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Research article

The effects of Covid-19 pandemic on food safety between Indonesia and Bangladesh: A comparative study

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ABSTRACT

The recently emerged Covid-19 pandemic is greatly impacting every corner of human society throughout the world including human health. This study aimed to provide important insights into the response of food safety system on the perspective of preventing Covid-19 pandemic effect. A survey was conducted in Indonesia and Bangladesh to collect information from food companies about food safety preparedness associated with Covid-19, priorities in the prevention of pandemic effect on food companies, and the effect of the pandemic on the food supply chain. Hygiene and the use of masks and gloves are the two most significant attributes to prevent and combat the pandemic situation in terms of food safety, effective distance maintenance between persons, and restrain or limit visits to the object are considered as attributes with less significance. The retail part of the food supply chain was figured out as mainly affected by the pandemic as opposed to food storage was identified as least affected. The development of attitude in the food sector that not to compromise food safety at any moment is the strength to combat the pandemic crisis to retain the food safety standard globally.

1. Introduction

The novel coronavirus disease 2019 also shortly known as Covid-19, has spread rapidly all over the world and gave rise to a tremendous threat to global public health (Hu et al., 2021). On January 30th 2020, the World Health Organization (WHO) declared a public health emergency of international concern due to the novel coronavirus outbreak (EET, 2020) and on February 11th of the same year, Covid-19 was officially named as severe acute respiratory syndrome coronavirus 2 or SARS-CoV-2 (Coronaviridae Study Group of the International Committee on Taxonomy of Viruses, 2020). By the 3rd week of February 2022, the uncontrolled spread of coronavirus resulted in over 422 million confirmed cases with more than 5.8 million deaths worldwide (World Health Organization, 2022). As of 20 Feb 2022, almost 5,197,505 confirmed Covid-19 cases in Indonesia and 1,933,291 in Bangladesh have been reported (Figure 1). The impacts of Covid-19 experienced in all dimensions of life include interruption of livelihoods, destroying the supply chain system, limited access to medical facilities, and also weakened social protection (IFPRI, 2020).

The continuous supply of safe food raises due to the estimation of the human population to reach ten billion next 30 years (Ma et al., 2021). It is a vital aspect of global public health due to the intake of safe and nutritious food instigates the immunity system to fight against foreign bodies like diseases. Since Covid-19 is not a foodborne disease, however, there have other secondary consequences on food safety. The health of workers involved in the food supply chain is important for safe food production to keep active the food supply chain until consumers. Many people are involved in the food supply chain, for example, raw materials suppliers, food processing workers, distributors, wholesalers, retail vendors, and different authorities where the lockdown and rapid spread of Covid-19 have tangled the entire supply chain from primary production to consumption (Galanakis, 2020, Charlebois and Music, 2021; Han et al., 2021; Raptou et al., 2022). Availability and access to safe food are most vulnerable during a pandemic due to multiple factors, different bodies, many people, and issues of public health that are directly connected with the entire food supply chain. Moreover, the national public health agency of the United State of America (USA), the Centers for

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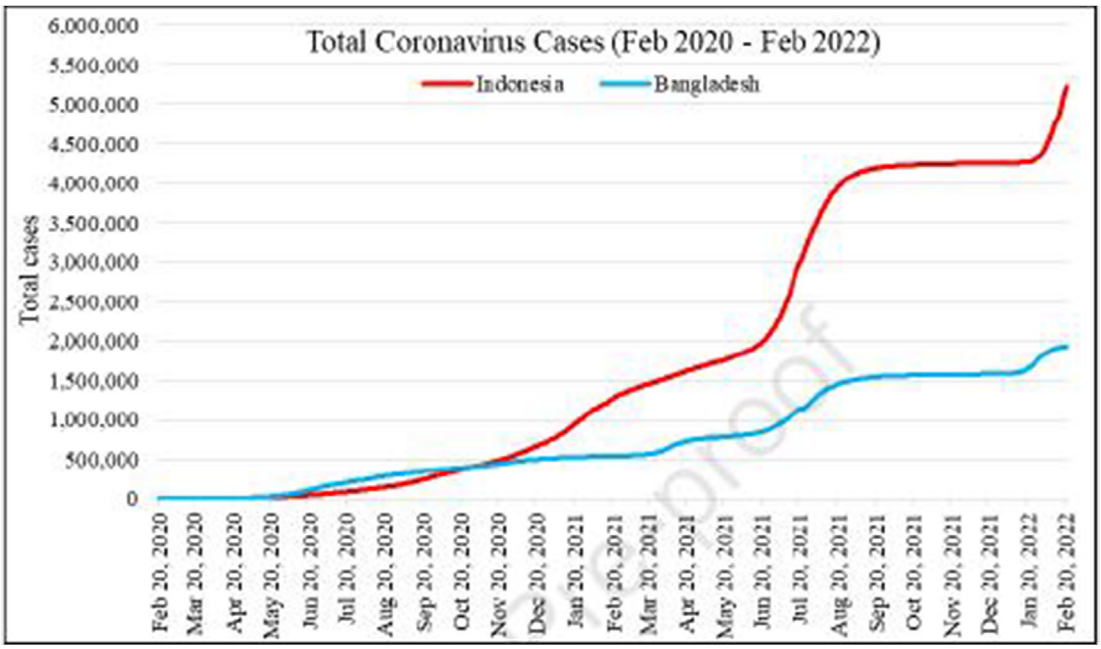

