

Food safety knowledge, attitudes, and practices among online food delivery services during COVID-19 pandemic in Jabodetabek area, Indonesia

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Article history:

Received: 28 January 2022

Received in revised form: 26 March 2022

Accepted: 29 March 2022

Available Online: 31 October 2023

Keywords:

Food delivery workers,

Food handlers,

Food safety,

Sem modelling,

Online food delivery services

DOI:

[https://doi.org/10.26656/fr.2017.7\(5\).059](https://doi.org/10.26656/fr.2017.7(5).059)

Abstract

The coronavirus 2 (SARS-CoV-2) in some countries including Indonesia, has changed consumer behavior in accessing their food from direct buying from food services (i.e. food groceries, restaurants, cafes) to online buying by using an application from their smartphone. By using online food delivery services, knowledge, attitude, and practices of food handlers (FH) and food delivery workers (FDW) contributed to food safety. This study aimed to predict the food safety practices of FH and FDW by conducting a survey on their knowledge and attitude on food safety in Jakarta-Bogor-Depok-Tangerang-Bekasi (Jabodetabek) area, Indonesia. The FDW were from Gofood, Grabfood, ShopeeFood, and Kulina. The questionnaire was distributed via social media, e-commerce sites, and messenger applications to 675 respondents. The survey contained 36 questions and the data were analyzed by using the partial least squares structural equation modeling (PLS-SEM) technique. This study revealed that knowledge ($\beta = 0.311$ for FH; $\beta = 0.136$ for FDW; $p < 0.05$) and attitude ($\beta = 0.417$ for FH; $\beta = 0.342$ for FDW; $p < 0.05$) were positively correlated to good food safety practices. The study also indicated that attitude was the main variable in predicting the practices of FH and FDW. Overall, the structural model for FH has a better prediction ($R^2 = 0.374$) than that for FDW ($R^2 = 0.165$). There were gaps in food safety practices between FH and FDW that could contribute to achieving safe foods. Comprehensive knowledge through food safety campaigns, food safety training, and food safety culture for FH and especially FDW could be a strategy to strengthen food safety.

1. Introduction

The coronavirus disease 2019 (COVID-19) has caused people in the world to live in a new normal era. Since the first case of COVID-19 was confirmed in Indonesia on 2 March 2020, Indonesia started to apply social distancing. To prevent the spread of this virus, the central government of Indonesia has officially issued Government Regulation (2020) No. 21/2020 regarding large-scale social restriction (PSBB) in some areas on 31 March 2021. This regulation has limited some public activities in some sectors, which changed people's lifestyles to work from home, school from home, and pray from home. Jakarta, Bogor, Depok, Tangerang, and Bekasi (Jabodetabek) are the metropolitan areas in Indonesia which applied PSBB. As the capital city of Indonesia, Jakarta has the highest density in population

and become the center of government and business activities. Based on Statistics Indonesia (2020c), the population density in Jakarta was 15,900 citizens/km² in 2019. This city is closely connected with some cities in West Java (Bogor, Depok, Tangerang, Bekasi), hence the people's mobilization inter-city was very high. Due to the high-density population and high mobilisation, COVID-19 transmission in this area become faster. The COVID-19 National Task Force (2021) in Indonesia reported as of 7 October 2021, Jakarta has the highest total positive cases of COVID-19 (20.3%) in Indonesia, followed by West Java (16.7%).

The government's regulation to control COVID-19 also had an impact on the food business. Brazil, the country with the third-highest number of COVID-19 cases in October 2020, has applied social distancing to

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contain the disease, including the closing of restaurants, bars, and snack bars. The study by Hakim *et al.* (2021) in Brazil reported that the intention to visit restaurants during the COVID-19 pandemic was affected by consumers' risk perception and different types of trust. It was highlighted that safety and brand were important to increase consumers' intention to visit the restaurant. This phenomenon also happened in Indonesia. Social distancing regulations made consumers minimize direct buying from grocery stores, restaurants, or cafes, which affected to increase in online food delivery services. McKinsey (2020) reported that 34% of Indonesian consumers ordered more food during the pandemic through online food delivery services. This service is estimated to grow by around 11.5% every year from 2020 to 2024 in Indonesia (Aprilianti and Amanta, 2020).

Previously, food delivery services only belonged to some restaurants, which provided their driver and transportation. The ordering system mostly used phone calls, then delivered to the customers based on the address informed. Since the use of the internet and mobile phones increased, many applications appeared to fulfil consumer's daily needs. Consumers were introduced to some online applications for food delivery services since 2015 (Grab, 2016; Gojek, 2021). Those applications were third parties that connected food service, customers, and food delivery workers. Food service and food delivery workers are not the application's employees but business partners. It starts when customers order food online by using an application on their smartphone. After the order is received by food service, the application connects the driver who plays a role as FDW. FDW will deliver the food ordered by using their motorcycle to the customer. This service has provided an opportunity for small enterprise to expand their business and also provided more food choices for consumers (Alharthi and Islam, 2021).

