty-five questions (K1-K13, A1-A11, and P1-P11) were used to measure the following three latent variables: knowledge (K), attitude (A), and practices (P) to be accepted KAP, as shown in Table 1.

The present study’s findings indicate that the questionnaire on food safety KAP and prevention was valid and reliable. The reliability study revealed that all items in the three latent constructs had strong internal consistency, with Cronbach’s alpha coefficients of more than 0.50 for each construct. This finding was consistent with that of,[26] who found that all items in a food safety practice questionnaire met the acceptable criteria for internal consistency and that a Cronbach’s alpha of 0.50 or greater was an acceptable criterion for internal consistency in reliability analysis.[27]

Results and discussion

Sociodemographic profiles

The sociodemographic profiles of the respondents are presented in Table 2. Out of the 400 food handlers, 76.75% (n = 307) were male, and 23.25% (n = 93) were female. Most studies[20,28,29] have reported a higher proportion of males, involved in food handling. The mean age of the respondents was 39, ranging between the ages of 20 and 69, and 78% were married. Approximately 10.75% of the respondents had no formal education. More than half (70.75%) of respondents had worked for more than 5 (five) years, but very few respondents had food safety training (21.25%) or health certificate (25.75%). About 58.76% of the respondents reported having experienced symptoms of food poisoning diseases such as vomiting, diarrhea, headaches, stomach cramps, fever, and loss of appetite (Table 2).

Figure 2 shows that 64.75% of respondents had adequate knowledge, 49.46% had adequate attitudes and 12% had adequate food safety and hygiene practices. Knowledge of food safety concepts does not necessarily corroborate self-reported practices for food safety behavior. Although 64.75% showed positive knowledge, only 12% implemented adequate food safety practices.[30,31]

Association between KAP (knowledge, attitudes, and practices) of meat handlers

Table 3 shows an association between KAP and food handlers working in food courts. There was a statistically significant association between knowledge and attitudes (X = 0.896, p = .014) and attitudes and practices (X = 0.766, p = .049 and practices score (X = 0.667, p-value = 0.501) (Table 3). The strongest positive correlation was between attitude scores and practice scores. Knowledge is the key element influencing attitudes and practices among food handlers. This association shows that food handlers with excellent knowledge will have good attitudes and practices. These findings support a prior study that showed a strong positive relationship between knowledge, attitude, and behavior.[32] However, several studies have shown that simply learning about food safety does not instill a healthy sanitary attitudes and practices among farmers and food handlers.[33]
Partial least square structural equation modeling (PLS-SEM) results

In contrast to previous investigations on the interrelationships of food safety KAPs, we examined the postulated links using PLS-SEM, a second-generation statistical approach. For this type of research design and causal link prediction, PLS-SEM is a good choice as it is the most commonly used SEM approach when the sample size is small and the topic field is new. In most cases, a PLS-SEM is analyzed and interpreted in two stages. The first step is to examine and refine the measurement model’s adequacy, followed by examining and reviewing the structural model. This guarantees that the metrics are reliable and valid before attempting to draw conclusions from the structural model. We will test the following three hypotheses,

\( H_1 \): Red meat handlers’ knowledge has a moderating effect on the relationship between attitude and practices toward food safety.

\( H_2 \): Red meat handlers’ knowledge has a positive effects food safety practices.

\( H_3 \): Red meat handlers’ attitudes have a positive effect food safety practices.
Red meat handlers’ knowledge has a moderating effect on the relationship between attitude and practices, where attitude positively impacts practices toward food safety. The hypothesized model for food safety knowledge, attitude, and practices had a good fit and was acceptable. The structural model showing the relationship between the variables of food safety knowledge, attitude, and practice is shown. Hypothesis testing was performed using PLS-SEM. The PLS-SEM full model can be seen in Figure 3.

The PLS-SEM analysis showed that the path coefficient for food safety knowledge and practices was 0.218 ($P < .05$), suggesting that food safety knowledge affects food safety practices. The path coefficient is positive, signifying that attitudes toward food safety become more positive as knowledge of food safety increases. This result indicates the importance of developing programs that improve food safety knowledge of red meat handlers. Therefore, $H_1$ is supported. This result was similar to \cite{16, 19, 36}.