Figure 1. Total Covid-19 cases in Indonesian and Bangladesh from 2020 to 2022 (Source: Worldometer, 2022).

Disease Control and Prevention (CDC), reported numerous cases and deaths caused by coronavirus among the food workers in the USA and the potential risk factors for infections included crowded living, less physical distancing in workplace and transportation conditions (Centers for Disease Control and Prevention, 2020a; Centers for Disease Control and Prevention, 2020c).

Within the food supply chain, there are numerous standards to ensure the hygiene and safety of all food products. The food safety management systems (FSMS) have evolved from the commencement of good hygiene practices (GHP) and the implementation of hazard analysis and critical control point (HACCP) principles to ensure proper food hygiene (Codex Alimentarius Commission, 2003). Food companies are responsible to implement the food safety management standards while the regulatory bodies are responsible for investigating and assessing the effectiveness (Lee et al., 2021).

Two of the more populous Asian nations are Indonesia and Bangladesh, and they are also among those countries where the Covid-19 is having the greatest impact in terms of total cases, deaths, and pandemic effects. Since the pandemic started, the overall food safety and food supply chain has been disrupted severely. However, there is still a dearth of information that is directly associated with the effect of Covid-19 on food safety and supply chain. In this study, the survey aimed to investigate the effect of Covid-19 by the response of different food companies from two different countries concerning food safety, emergency preparedness, and food supply chain. The results were distributed to different categories – business operation country, type of food business, size of the food company, and food safety management system. This study's findings are intended to shed insight on ongoing studies on food safety in pandemic situations.

2. Materials and methods

2.1. Survey and data collection

The data used to analyze the effect of Covid-19 on the food industry were accumulated from the commercial food establishments in Indonesia and Bangladesh in the period from August to October 2021. The criteria for food industries involved in this survey were they operate at least a single section of the food supply chain, for example, primary production of food, product processing, storage, distribution, and transportation, wholesale or retails of the food origin of animal source or plant source or both.

A questionnaire has been used for the survey that was developed primarily in English language and was translated to the local languages of the participated countries (Bengali language for the Bangladesh part and Indonesian language for the Indonesian part). The translation process was accomplished in several steps that include forward translation by two translators from the source language to the target language, reviewing the instrument by a bilingual expert group, back translation, pretesting the instrument, and the formation of the final version of the instrument (Kalfoss, 2019).

In this study, convenience sampling was used as it is a widely used method, and the sample size according to its availability and accessibility (Elfil and Negida, 2017). Due to the Covid-19 pandemic situation, it was difficult to access the food companies and some of them were unwilling to participate as the guidelines or regulations from the authority were changing rapidly. Thus, the participation of food companies in this study is based on volunteering or willingness to respond to the developed questionnaire which was created for data collection. The questionnaire was supplied to the food industry by using online platform and asking them to answer the questionnaire form.

2.2. Questionnaire development

A survey questionnaire has been prepared to contain the sets of questions related to the opinion of food companies about the Covid-19 pandemic, food safety attributes, and weak points in the overall food supply chain.

The item validity was tested involving a separate sample consisting of 30 respondents from similar companies. Item validity was determined based on the Pearson correlation between the item to the total answers and then compared to the r-table at df = 28 (n-2) and 95% CI. There were 60 questions in the instrument before the validity test. Among 60 items, 19 items dropped out (Pearson correlation score was less than (<) r-table) so 49 valid questions were obtained.

The instrument reliability test was also conducted to measure answer consistency among respondents based on the Cronbach Alpha score. In this study, the Cronbach Alpha score obtained is 0.868 or >0.7 (Nunnally and Bernstein, 1994) so the instrument was interpreted as sufficiently reliable.

Table 1. List of food safety attributes related to Coviv-19 used for BWS analysis.

Food safety attributes related to Coviv-19
Hygiene of the object
Staff awareness
Frequent hand washing
Health regulations from WHO/government
Temperature checking of workers
Sufficient stock of gloves, masks, sanitizers and cleaning chemicals
Maintaining physical distance
Use of masks and gloves
Limit/restrain visits to the object

Note: List of attributes prepared as requirement of GHP and recommendation from WHO (British Retail Consortium, 2018; IFS, 2017; ISO, 2018; Codex Alimentarius Commission, 2003; World Health Organization, 2020b; World Health Organization, 2020c; World Health Organization, 2020d)s.