GoFood, GrabFood, ShopeeFood, and Kulina are some examples of online food delivery services used in Indonesia. Gojek, an online application that provides GoFood, appeared for the first time as an online transportation and logistics service, then expanded to food delivery services as the demand for food increased (Vamela, 2021). Grab also launched GrabFood to expand services in food delivery (Grab, 2016). Meanwhile, ShopeeFood was the extension of Shopee, one of the big marketplaces in Indonesia (Shopee, 2021). Slightly different from the three applications, Kulina specialized in online food delivery services in Jakarta (Kulina, 2021). Gojek, which has the largest user in Indonesia, claimed that they had 750,000 food services partners in

2020, which increased 50% from the previous year. The new food services partners mainly come from small medium enterprises (SME) (Jatmiko, 2021). It also reported that the transaction amount of GoFood increased by 20% during the pandemic (Artanti, 2020). Research done by Ikram (2021) showed GoFood already become a basic need for consumers in South Jakarta, while their purchase decision was not influenced by promotion. Due to the high number of orders received, online food delivery services face new food safety challenges (FDA, 2020). The increasing amount of online food businesses and online food delivery orders during the pandemic should be supported by good practices along the food chain to ensure the food safe until ready to consume.

Access to safe foods and adequate nutrition in the new normal era is the key to sustainable development. Food safety is the most important factor which can be assured by good hygiene practices or even food safety certification. The report from Havelaar *et al.* (2015) showed that the status of food safety in Indonesia is inadequate. The National Agency of Drug and Food Control (NADFC) in Indonesia reported that food from food service was the second highest cause of foodborne illness from 2017-2019 (NADFC, 2019). More than 1 million cases of diarrhea occurred throughout Indonesia in 2018 (Ministry of Health Indonesia, 2018). The presence of pathogenic microorganisms in food is closely related to sanitation and personal hygiene practices. In food service and SME, those practices are highly dependent on FH and FDW (Purnawita *et al.*, 2020; Limon., 2021). Besides personal hygiene, improper cooking and storage practices also can contribute to foodborne illness (Arisanti *et al.*, 2018). FDW plays a vital role in keeping the food temperature and delivery time appropriate and also maintaining the storage condition and packaging cleanliness. Research done by Wu *et al.* (2018) and Azanaw *et al.* (2019) showed that lack of knowledge is the reason for improper practices in food services. Many studies have shown that attitudes toward food safety are influenced by knowledge (Kuo and Weng, 2021; Hashanuzzaman *et al.*, 2020). Liu and Niyongira (2017) reported that respondents with higher levels of education tend to be more concerned about food safety factors as compared to those with lower levels of education in Nanjing and Beijing, China.

During the COVID-19 pandemic, although there is no evidence that coronavirus is transmitted via food or food packaging, consumers give more attention to food safety. Based on the World Health Organization (WHO) and the Food and Agricultural Organization (FAO) (2020), the primary transmission route of coronavirus is

through person-to-person contact and through respiratory droplets from infected person's coughs or sneezes. The risk of virus transmission becomes higher in enclosed environments, frequently touched surfaces, and poor physical distancing. Although coronavirus needs animals or a human host to multiply, a study by Han *et al.* (2020) mentioned some cases that coronavirus found in frozen foods, packaging material, and the interior of a shipping container. This food contamination might occur through respiratory droplets from different workers and ambient environments that contact with food along the farm-to-table lifecycle. By touching their eyes, nose, and mouth after touching contaminated surfaces, a person can get COVID-19. Based on this mechanism, FDW might be the carrier for coronavirus.

Some studies have reported food safety practices among FH and FDW. Based on research conducted by Haryanti and Suryaningsih (2021), as many as 47.4% of food handlers and food presenters in Jember, Indonesia had poor knowledge of food safety and 73.8% of them had poor hygiene and sanitation practices. Good knowledge led them to better practice hygiene and sanitation. A study conducted by Muna (2016) in a campus cafeteria showed that 56.9% of food handlers have good knowledge, 58.5% have fair attitudes, and 55.4% have fair practices on food safety. Poor practice of food safety on FH was caused by a lack of hygiene facilities (apron, head cover, and hand gloves). Kim and Lee (2011) have studied sanitation management practices of FDW in Daegu and Gyeongbuk area, Korea. The result showed that their sanitation knowledge of them was low. The total score only reached 3.75 out of 7.00. Meanwhile, the total mean sanitary performance for factory workers was higher (4.58 out of 5.00). Some difficulties with delivery were delivering on time and temperature management.

The risk of foodborne illness, cross-contamination, and coronavirus transmission in online food delivery services could be minimized by applying food safety practices, specifically in FH and FDW. Based on Limon (2021), FH and FDW are important factors in ensuring food safety during preparation and delivery. They should have basic knowledge about food safety that can be received through food safety training programs, which is known as one of the keys to food safety practices (Woh *et al.*, 2016). Besides knowledge, attitudes also play a vital role towards better food safety practices (Bai *et al.*, 2014; Ruby *et al.*, 2019). A study by Nyarugwe *et al.* (2018) showed that FHs who have positive attitudes toward food safety tend to comply with hygiene and food safety requirements. Several studies have shown that food safety behaviours are positively influenced by attitudes. Good attitudes towards food safety among

hotel workers in Turkey significantly influence their behavior regarding food hygiene, cooking, preparation and storage (Baser *et al.*, 2017).