The path coefficient of food safety knowledge and attitude was 0.220 ($P < .05$), suggesting that food safety knowledge affects food safety attitude. This result is in accord with studies \cite{16, 19, 36} and \cite{37} that stated that good knowledge could lead to a positive attitude. Similarly, a study by \cite{38} found a significant positive correlation between knowledge and attitude. This result indicates the need to improve food safety attitudes. The path coefficient of food safety attitude and practice was 0.322 ($P < .01$), suggesting a relationship between attitudes toward food safety practices, and the results showed that these two constructs are significantly and positively related. Thus, $H_3$ is supported, but the result is argued by \cite{39}.

Knowledge has a considerable impact on food safety attitudes and practices, and attitudes toward food safety and practices are also significant and positively related. These findings, comparable to \cite{36}, imply the necessity to increase food safety knowledge to improve red meat handlers’ food safety attitudes and practices.

**Outer model test results**

The outer model focuses on testing the validity and reliability of each indicator on its latent variable. This outer model (measurement model) is formed by testing convergent validity, discriminant validity, extracted average variance (AVE), and composite reliability.
Convergent validity

The average variance recovered should be greater than 0.5, which refers to how well individual items reflect concept coverage compared to items measuring various constructs. The factor loadings in this investigation showed that the six constructs have convergent validity. All loadings are above 0.50, with a majority more than 0.60. The loadings of the factors ranged from 0.56 to 0.96. The high factor loadings conclude that the measures have convergent validity. All construct factor loadings exceeded the 0.50 cutoff, except IS sophistication (AVE = 0.2). However, the IS sophistication dimensions were found to have adequate convergent validity based on their high composite reliability (>0.70).

Reliability of measures

The reliability of the construct items is the final stage in determining construct validity. A composite alpha value is a measure of internal consistency or composite dependability. This value was used to evaluate the ten constructs’ dependability. Construct reliability coefficients should all exceed the 0.70 lower limits. The composite reliability and Cronbach’s alpha values for the studied constructs were computed by SmartPLS and ranged from 0.690 to 0.830 and 0.255 to 0.5, respectively. From the Table 4 it is clear that the variables used in this research were reliable since they obtained composite reliability and Cronbach’s alpha values greater than 0.5. All values fall within the acceptable range to conclude good reliability.

Discriminant validity

To measure discriminant validity, we used the Heterotrait-Monotrait Ratio (HTMT). HTMT criterion. It examines the findings of the Heterotrait-Monotrait ratio of correlations (HTMT) criterion (Table 6), the cross-loadings of each item in the constructs (Table 2), and the estimated square root of average variance extracted (AVE) for all constructs (Table 4).

The fornell-larcker criterion

Table 5 represents the results of the Fornell-Larcker criterion. The square root of AVE of the latent variable should be more than other correlation values among the latent variables. For example, the latent variable knowledge AVE is 0.116 (Table 4); hence, its square root becomes 0.3. This number is larger than the correlation values in the knowledge column (Table 5) and more significant than those in the knowledge row (0.220). A similar observation is also made for the latent variable of attitude and practices. The results indicate that discriminant validity is well established.

Heterotrait menotrait ratio (HTMT)

The correlation of indicators within the same notion refers to measuring distinct phenomena via indicators. Smart PLS3 software was used to estimate the Heterotrait Menotrait ratio (HTMT). The threshold value of HTMT was found to be <1. The HTMT results revealed that all the values were substantially different from 1. The HTMT ratio of correlation in Table 6 shows that all values are below the threshold of 0.85, indicating that the reflective constructs are discriminately valid.
Cross-loadings

All the constructs’ elements were weighted more heavily on their respective constructs. As a result, concept discriminant validity was sufficient.

Average variance extracted (AVE)

The average commonality is used to assess the reflective construct’s convergent validity (average variance extracted). It should be greater than 0.5 to be considered suitable. The AVE for each latent factor was more significant than the squared correlation between the factors, indicating discriminant validity.\[46\]

Goodness-of-fit indices

The SRMR is an index that measures the average of standardized residuals between observed and hypothesized covariance matrices and is an estimated measure of model fit. The estimated model has a good fit when SRMR = 0.08, with a smaller SRMR showing a better fit. Table 7 presents that value of SRMR was 0.073, indicating that it fit well, while the chi-square was 1101.74 and the NFI was 0.239.

The values for SRMR, dULS, and dG in the “Estimated Model” column for the assessment use the guidelines stated earlier. The SRMR value in our model is 0.086, which is slightly higher than the 0.08 criterion, showing a poor theoretical model fit.