The first part of the questionnaire was about the company information such as origin country, size of company, type of food business, and food safety standards in place. The following part of the questionnaire consisted of questions associated with safety preparedness during the pandemic. There were options to rate the degree of agreement with the statements according to the Likert scale from 1 = "strongly disagree", 2 = "disagree", 3 = "no opinion", 4 = "agree" to 5 = "strongly agree".

The 3rd part of the questionnaire was focused on priorities in the prevention of pandemic effects in food companies which was analyzed by the Best-Worst scale (BWS) where 'best' = "most influential" and 'worst' = "least influential" on nine attributes associated with Covid-19. The choice of attributes (Table 1) for Best-Worst scaling was made with the outline of good hygiene practices and guidelines from the World Health Organization (WHO). We created seven subsets (Figure 2) containing 4 attributes in each for the Best-Worst scaling (Merlino et al., 2018; Djekic et al., 2021).

The fourth part of the questionnaire was an investigation to identify mostly affected food safety system within the entire supply chain due to the pandemic containing 6 sectors (Figure 3).

2.3. Data analysis

The BWS was analyzed as described by Wittenberg et al. (2016) represented in the equation below:

$$\text{BWS} = \frac{N_B - N_W}{a \times p} \quad (1)$$

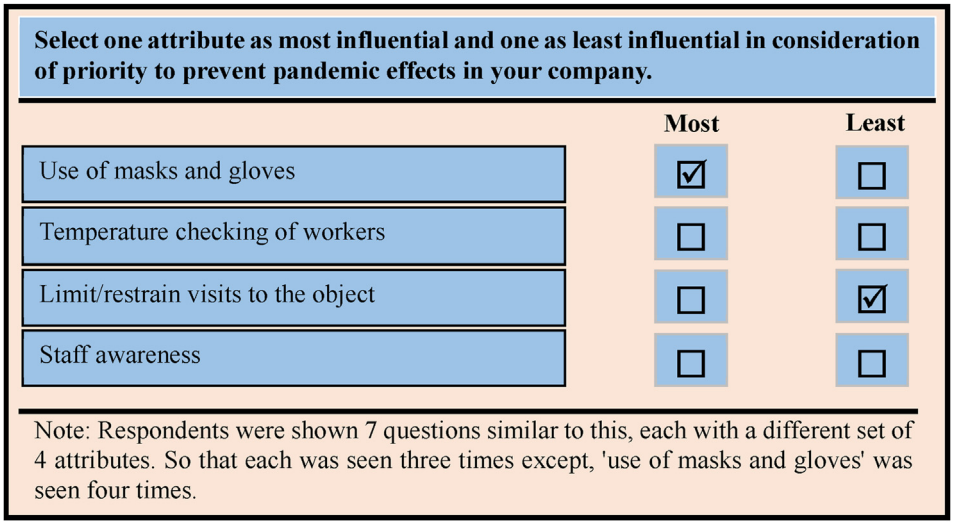

Figure 2. Sample of questions from the survey, the subset containing 4 attributes.

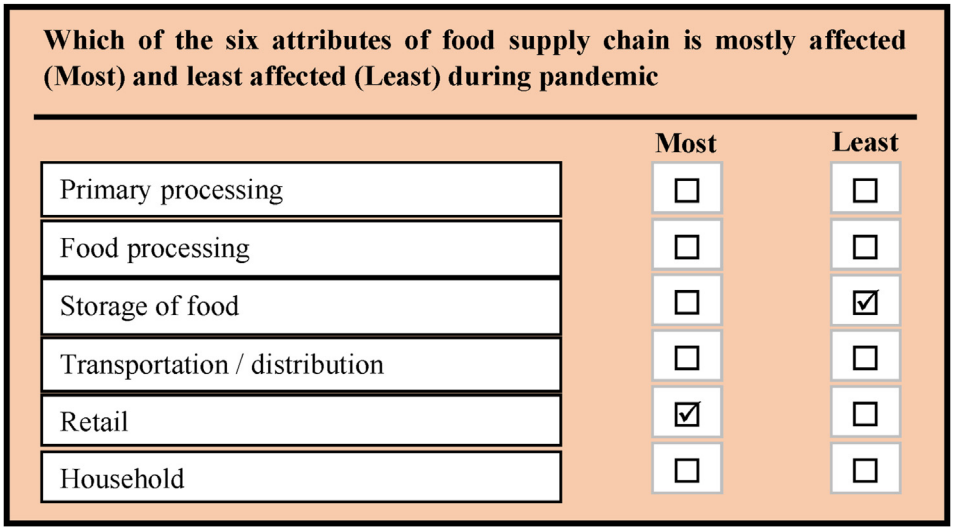

Figure 3. Six attributes of food supply chain is that affected during the pandemic.