This study aimed to predict the food safety practices of FH and FDW by conducting a survey on their knowledge and attitude toward food safety in the Jakarta-Bogor-Depok-Tangerang-Bekasi (Jabodetabek) area, Indonesia during the COVID-19 pandemic. Based on this research data, the knowledge, attitude and practice (KAP) model was used to reveal the relationship between KAP among Indonesia FH and FDW. The research object of FH was food service from A and B categories based on regulation from the Ministry of Health Indonesia (2011) No. 1096/2011, which provides delivery service, while FDW were driver partners from food delivery online application (GoFood, Grabfood, ShopeeFood, and Kulina). The questionnaire was distributed to FH and FDW by using online platforms and offline. A hypothetical model from Ellinda-Patra *et al.*, (2020) was used to reveal the relationship between KAP, which are: (1) Knowledge affects food safety attitudes, (2) Attitudes affect food safety practices, and (3) Knowledge affects food safety practices.

2. Materials and methods

2.1 Research design

This research was conducted in Jabodetabek area with five steps: respondent identification, questionnaire preparation and verification, data collection, data analysis, and modelling. A cross-sectional survey that has been frequently used in food safety research from Ruby *et al.* (2019) and Ellinda-Patra *et al.* (2020) was the main reference for KAP modelling in this research. Respondents used in this research are determined by purposive sampling, with criteria: work in Jabodetabek area, food service that has a partnership with a food delivery online application, food service without food delivery online application partnership, and FDW from GoFood; GrabFood; ShopeeFood; and Kulina partners. The G* Power 3.1.9.4 software suggests that minimum sample (respondents) size based on 3 predictors, statistical power of 80%, and medium effect size ($f^2 = 0.15$) was 77 (Hair *et al.*, 2014). The number of samples was increased to 700 in order to obtain more feasible data.

In order to verify the questionnaire, it was tested on 30 respondents and improvements were made based on the responses. The verified questionnaires were then distributed online by using e-commerce sites, social media (Facebook, Twitter, LinkedIn, and Instagram), and instant messenger applications (Whatsapp and Telegram). In addition, an offline survey was conducted

by visiting home, restaurant, public area, train station, or driver shelter. As a result, 675 completed questionnaires were obtained from 91 Facebook groups; Twitter influencers; LinkedIn In influencers; food delivery business accounts on Instagram, 3 WhatsApp groups, 1 telegram group, and food delivery business account at Shopee.

2.2 Measurement of food safety knowledge, attitude and practice

The questionnaire for food safety was developed by Ellinda-Patra *et al.* (2020) and WHO (2006) for 5 keys to safer foods. In total, there were 36 questions filled out by each respondent in the questionnaire, which was composed of 6 demographic questions, 30 food safety KAP questions for FH, and 30 food safety KAP questions for FDW. The KAP questions were divided into 10 questions for each knowledge, attitudes, and practices.

Each question of the knowledge section came with three alternative responses: "I don't know", "False", and "True". Score '1' is given when a respondent answered correctly, while '0' is given if the respondent answered wrong or had no answer. The attitudes section came with 5 points likert-scale answers, from strongly agree (5) to strongly disagree (1). The food safety practices section also came with 5 points likert-scale, from always (5) to never (1). The limit score for knowledge was 5, while for attitudes and practices was 25. If respondents score above the limit for every section, it can be concluded that they have a good KAP on food safety. The formula for measuring the KAP is as follows.

$$\% \text{ KAP level on food safety} = \frac{\text{Amount of correct answers}}{\text{Total score}} \times 100\%$$

3.3 Structural equation modelling

The structural model is part of the SEM model which describes the relationship between latent variables or between the endogenous variables. This relationship is expressed through the beta (β) value which describes the direct relationship between endogenous variables. The significance level was obtained by using the bootstrapping procedure in PLS-SEM. The significance test was conducted to determine the influence of the independent variables on the dependent variables. If the $p\text{-value} < \alpha$, the independent variable has a significant effect on the dependent variable (Streukens and Leroi-Werelds, 2016).

The measurement model was evaluated based on average variance extracted (AVE), composite reliability (CR), and factor loading. The higher AVE indicates that a factor extracts more variance from the indicator. An AVE value of > 0.5 indicates that the measurement tool

better reflects the characteristics of the variables in the model (Gu *et al.*, 2019). CR shows the extent to which measurement can provide consistent results. In general, a CR value of more than 0.7 indicates that measurement tools have high consistency (Hair *et al.*, 2014). Meanwhile, factor loading is the correlation coefficient for variables and factors (Maskey *et al.*, 2018). The convergent validity is fulfilled by various conditions including factor loading must be above 0.6 (Maskey *et al.*, 2018), AVE above 0.5 or 0.7 for composite reliability (Hair *et al.*, 2014).