Standardized root means square residual (SRMR)

We calculated and presented the results using the model evaluation findings as a guide. The An SRMR of 0 implies a perfect fit, and an SRMR value of less than 0.05 suggests an adequate fit.\[47\] SRMR value of 0.08 or lower is acceptable. A value significantly greater than 0.08 suggests the absence of fit. Some studies use a more lenient cutoff of less than 0.10. The lower the SRMR, the
more accurate the model. When SRMR is zero, the ideal fit is realized. An SRMR of 0.08 or less is considered acceptable. A score much more than 0.08 indicates a lack of fit. Others choose a softer cutoff of less than 0.10.

**Normed fit index (NFI)**

The Bentler-Bonett index, known as the normed fit index (NFI) is an incremental fit metric that computes the proposed model’s chi-square value and compares it to a meaningful benchmark, measuring how well something fits. NFI values greater than 0.9 indicate a good match and are deemed acceptable for factor models. The NFI levels for composite models have yet to be specified. The NFI is rarely used and should be implemented with caution when comparing models because it does not penalize increasing parameters.

**D_ULS and D_G**

According to, dLS and dG are two distinct methods for calculating this discrepancy. The lower the dULS, the more accurate the model. The geodesic (dG) inconsistency was 0.516, indicating that the model in this investigation is better suited.

**Conclusion**

This study investigated red meat handlers’ food safety KAPs in the DMCB. The results found that food safety knowledge has a significant and favorable impact on attitudes toward food safety. Additionally, attitudes regarding food safety and practices were strongly and positively interrelated. However, food handlers in Bangladesh have insufficient food safety knowledge and practices. They need to improve their expertise, increase secondary education attainment, gain more work experience, and more working hours per day, increase training, and raise income. These factors are linked to better food safety awareness among meat handlers in Bangladesh. Red meat handlers have enough food safety knowledge but do not convert it into tight hygienic standards of food processing and handling. Food handlers have an important role in preventing food contamination that can develop into foodborne disease outbreaks. Food handlers who work with red meat in the DMCB must handle meat properly to avoid food contamination. This study aimed to evaluate the knowledge, attitudes, and food handling practices regarding food safety and personal hygiene among food handlers at DMCB. Training programs must be institutionalized with specific guidelines that covering food safety and meat hygiene topics to educate meat handlers better. Finally, to reduce foodborne infections and diseases in Bangladesh, intervention and longitudinal studies including large, diverse samples of Bangladeshi meat handlers, are needed to investigate characteristics associated with their food safety knowledge and practices.
Limitations of the study

Our study has limitations due to the limits of food safety knowledge questionnaires, and only a few KAP items were included in this study. This study considers certain limitations when interpreting the findings because of the small sample size and a lack of KAP questions. The first was the intrinsic limitation of the cross-sectional sample, which prevents the formation of cause-effect correlations, and the second was the possibility of social desirability bias. Furthermore, because it was self-reported, this study did not provide a complete picture of the country, necessitating additional micro-level research that considers other aspects of food safety concerns.

Abbreviations

KAP: Knowledge, attitude, and practice; FBD: Foodborne diseases; SD: Standard deviation; DMCB: Dhaka Megacity of Bangladesh; PLS-SEM: Partial least square structural equation modeling.

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Availability of data and materials

The data used in this study are included in the article. We cannot provide a STATA file of the data because the file comprises some other data that have not yet been published. A portion of the data can be provided upon request to the corresponding author.

Disclosure statement

The authors declare there is not conflict of interest.

Authors ‘contributions

PKS created the data gathering instruments, coordinated and oversaw the data collection, performed and analyzed the data, and assessed and wrote the manuscript. MJA evaluated the quality of the analyses and gave feedback on the draft manuscript. IAB reviewed, re-written and gave feedback on the manuscript. All authors read and approved the final manuscript.

Ethics approval and consent to participate

Data were collected and analyzed anonymously. The researcher(s) received verbal consent to participate from each respondent before starting the interviews.

Ethical issues

Ethical approval for this research was obtained from the “Ethical Standard Review Committee” (No. ESRC-BAURES-ECON-28/2022) of the Bangladesh Agricultural University Research System (BAURES), Bangladesh. Every participant consented voluntarily and based response on their knowledge. The questionnaire was anonymous, and the collected data was kept confidential.

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