Table 2. Characteristics of food companies (n = 45).

Food company characteristics	Overall (%)	Indonesia (n = 23)	Bangladesh (n = 22)
Size of the company			
Small (<50 employees)	18 (40)	15 (65.2)	3 (13.6)
Medium (51–250 employees)	11 (24.4)	3 (13)	8 (36.4)
Big (>250 employees)	16 (35.6)	5 (21.7)	11 (50)
Category of food business			
Animal origin food company	15 (33.3)	10 (43.5)	5 (22.7)
Plant origin food company	17 (37.8)	9 (39.1)	8 (36.4)
Service based food company	13 (28.9)	4 (17.4)	9 (40.9)
Status of FSMS in the company			
Standard FSMS	17 (37.8)	8 (34.8)	9 (40.9)
HACCP based food safety system	12 (26.7)	2 (8.7)	10 (45.5)
No standard FSMS	16 (35.6)	13 (56.5)	3 (13.6)
Area of business			
Both (domestic and export)	11 (24.4)	5 (21.7)	6 (27.3)
Only domestic (no export)	33 (73.3)	18 (78.3)	15 (68.2)
Only export	1 (2.2)	0 (0)	1 (4.5)

Legends: n = number of companies.

Where N_B = total count of 'Best'; N_W = total count of 'Worst'; a = count of availability in all 7 sets; p = total count of participants. The same procedure was also followed for identifying the attribute of the entire food supply chain that was affected by Covid-19. A two-step cluster analysis procedure was used to make clusters of food safety statements and the companies based on FSMS in place. Statistical significance difference was analyzed by the Kruskal-Wallis H test while the significance level was set at 0.05 (Djekic et al., 2021).

2.4. Ethics

This research followed the ethical guidelines established by the Committee on Publication Ethics and was approved by the review board of Ethics Committee of the Faculty of Public Health, Airlangga University (reference no. 172/EA/KEPK/2022). The participation of respondents was based on willingness to participate in this study and informed consent was obtained from all the participants.

3. Results

3.1. Characteristics of food companies

The brief information on the food establishments which responded to this study is presented in Table 2. A total of 45 companies participated in this study, by answering the survey questionnaire, from Indonesia (51.1%) and Bangladesh (48.9%). The companies were categorized into three groups based on the number of employees; small companies with 1–50 employees (40%), medium-sized companies with 51–250 employees (24.4%), and big companies with over 250 employees (35.6%). The persons who answered the questionnaire for this survey involved business owners, HACCP personnel, production manager or production officer, and others (Figure 4).

Among the companies, the highest numbers are doing business on plant origin (37.8%) food business (primary production, processing, etc.), followed by animal origin food supply chain (33.3%) and some are operating business of food service (storage, distribution, retail, etc.) represents 28.9%. Regardless of the type of food business, 73.3% of companies maintain food supply chain only for domestic consumers while 24.4% of companies maintain food supply chain for both domestic and export purposes, and 2.2% conduct food business only for export to other countries. Continuous supply of safe food is one of the vital factors of global public health, thus we asked about the existing standard food safety system in the food companies. Concerning food safety and hygiene standards, 37.8% of companies have certified FSMS from recognized food safety standards like BRC, GlobalGAP, FSSC, etc. and 26.7% of food companies implemented the HACCP system. However, most importantly 35.5% of companies have no standard of FSMS.

3.2. Food safety statements connected to FSMS and Covid-19

The second part of the questionnaire consisted of some associated with safety preparedness during the pandemic. The Likert scale from 1 'strongly disagree', 2 'disagree', 3 'no opinion', 4 'agree' to 5 'strongly agree' were used to rate the degree of agreement with the statements. Based on the Likert scale (Table 3), food companies from both Indonesia and Bangladesh reported that they had to buy more face masks, hand gloves, other protective clothing, etc. as recommended personal protective equipment (PPE) due to the pandemic (4.2). They also stated that however the pandemic situation, food safety was not compromised at any