The measurement model was evaluated by calculating discriminant validity (DV). The discriminant validity relates to the principle that different constructs should not be correlated. A latent variable can predict indicators better than others if the correlation between latent variables and each indicator is greater than the correlation with other latent variables. The DV was calculated using the heterotrait-monotrait correlation ratio (HTMT) method. A measurement model is considered to have good discriminant validity if the HTMT ratio is less than 0.85 (Henseler *et al.*, 2015).

3.4 Statistical analysis

This study used a modified hypothetical model from Ellinda-Patra *et al.* (2020) A descriptive analysis was conducted to assess the demographic profile of the respondents. The demographic profile consists of gender, age, monthly net income, and education level. The IBM SPSS Statistics 25 was used to test the reliability of the pilot study regarding food safety knowledge, attitude, and practices by measuring Cronbach's Alpha. A statement is considered reliable when Cronbach's Alpha is > 0.6 (Ursachi *et al.*, 2015). Smart-PLS 3.0 was used to analyze the measurement and structural models. The measurement model was evaluated based on composite reliability (CR), average variance extracted (AVE), factor loading, and discriminant validity (DV). The structural model was assessed based on path analysis, significance level, coefficient of determination, and the relevance of the predictions (Hair *et al.*, 2020).

3. Results

3.1 Characteristics of respondents

Table 1 shows the demographic characteristics of FH and FDW, including area, age, gender, education level, and income. From 675 respondents participated in this research, 386 (57.19%) were FH, while 289 (42.81%) were FDW. FH mostly came from Bogor (27.72%) and Jakarta (25.91%), with age 21-30 years (54.95%), dominated by females (53.89%), highly educated (61.40% has graduated from academy/university), and income more than USD 280 per month (31.35%).

Table 1. Demographic characteristics of FH and FDW in Jabodetabek.

Characteristics	Food handlers		Food delivery workers	
	Number	%	Number	%
Location				
Bekasi	60	15.54	54	18.69
Bogor	107	27.72	51	17.65
Depok	54	13.99	49	16.96
Jakarta	100	25.91	89	30.80
Tangerang	65	16.84	46	15.92
Age (years)				
<20	21	5.47	10	3.46
21-30	211	54.95	88	30.45
31-40	88	22.92	131	45.33
41-50	43	11.20	53	18.34
51-60	21	5.47	7	2.42
Gender				
Male	178	46.11	249	86.16
Female	208	53.89	40	13.84
Educational level				
Academy/University	237	61.40	55	19.03
Tertiary school	119	30.83	188	65.05
Secondary School	18	4.66	34	11.76
Primary school	6	1.55	7	2.42
Less	6	1.55	5	1.73
Income (USD)^a				
Less than 70	73	18.91	65	22.49
More than 280	121	31.35	18	6.23
70-140	95	24.61	110	38.06
140-280	97	25.13	96	33.22

^a This paper uses the exchange rate USD 1 = IDR 14,367, the average rate between April and October 2021.

Slightly different from FH, FDW mainly came from Jakarta (30.80%), age 31-40 years, dominated by males (86.16%), has graduated from tertiary school (65.05%), and has income around USD 70-140 per month.

3.2 Food safety knowledge, attitude and practice level of food handlers and food delivery workers

Figure 1 shows the KAP level of FH and FDW during the COVID-19 pandemic. Both FH and FDW already have good knowledge, attitudes, and practices. If

compared to FH, FDW has a lower KAP level. Knowledge, attitudes, and practices of FH on food safety were between 82-84%, while knowledge and attitudes of FDW were below 80%. Although FDW had a lower knowledge and attitude level on food safety, the practice level was close to FH (above 82%). Personal hygiene, cross-contamination, cleaning and disinfection, and appropriate cooking temperature were the main concerns of food safety in this research.

3.3 Structural model

Table 2 shows the result of the measurement model for food handlers, while Table 3 is for food delivery workers. The model was constructed with knowledge, attitudes, and practices. There were 3 variables for knowledge, 5 for attitudes, and 6 for practices on FH. Besides, there were 4 variables for knowledge, 9 for attitudes, and 8 for practices on FDW. All variables presented have factor loading exceeding 0.6, AVE above 0.5, and CR above 0.7, which means those variables were valid and reliable. Based on Table 4, the HTMT ratio was below the threshold of 0.85, showing adequate discriminant validity. The results of the path analysis for

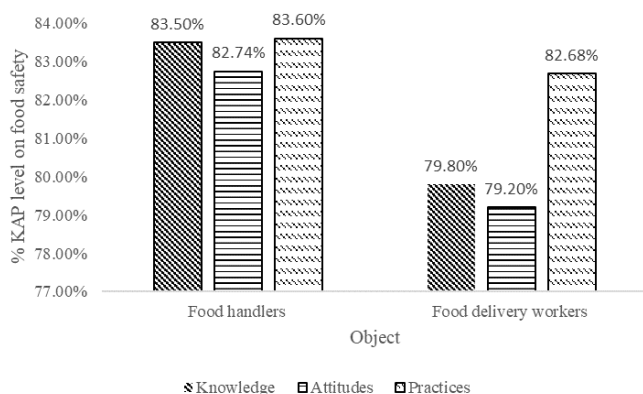


Figure 1. KAP level on food handlers and food delivery workers.

Table 2. Assessment of measurement model for food handlers.

Variable	Indicators	Loading	AVE	CR
Knowledge	12. Non-cash payments have the advantage of being able to prevent cross-contamination	0.722	0.565	0.795
	13. Cutting board can be used for raw meat and cooked meat simultaneously	0.706		
	14. Ready-to-eat food can be stored together with raw materials	0.822		
Attitude	12. I will prioritize non-cash payments because it is safer and more practical	0.788	0.566	0.866
	13. Separating ready-to-eat food from raw materials can reduce the risk of getting sick from cross-contamination	0.832		
	16. A thermometer is important to ensure meat is well cooked	0.651		
	19. Checking is important to ensure the freshness and cleanliness of raw materials	0.815		
Practices	20. I would not leave ready-to-eat food for more than 2 hours at room temperature	0.654	0.542	0.876
	12. I prioritize payment methods without direct contact with restaurant employees or customers	0.678		
	13. I use 2 cutting boards to cut fresh broccoli and boiled broccoli separately	0.720		
	14. I use 2 knives as a tool to cut fresh fish and fried fish separately	0.811		
	15. I separate raw materials and ready-to-eat food when stored in the refrigerator	0.808		
	16. I check meat by observing that the liquid that comes out is clear and the inside is not pink	0.714		
	20. I do not leave ready-to-eat food for more than 2 hours at room temperature	0.673		

Table 3. Assessment of measurement model for food delivery workers.

Variable	Indicators	Loading	AVE	CR
Knowledge	13. Ready-to-eat food, chicken porridge ready to be served, should not be allowed to sit for more than 2 hours at room temperature	0.766	0.532	0.820
	14. Ready-to-eat food, beef soup, should be kept at a temperature not less than 60°C before serving	0.713		
	18. Cleanliness of tertiary packaging is important to maintaining food quality and safety	0.756		
	20. Proper packaging is important to keep these foods safe	0.680		
Attitude	12. Payment methods without direct contact must be prioritized	0.778	0.632	0.939
	13. Foods ready to be served should not sit for more than 2 hours at room temperature	0.693		
	14. Hot food should be kept at a temperature not less than 60 ° C before serving	0.759		
	15. Clean gloves is important because it can reduce the risk of cross-contamination	0.853		
	16. Leaked or damaged primary packaging can cause cross-contamination which has the potential to cause food poisoning	0.849		
	17. Tertiary packaging (for example aluminum bags) which can prevent leaks from the outside such as rainwater is very good	0.824		
	18. Cleanliness of tertiary packaging is important in maintaining food quality and safety	0.869		
	19. Direct disinfection of food could lead to chemical contamination	0.656		
Practice	20. Proper packaging is important to prevent spilling and contamination from the air	0.845	0.529	0.899
	12. I prioritize payment methods without direct contact with restaurant employees or customers	0.699		
	13. I do not want customers to wait or leave food for more than 2 hours at room temperature	0.626		
	14. I keep my food hot at no less than 60°C before serving	0.650		
	15. I use clean gloves when I work	0.781		
	16. I ensure that food packaging does not leak before receiving and delivering	0.796		
	17. I use tertiary packaging which can withstand leakage from the outside	0.694		
	18. I keep my tertiary packaging (aluminum bag/goodie bag) clean every day	0.762		
	20. I ensure the food I receive is properly packed	0.791		

Table 4. HTMT ratio of correlations.

	Food handlers			Food delivery workers		
	Knowledge	Attitude	Practice	Knowledge	Attitude	Practice
Knowledge						
Attitude	0.564			0.389		
Practice	0.605	0.657		0.32	0.422	

FH are presented in Table 5 and Figure 2. It can be seen that knowledge positively affect food safety attitudes ($\beta = 0.398$; $p < 0.05$), attitudes positively affect food safety practices ($\beta = 0.417$; $p < 0.05$), and knowledge ($\beta = 0.311$; $p < 0.05$) positively affect food safety practices. Therefore, the above three hypotheses can be accepted. The FH model had a coefficient determination (R^2) of 0.159 and 0.374, indicating that the variables explain 15.9% of the variance in attitudes and 37.4% of the variance in practices. Generally, consumer behavior studies with R^2 values of more than 0.20 is declared to achieve a good level of predictive accuracy (Hair et al., 2014). Furthermore, the relevance of the prediction was determined by using the blindfold procedure to calculate the value of Q^2 . The measured Q^2 values were 0.086 and 0.193 for attitudes and practices suggesting that the structural model was acceptable. A structural model has an acceptable predictive power if Q^2 is more than 0 (Hair et al., 2019).