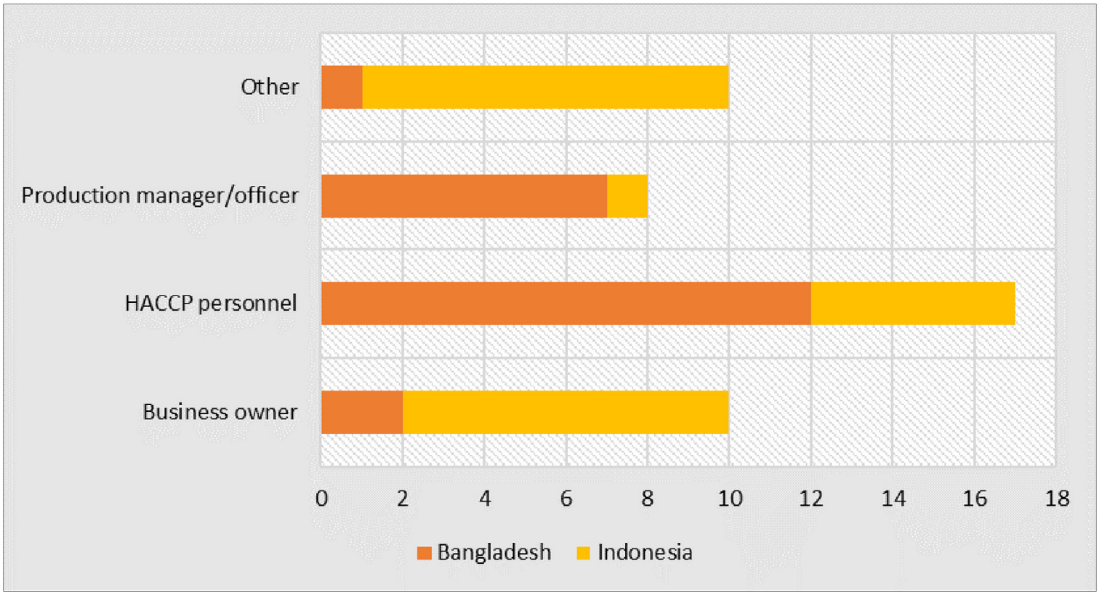

Figure 4. The persons from food companies answered the questionnaire in this survey.

Table 3. Profile of food establishments responded to this study and food safety statements.

Company characteristics		Cluster 1 (n = 14)	Cluster 2 (n = 14)	Cluster 3 (n = 17)	Total (n = 45)
Country	Indonesia	11 (47.8)	7 (30.4)	5 (21.7)	23 (100)
	Bangladesh	3 (13.6)	7 (31.8)	12 (54.5)	22 (100)
Size	1–50	8 (44.4)	6 (33.3)	4 (22.2)	18 (100)
	51–250	4 (36.4)	4 (36.4)	3 (27.3)	11 (100)
	>250	2 (12.5)	4 (25)	10 (62.5)	16 (100)
Type	Animal	7 (46.7)	3 (20)	5 (33.3)	15 (100)
	Plant	5 (29.4)	6 (35.3)	6 (35.3)	17 (100)
	Service	2 (15.4)	5 (38.5)	6 (46.2)	13 (100)
Status	FSMS	4 (23.5)	4 (23.5)	9 (52.9)	17 (100)
	HACCP	2 (16.7)	6 (50)	4 (33.3)	12 (100)
	No	8 (50)	4 (25)	4 (25)	16 (100)
FSMS statements		**Mean ± SD**	**Mean ± SD**	**Mean ± SD**	**Mean ± SD & Mode**
We treated Covid-19 pandemic as potential emergency state in our FSMS		2.9 ± 0.7^{a}	3.3 ± 0.7^{b}	4.7 ± 0.5^{c}	3.7 ± 1.0 & 4
We prepared documents related to emergency situation, preparedness and response to the threat of food safety		2.9 ± 0.9^{a}	3.5 ± 0.5^{b}	4.2 ± 0.8^{c}	3.6 ± 0.9 & 4
We arranged essential training for staff to combat Covid-19 pandemic		2.7 ± 0.9^{a}	3.6 ± 0.8^{b}	4.4 ± 0.6^{c}	3.6 ± 1.0 & 4
Food safety team was trained how to overcome pandemic situation		3.0 ± 0.9^{a}	3.5 ± 0.7^{b}	4.4 ± 0.6^{c}	3.7 ± 0.9 & 4
We had modified ours sanitation/cleaning practices related to hygiene of the object during pandemic		3.1 ± 1.1^{a}	3.9 ± 0.6^{b}	4.7 ± 0.5^{c}	4.0 ± 1.0 & 4
We have implemented more restrictive personal hygiene practices (hand washing, physical distance, …) during pandemic		3.4 ± 1.5^{a}	4.0 ± 0.6^{b}	4.8 ± 0.4^{c}	4.1 ± 1.0 & 5
We had to make additional invest for sanitation/cleaning equipment during Covid-19 pandemic		2.9 ± 1.0^{a}	3.6 ± 0.7^{b}	4.7 ± 0.6^{c}	3.8 ± 1.1 & 4
We had to buy more PPEs (masks, gloves, protective clothing) during Covid-19 pandemic		3.6 ± 0.9^{a}	4.1 ± 0.7^{b}	4.8 ± 0.4^{c}	4.2 ± 0.9 & 5
We considered food safety as our top priority during pandemic		3.1 ± 0.9^{a}	3.9 ± 0.5^{b}	4.9 ± 0.3^{c}	4.0 ± 1.0 & 5