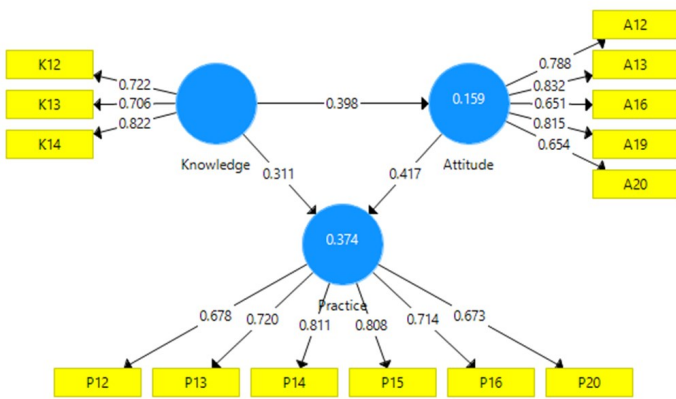


Figure 2. Structural model of food safety KAP on food handlers.

The results of the path analysis for FDW respondents are presented in Table 5 and Figure 3. It can be seen that knowledge positively affects food safety attitudes ($\beta = 0.322$; $p < 0.05$), attitudes positively affect food safety practices ($\beta = 0.342$; $p < 0.05$), and knowledge ($\beta = 0.136$; $p < 0.05$) positively affect food safety practices. Hence in the case of FDW, the three hypotheses tested can also be accepted. The FDW model has a coefficient determination (R^2) of 0.104 and 0.165, suggesting that the variables explain 10.4% of the variance in attitudes

and 16.5% of the variance in practices. Based on the results, the predictors were unfavorable because the R^2 value is less than 0.2 (Hair et al., 2014). The measured Q^2 values are 0.061 and 0.083 for attitudes and practices, respectively.

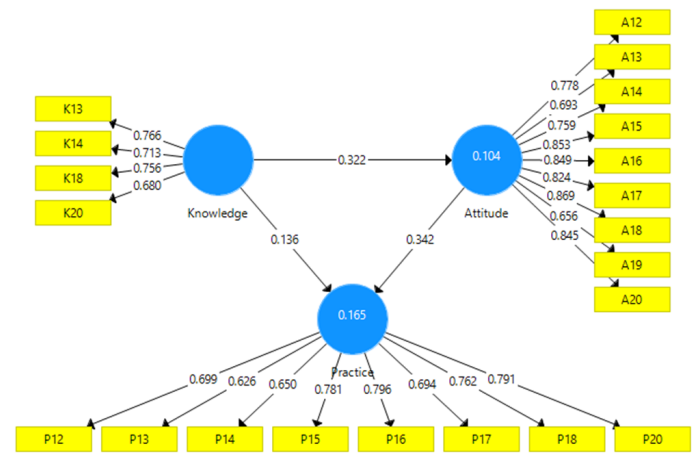


Figure 3. Structural model of food safety KAP on food delivery workers.

4. Discussion

The total area and total citizens might be affected to amount of participating respondents. Bogor has the widest area and the largest amount of citizens among all cities surveyed. Bogor has an area of around 2700 km² with approximately 7 million citizens in 2016, while Depok only has an area 200.3 km² with around 2.5 million citizens (Statistics Indonesia, 2016; Statistics Indonesia, 2018; Statistics Indonesia, 2020a). In this research, the FH was predominantly female, which is linear with the research result conducted by Ellinda-Patra et al. (2020). Meanwhile, there was a difference in data between this research and national data regarding gender workers in food and beverage activities (restaurant, catering, and food industry) in 2017. The national data reported workers were dominated by males (63.68%) than females (36.32%) in Jakarta province. West Java province also showed the same result, male workers (66.83%) were more dominant than female workers (33.17%). This difference is caused by national data not only reported percentage of FH, but also every worker

Table 5. Result of hypothesis testing for FH and FDW.

	Hypotheses	β -value	p-value	R^2	Q^2	Decision
Food handlers						
Hypothesis 1	Knowledge→Attitude	0.398	0.000	0.159	0.086	Supported
Hypothesis 2	Attitude→Practice	0.417	0.000	0.374	0.193	Supported
Hypothesis 3	Knowledge→Practice	0.311	0.000			Supported
Food delivery workers						
Hypothesis 1	Knowledge→Attitude	0.322	0.000	0.104	0.061	Supported
Hypothesis 2	Attitude→Practice	0.342	0.001	0.165	0.083	Supported
Hypothesis 3	Knowledge→Practice	0.136	0.034			Supported

related to restaurant activities, including manager, marketing, purchasing, accounting, administration, and human resources (Statistics Indonesia, 2017). Most of the FH in this research have a high income. This might be caused by the high number of online orders during the COVID-19 pandemic (Aprilianti and Amanta, 2020). The pandemic condition increased digital service, including fulfilling the consumer need for food consumption.