SD = Standard deviation; ^{a,b,c} significant difference.

moment in their food establishment (4.0). To handle the pandemic situation, food companies agreed that they had to modify sanitation/cleaning practices related to the hygiene of the object during pandemic (4.0) during the pandemic of Covid-19 and they also installed necessary restrictive personal hygiene practices like hand washing, physical distance, use of mask, hand sanitizer, etc. (4.1). Food companies also invested more to buy additional sanitation/cleaning equipment (3.8). Some food companies arranged the training for food safety team about how to react in case of a pandemic situation (3.7) and they also additionally trained their staff (3.6) to face and overcome the pandemic situation. Few of the companies identified 'pandemic' as a potential emergency state in their FSMS (3.7). However, less response was recorded for document preparation related to an emergency, preparedness and response to the threat to food safety within their FSMS (3.6).

From the information on company characteristics, depending on the existing level of FSMS, a "two ways" cluster analysis resulted in three clusters namely "basic' (cluster 1), 'on-the-way' (cluster 2), and 'mature' (cluster 3). The first cluster (basic) consists of 14 food companies mainly from Indonesia with small in size (44.4%), operating businesses related to animal origin food (46.7%), and having no FSMS in place (50%). The second cluster (on-the-way) also consists of 14 companies mostly medium scale companies (36.4%), with a background in the food servicing business (58.5%), and the majority have HACCP system in place (50%) which originated from both Bangladesh and Indonesia. The last cluster (mature) with 17 companies mostly from Bangladesh with companies large in size (62.5%), operating a food business in food servicing (46.2%) along with plant origin food supply chain (35.3%) and mainly having standard or certified FSMS (52.9%) in place.

Based on cluster classification, the scores for all nine statements showing in Table 3. Among three clusters, the companies having standard FSMS (cluster 3) achieved the highest Likert scores on all statements related to food safety management systems and pandemic issues compared to the companies with no FSMS (cluster 1) which had the lowest scores. The scores between the clusters were significantly different ($p < 0.05$).

3.3. Best-Worst scales

The Best-Worst score was calculated by counting the differences between frequencies of an attribute being chosen as best (most influential) vs worst (least influential) divided by the availability of each attribute. The BWS of each attribute for each cluster and the overall sample is represented in Table 4. From the overall responses, 'hygiene of the object' (0.096) was identified as the most important food safety attribute, followed by 'use of masks and gloves' (0.078). Within the clusters, 'use of masks and gloves' had the highest BWS (0.161) in cluster 2 compared to the lowest score (−0.036) in cluster 1 while, 'hygiene of the object' scored the highest (0.167) in cluster 1 compared to cluster 3 with the lowest score (0.020). Another important attribute was 'health regulations from WHO/government' as it scored 0.052 on average followed by 'sufficient stock of gloves, masks, sanitizers and cleaning chemicals' with a comparatively lower score of 0.007. Among the clusters, the highest score of 'health regulations from WHO/government' was from cluster 3 (0.098) and the lowest from the on-the-way cluster (−0.048) on the other hand cluster 2 (0.024) responded more effectively to 'sufficient stock of gloves, masks, sanitizers and cleaning chemicals' compared to other two clusters.

Some attributes were recognized as limited resilience by the food companies. 'Physical distance between workers' was identified as the least resilience among the attributes (−0.111). All three clusters showed less importance to maintain physical distance between the workers in place. In this study, the average score for 'Temperature checking of workers' and 'Staff awareness' were -0.015 and -0.030 respectively. The 'mature cluster' had a higher score of 'temperature checking of workers' (0.078) compared to the lowest score in the 'basic cluster' (−0.015); on the other hand, the 'on-the-way cluster' showed the highest score (0.071)

Table 4. Priority of attributes in the prevention of pandemic effect in food companies.

Attributes	Frequency of Best	Frequency of Worst	BWS Average	BWS Cluster 1	BWS Cluster 2	BWS Cluster 3
Hygiene of the object	46	33	0.096	0.167	0.119	0.020
Health regulations from WHO/government	39	32	0.052	0.095	-0.048	0.098
Staff awareness	32	36	-0.030	-0.071	0.071	-0.078
Frequent hand washing	32	37	-0.037	0.024	-0.071	-0.059
Sufficient stock of gloves, masks, sanitizers and cleaning chemicals	34	33	0.007	0.000	0.024	0.000
Use of masks and gloves	44	30	0.078	-0.036	0.161	0.103
Physical distance between workers	26	41	-0.111	-0.071	-0.19	-0.078
Temperature checking of workers	33	35	-0.015	-0.119	-0.024	0.078
Limit/restrain visits to the object	29	38	-0.067	0.024	-0.095	-0.118

Table 5. Priority of attributes in the prevention of pandemic effect in the entire food supply chain.