As shown in Table 1, FDW mainly lives in Jakarta. Besides the high number of citizens living in Jakarta, Jakarta also has higher motorcycle ownership than West Java. Based on Statistics Indonesia (2020b), there were around 16 million motorcycles in Jakarta, while in West Java only 12 million. FDWs who participated in this survey mostly ranged between 31-40 years old. This data was suitable with national data, which was reported by the Demographic Institute of FEB UI (2021), that 64% of FDW in Indonesia were of productive ages (20-39 years old). Ages above 51 years old were the lowest percentage of FDW because, during those ages, people become less productive. According to a study by Arofah and Alam (2019), women as a single parent was one of the main factors that made them work as a driver. Different from FH, most FDWs graduated from tertiary school. Data from the Demographic Institute of FEB UI (2021) also reported the same result, in which 67% of Gojek's driver was tertiary school graduates. The monthly income for FDW mostly ranges between USD 70-140. The drivers' income is not only affected by the food sector, but also by shuttle service for people, goods, and other logistics. Although online food orders increased during the pandemic, the other service was decreased because of the social distancing policy. Mallo and Nugroho (2021) reported that online transportation services (Go-Jek) decreased during the pandemic because people were advised to do daily activities at home. This phenomenon has a significant negative effect on online drivers' income, which decreased between 50-81% as reported by Waluyoajati and Sugiyanto (2021).

Based on bivariate analysis from Septiyani *et al.* (2021), knowledge level and age were factors that affect significantly food safety practices of housewives, while not affected by attitudes and education level. Other results also reported by Swandharu (2014), that food handling practices were similar among housewives although they have different education levels. A study by Nurfikrizd and Rustiawan (2019) mentioned that there was no relationship between education level and food safety practices in food handlers. On the other hand, Swamilaksita and Pakpahan (2016) showed a different result in food handlers. That study found a relationship between education and hygiene sanitation practices. In

this study, FH and FDW have different characteristics, including age, gender, educational level, and income. Although there were differences in those factors between FH and FDW, further analysis is needed to conclude its relationship to food safety KAP.

In this new normal era, Gojek already applied some policies to assure the safety and health of their partners, which are called J3K (stay healthy, hygienic, and protected) protocols. For example, there was a masker verification before the driver works, body temperature check, the vaccine for drivers, and vehicle disinfection. Especially for Gofood, Gojek provides insulated bags and reusable plastic bags for their driver-partners in order to maintain food hygiene and quality (Gojek, 2020). Before working as a driver-partner in Gojek, there was training in safety riding for all drivers. Unfortunately, there is no training for food safety.

A structural model of knowledge, attitudes, and practices on food safety among FH and FDW has been developed to predict their real practices. The study suggests that there are differences in the structural model for FH and FDW. The R^2 value of the FH model measured was 0.374, suggesting that the knowledge and attitude of the FH collectively explained 37.4% of the variance associated with food safety practices. Meanwhile, the knowledge and attitude of the FDW only described 16.5% of the variance. Based on Hair *et al.* (2014), the R^2 values in this study were considered high for the FH and low for the FDW. Food safety knowledge is not always translated into behavior. However, perception of behavioral control, attitudes, and subjective norms can contribute to safe food handling intention (Lin and Roberts, 2020).

Knowledge has a significant effect on the attitudes of both the FH ($\beta = 0.398$; $p < 0.05$) and the FDW ($\beta = 0.322$; $p < 0.05$). Previously, a study conducted among dairy factory workers in China also showed a significantly positive relationship between knowledge and attitude toward food safety. Most workers agree with the importance of wearing uniforms during work, separation of raw materials and ready-to-eat food, food safety training programs, and the importance of storage temperature monitoring (Chen *et al.*, 2018). The same result was reported by Al-Shabib *et al.* (2016) who suggested a significantly positive correlation between knowledge and attitudes of FH employed at restaurants in Saudi Arabia. [This result](#) is also consistent with a study conducted by Ruby *et al.* (2019) suggesting that knowledge of personal hygiene is a predictor for the respondents' attitude in households of the Sibu district, Malaysia. In a study on restaurant FH in Dubai, Uni Arab Emirates, Taha *et al.* (2020) reported that

knowledge of cross-contamination prevention and storage temperature regulation had significant effects on food safety attitudes. Many households were not aware of storing foods at the right temperature which potentially could cause food poisoning (Odeyemi *et al.*, 2018). There were more than 1000 foodborne outbreaks in Indonesia from 2000 to 2015. Among 34 provinces in Indonesia, West Java Province (including Jabodetabek area) has the highest cases of foodborne illness and deaths. Household and catering foods are the sources of the outbreaks with pathogenic *Escherichia coli* as the major causative agent. The most contributing factors to the outbreaks were inappropriate storage temperatures and inadequate cooking (Arisanti *et al.*, 2018). A modelling study among housewives, street food vendors, small-medium enterprises, and food retailers communities in Jakarta by Ellinda-Patra *et al.* (2020) suggested that food safety practices can be improved through sufficient knowledge, positive attitude, and environmental support on households.