Attributes	Frequency of most affected	Frequency of least affected	BWS Average	BWS Cluster 1	BWS Cluster 2	BWS Cluster 3
Primary stage	9	5	0.089	0.143	0.000	0.118
Food processing	9	6	0.067	0.071	0.143	0.000
Transport/distribution	7	6	0.022	0.071	-0.143	0.118
Storage	2	13	-0.244	-0.214	-0.143	-0.353
Retail	13	5	0.178	0.143	0.071	0.294
Household	5	10	-0.111	-0.214	0.071	-0.176

for the attribute 'staff awareness'. Other attributes 'frequent hand washing' and 'limit/restrain visits to the object' also had less salience with an average score of -0.037 and -0.067 respectively. From the cluster classification, cluster 1 had the highest average score of 0.024 for both 'frequent hand washing' and 'limit/restrain visits to the object' comparatively cluster 3 had the lowest score (−0.118) for 'limit/restrain visits to the object' and cluster 2 had the lowest score (−0.071) for 'frequent hand washing'.

Best-worst scale was used to investigate to identify the most affected food safety system within the entire food supply chain because of the Covid-19 pandemic. Table 5 depicts the average score for most or least affected attributes for the entire sample and per cluster. Considering the responses from all food companies, the "retail' part of the food supply chain was recognized as the 'most affected' food safety system during the Covid-19 situation (0.178). Among the clusters, the highest score was in cluster 3 (0.294) compared to the lowest score in cluster 2 (0.071). On the other hand, "storage" was ascertained as the 'least affected' food safety system in food supply chain (−0.244). Other parts of the food supply chain were also affected slightly in terms of food safety systems such as primary processing (0.089) of food, food processing (0.067), and transportation and distribution (0.022) of food. Our study also shows that 'household' had also not affected in terms of food safety system during the pandemic (−0.111).

4. Discussion

As all consumers have the right to expect safe and high quality food, it is necessary to ensure the establishment of food safety system in the entire food supply chain (Panghal et al., 2017). Government, related bodies, and food companies are jointly responsible to ensure the implementation of food safety practices as it is a significant global issue that is closely related to foodborne diseases, food security, public health, and economics (da Cunha, 2021; Fung et al., 2018).

Implementation of hygiene control within food establishments is essential to control and prevent the cross-contamination of pathogens and biohazards. However, it is reassuring to say that there is no scientific report on Covid-19 transmission or Covid-19 related public health issues due to food consumption or food materials (Centers for Disease Control and Prevention, 2020b; Nakat and Bou-Mitri, 2021; World Health Organization, 2020b). The Covid-19 pandemic exposed inequities and inequalities in the entire food system which resulted in significant changes in working condition, food safety practices and responsibilities (Rossiter and Godderis, 2020). In such conditions, additional training was important to overcome the pandemic issue as it was also proposed by the BRC guide during the pandemic (BRCGS, 2020; Djekic et al., 2021). Mohammadi-Nasrabadi et al. (2021) also reported food safety training intervention among food handlers during the Covid-19 pandemic.

The Best-Worst scale methodology was used to analyze the responses on food safety attributes related to Covid-19 which focused on priorities in the prevention of pandemic effects in food companies. For easier explanation, the BWS scores indicate the salience or strength of influence of the priority attribute where "0" represented no salience and towards "±1.0" indicated the increasing or reducing salience (Wittenberg et al., 2016).

One of the reasons behind the attribute 'Hygiene of the object' is recognized as most influential due to the early Covid spreading pattern as people related to food service were among the first workers in frontline employment sectors experiencing the impact of the Covid-19 (Olaimat et al., 2020). Despite this, the dearth of research and availability of misconceptions, myths or false news make people believe that coronavirus can be spread by objects or foods (Sahoo et al., 2020; Dakhode et al., 2021; Yekta et al., 2021). This may also affect the respondents to choose "Hygiene of the object" as the top priority attribute in the prevention of pandemic effect in food companies. However, there is no report of the spreading Covid by food or food packaging or consumption of food (Desai and Aronoff, 2020; European Food Safety Authority, 2020; Olaimat et al., 2020; World Health Organization, 2020a). As the primary transmission of SARS-CoV-2 from person to person occurs through respiratory droplets that enter the human body either the mouth and nose or eyes by contaminated hands (Desai and Aronoff, 2020), therefore, the use of PPEs such as masks, hand gloves, and face shield (Nakat and Bou-Mitri, 2021) combined with wearing orderly workwear (worn on-site and laundered regularly) is repeatedly emphasized in several Covid-19 pandemic guidelines (BRCGS, 2020; World Health Organization, 2020b). Due to the newly evolved pandemic situation with a lack of knowledge, it was recommended to follow the updated regulations from

WHO or the government as they directed necessary safety guidelines for food and human health (World Health Organization, 2020b).

As for low responses from the companies to follow health regulations from WHO/government or less stock of gloves, masks, sanitizers, and cleaning chemicals, there are some potential reasons behind the low adherence. The Covid-19 pandemic accompanied by rumors and false-misleading information especially on social media slightly damage the value of guidelines from health regulatory bodies or government, so social media also launched a program to spread accurate and scientifically proven information and to prevent rumors on the Covid-19 (Tasnim et al., 2020; van der Linden et al., 2020). The WHO has issued several methods to prevent Covid-19 transmission including social distance and physical distance at the workplace (World Health Organization, 2020b). The physical distance of 1 m at the workplace with proper use of PPEs recognized as an effective measure to reduce the Covid-19 transmission rate among food workers (Djekic et al., 2021). However, prolonged practice of work environment without maintaining distance or isolation of workers from general people followed by less practice of physical distance may affect the response in this study.

Regular temperature checking was considered one of the best ways to reduce contagion as high temperature is a typical symptom of Covid-19 (World Health Organization, 2020b). However, Stave et al. (2021) reported that worksite temperature checking was ineffective for Covid-19 detection among workers and is not recommended. Similar findings were reported by Nuertey et al. (2021), that temperature screening is not worthwhile and they recommended the use of mask, hand hygiene, and social distance. To minimize the secondary infection of Covid-19 it is strongly recommended to prevent human-to-human Coronavirus transmission (Lai et al., 2020). It is also recommended to have enough sealed bins/bags or separate lockers at the workplace to maintain personal safety to prevent cross-contamination. Besides increasing staff awareness it's also recommended by the different regulatory bodies of occupational health safety that the workplace must be prepared to effectively control Covid-19 to ensure occupational safety and health (Occupational Safety and Health Administration, 2020).

Burgos and Ivanov (2021) examined the impact of the Covid-19 pandemic on retail supply chains and they reported that retail supply chains were highly affected whenever surges in demand and supplier shutdowns. Overall small to medium-sized companies and the farmers or primary producers in developing countries are mostly affected by the Covid-19 pandemic (Reardon et al., 2020). Transportation and distribution of food are also crucial parts of food supply chain due to maintaining food safety, especially for the foods like fish-meat, or vegetables-fruits with low shelf-life (Galanakis, 2020). Moreover, multiple factors associated with transportation and distribution of food like tax and trade policies, food availability, food price, etc.; in this context, FAO has suggested for priority-based uninterrupted transportation, regular import of food items, and availability of staple foods during the emergency due to Covid-19 pandemic (Food and Agriculture Organization, 2020a; Food and Agriculture Organization, 2021). Overall food supply chain requires adjusting with a different approach associated with updated safety measures during the Covid-19 pandemic.

5. Conclusion

Undoubtedly, the Covid-19 pandemic crisis has created another period in food safety, and the entire supply chain. This study shows the food safety status and responses of the food safety system in food companies during the Covid-19 pandemic in two populated countries in Asia. It has been confirmed that the food establishments with standard FSMS have installed severe measures to prevent and combat the pandemic situation. However, 35.5% of companies have no standard of FSMS which may significantly affect the food safety supply chain, and be a potential threat to public health. Hygiene and the use of personal protective equipment like masks and gloves are the most significant attributes that evolved from the current pandemic associated with safe food as well as public health. Contrariwise, maintaining distance between persons at the workplace and limit/restrain visits to the object have been considered as the less important attributes by the food companies. However, the food companies also confirm they have implemented more essential personal hygiene practices than ever to ensure food safety during pandemic. Moreover, the retail part of the entire supply chain was severely affected during the pandemic. Besides all the obstacles, considering food safety as the top priority and developing this attitude in the food sector is the strength to combat the pandemic crisis. The government, related bodies, and food companies have combined responsibility to ensure the practice and implementation of food safety. The limitation of this study was focused on food companies' responses with no on-site assessment of food safety practices in place. Future research should focus on the fruitfulness of safety systems associated with pandemics, the degree of success in the internal management during the pandemic with econometric analysis, investigation of the threats to food security, and the next steps to increase supply chain resilience in a post-pandemic era.

Declarations

Author contribution statement

Abdullah Al Mamun; Eka Rosanti; Aisy Rahmania; Monsur Ahmad; Siti Ma'rifah: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data; Wrote the paper.

Dian Afif Arifah; Khodadad Maruf: Conceived and designed the experiments; Performed the experiments; Analyzed and interpreted the data; Contributed reagents, materials, analysis tools or data.

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Data included in article/supp. material/referenced in article.

Declaration of interest's statement

The authors declare no conflict of interest.

Additional information

No additional information is available for this paper.

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