Knowledge has significant effects on food safety practices in FH ($\beta = 0.311$; $p < 0.05$) and FDW ($\beta = 0.136$; $p < 0.05$). Sufficient knowledge about keeping food at safe temperatures, cross-contamination, and the importance of food reheating affects the personal hygiene behavior of restaurants FH (Taha *et al.*, 2020). A similar result was reported by Ellinda-Patra *et al.* (2020), suggesting that knowledge affects personal hygiene behavior and storing foods at a safe temperature. Furthermore, da Cunha *et al.* (2019) in their study reported that knowledge significantly influences self-reported and observational food safety practices. Enriching food safety knowledge is the most important step towards change to good food handling practices (Seaman, 2010). Safe food handling practices of FH can be achieved through food safety training which is strategically designed since adequate food safety practices can be improved through food safety knowledge (da Cunha *et al.*, 2014). Most food safety training consists of hand hygiene, temperature controls, and personal hygiene which is evaluated by pre/post questionnaires (Reynolds and Dolasinski, 2019). Furthermore, da Cunha *et al.* (2014) suggest that FH practices should be improved by educating FH periodically and providing adequate facilities to support a suitable environment. In addition, a food safety culture may establish a good environment regarding food safety knowledge, good leadership, effective communication, environment support, FH commitment, and an implemented management system (de Andrade *et al.*, 2020).

Several other reports, however, do not support the result of this study. Baser *et al.* (2017), Lim *et al.* (2016),

and Woh *et al.* (2016) concluded that knowledge does not significantly relate to food safety behavior. Another study suggests that there were significant associations between food safety knowledge with age, gender, monthly salary, experience, educational level, and food safety training on FH in Jordan (Osaili *et al.*, 2018). Hence, the difference in results can be due to differences in respondent attitudes, which is a fundamental aspect that translates knowledge into food safety behavior (Zanin *et al.*, 2017).

Attitudes have the strongest effects on food safety practices by the FH ($\beta = 0.417$; $p < 0.05$) and the FDW ($\beta = 0.342$; $p < 0.05$) in this study. This finding is consistent with previous studies by Mihalache *et al.* (2021) who reported that an attitude which prioritizes food quality and food safety has a significantly positive effect on food safety practices in the kitchen. A similar result was reported by Kwol *et al.* (2020) that hygienic-sanitary conditions for food safety are met by increasing food safety knowledge which will have a positive impact on the attitude of FH. Food safety attitudes about cross-contamination also positively correlated with practices to avoid cross-contamination and use safe raw materials (Lim *et al.*, 2016). A survey by Abdul-Mutalib *et al.* (2012) shows that positive attitudes can influence food storage practices related to storage at the right temperature and good handling practices. Attitudes represent one's beliefs and can act as a crucial mediator between knowledge and practice (Soon, 2018). Although attitude is a reflection of traditional beliefs that can be an obstacle to good behavior, a good attitude can positively influence behavior (Dudeja *et al.*, 2017).

There are some important theoretical and practical implications from this research. The KAP model showed knowledge was important in increasing food safety attitudes and practices among FH and FDW. Knowledge can be gained through sharing or training from someone who has a higher education level to someone who is less knowledgeable. On the other hand, da Cunha (2021) reported that training might increase knowledge, but translating knowledge to practice was difficult due to many factors including attitudinal ambivalence. Ambivalence in food handling might be triggered by optimistic bias, knowledge with little practical application, external locus of control, inadequate infrastructure, lack of motivation, and egocentrism. To overcome those difficulties, da Cunha suggested applying behavioral based approach by strengthening food safety culture, leadership, and communication aligned with the food safety management system (FSMS). As a practical implication, a collaboration between FH, FDW, delivery services application, and government might be an alternative to strengthen food

safety in the pandemic situation.

5. Conclusion

There was a gap in the FH and FDW structural models that can contribute to the safety of food delivered. Based on the KAP models of FH and FDW, it is concluded that knowledge is positively associated with food safety attitudes, attitudes positively associated with food safety practices, and knowledge positively associated with safer food safety practices. This study revealed that the R^2 value of the FH model explained 37.4% of the variance, which is higher than the FDW model which could only explain 16.5% of the food safety practices. In addition, this study proved that the attitude variable is the strongest predictor of food safety practices. Attitudes towards personal hygiene, food storage at the right temperatures, cross-contamination, adequate cooking, and the use of safe water and raw materials were the main factors that contribute to the safety of the online food delivery system. Improving attitudes toward food safety among FDWs could be the strategy to ensure food safety practices in the online food delivery system.

Conflict of interest

The authors whose names are listed immediately below certify that they have NO affiliations with or involvement in any organization or entity with any financial interest (such as honoraria; educational grants; participation in speakers' bureaus; membership, employment, consultancies, stock ownership, or other equity interest; and expert testimony or patent-licensing arrangements), or non-financial interest (such as personal or professional relationships, affiliations, knowledge or beliefs) in the subject matter or materials discussed in this manuscript.

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