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Research Paper

Food safety practices of food handlers at home engaged in online food businesses during COVID-19 pandemic in the Philippines

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ABSTRACT

This study was conducted to assess the self-reported and observed food safety practices (FSP) of food handlers, who deliver food products that are prepared and cooked at home during the COVID-19 pandemic in the Philippines. 751 participated in the online survey who were selected using criterion sampling. A questionnaire developed by the researcher was used to gather data with Cronbach Alpha of 0.91. *t*-test, ANOVA, and Fleiss kappa were performed to treat data. There were no significant differences between self-reported FSP in four dimensions and demographic characteristics, except for age, where a significant difference exists between the FSP of the four age groups along food preparation ($F = 4.530$, $\rho<0.01$). The FSP in the four dimensions obtained a weighted $\bar{x}$ and σ of 1.72 ± 0.69 which is interpreted as *Sometimes Practiced*. The food handlers at home inadequately and inappropriately practiced the protocols in keeping the food safe to eat. The observed reports showed that the food handlers at home do not meet food safety standards as indicated in the weighted $\bar{x}$ and σ in the four dimensions 1.63 ± 0.11, with a description of *Sometimes Practiced*. Observed practices further show very poor adherence to guidelines. Test for inter-rater reliability yielded almost perfect agreement ($\kappa = 0.81$, $\rho<0.05$). There exists a significant difference with the FSP in personal hygiene ($t = 0.964$, $\rho<0.05$), cross-contamination prevention and sanitation ($t = 0.815$, $\rho<0.05$), food preparation ($t = 0.753$, $\rho<0.05$), and food delivery ($t = 0.794$, $\rho<0.05$). Government and non-government agencies should work together towards educating the food handlers at home on effective ways to learn about food safety concepts so they could become advocates of safer food practices.

1. Introduction

COVID-19, drastically spread worldwide in just three months after it was first discovered in Wuhan City, Hupei Province in China by the end of December 2019 (WHO, 2020a; WHO, 2020b). In the Philippines, the national government declared health emergency on March 09, 2020 after reports of confirmed cases and local transmissions were recorded (Philippine Star, 2020; OPS, 2020; Tomacruz, 2020; Wang, 2020; WHO, 2020b). The increasing growth of COVID-19 confirmed cases compelled the Philippine government to place the National Capital Region on partial lockdown and the entire island of Luzon on enhanced community quarantine (Dancel, 2020; Duddu, 2020; Merez, 2020; Petty and Morales, 2020; Philippine Star, 2020). This was followed by some areas of Visayas and Mindanao islands. Such setups limited people's movements, requiring them to stay in their homes and permitting them to go outside for essential purposes only. Consequently, a number of factories have been shutdown resulting in the displacement of hundreds of workers (Baraoidan and Cinco, 2020; Duddu, 2020; Magkilat, 2020). In order to protect its citizens and businesses from the negative impacts of the pandemic, the government provided a subsidy of approximately US $3.93 M, an amount that operationalized the Social Amelioration Package (SAP) (The Star, 2020). Beneficiaries of SAP have been given cash and in-kind assistance, ranging from US $100 to US $160 per month for three months (Aguilar, 2020; Carlos, 2020; Mendiola, 2020; Ramos, 2020). Since the SAP does not supplement the need of the families, people who are displaced from work have to find ways and means to augment their expenses, thus, they prepare, cook and deliver food initially to their relatives and friends, and that eventually led to selling food online.

With the assumption that a household has two family members earning US $420 monthly salary, Sy et al. (2018) and Cordero (2018) argue that in order for a family of five members to survive, an aggregate monthly income of US $840 is needed. Taking this information into account, the financial assistance from the government's SAP is apparently insufficient to sustain the needs of a family with five members. Since most work has been put to a temporary or permanent halt, and people are

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quarantined in their homes as part of the measures to stop the spread of COVID-19, many daily wage earners have been struggling to provide for their own and their families' basic needs (de Silva, 2020; Gutierrez, 2020). These inevitable social ramifications brought about by the pandemic negatively affected economic activities in the country. Realizing such a financial crisis, areas in the country that were classified as having low to moderate risks of contracting the virus among the people were eventually placed under Modified General Community Quarantine (MGCQ). By easing the quarantine, people are allowed to go to work with a maximum of 50%–70% capacity and operation for every establishment. Such a strategic move aimed at enabling the government to make revenues, which are spent to fund measures or programs that combat, not only the virus itself, but also the negative consequences that it has been causing the country. The new work and accommodation arrangements of the establishments provided people with varied sources of income. Business-oriented individuals took advantage of the MGCQ to sell their products, employing multiple ways and platforms.

Certainly, COVID-19 pandemic has shifted the retail landscape from brick and mortar to online processing of orders and connecting to last mile logistics providers to address the growing demands of people that are confined in their homes (Leyco, 2020; Magkilat, 2020). Buying and selling of goods and services via various modalities online is called e-commerce (EC). Castro (2019) and Magkilat (2020) claim that by 2022, EC activities are projected to account for half of the country's economy. During the MGCQ, people who are inclined to cooking are coordinating and negotiating with motorcycle riders or vehicle owners to deliver orders to intended destinations and/or meeting recipients at the nearest checkpoints. These food products are commonly prepared at home by small-scale online business owners, who are more often than not inexperienced when it comes to practicing food safety protocols. In a number of studies, it was revealed that foodborne disease (FBD) outbreaks are frequently caused by home-made food (Azanza et al., 2018; Byrd-Bredbenner et al., 2013; Nesbitt et al., 2009). This finding was backed up by researches reporting that cases of FBD that originate from food handling errors in homes are much higher than those that emanate from food establishments (Kennedy et al., 2005; Redmond and Griffith, 2009). Furthermore, the majority of services that offer food delivery to customers are not trained in food safety, which poses critical risks to individuals at the receiving end of the food supply chain. If food products are not properly packaged, these can be contaminated in the process of transporting them to the customer's locations. Additionally, FBD-causing bacteria could multiply at a faster rate when food products are kept above standard room temperatures.

In the Philippines, food handlers at home are not issued with sanitary permit or are not required to apply for food safety certification, which can lead to unsafe and unacceptable practices in food preparation putting customers at risk of FBD. Several improper food preparation practices at home, such as improper cooking practices, reheating, undercooking, cooling of food, inadequate preparation, cross contamination, insufficient processing and poor hygiene are found to cause FBD (Azanaw et al., 2019; Carstens et al., 2019; Ucar et al., 2016). With the exponential increase of online food businesses (Aning, 2020; Madarang, 2020) that may not be practicing food safety protocols, there is a need to problematize the varied ways of handling food at any point along the supply chain, most particularly when the food is prepared at the household level. Recognizing these needs and conditions, this study examined the practices of food handlers at home engaged in online food business. It utilizes food safety protocols and standards as an analytical lens to unveil problems that have the potential to result in critical health issues. Specifically, this study looked into the self-reported and observed FSP among food handlers at the time of pandemic. It also sought to test the difference between the demographic characteristics of the participants, and their self-reported FSP, and to test the difference between participants' observed and self-reported FSP.

2. Methods

2.1. Sampling plan

This study was initially participated in by 947 food handlers at home; however, only 751 were selected to become participants. The sample selection plan is shown in Fig. 1. Criterion sampling was used in selecting the participants. Selected participants must be selling food products online, using social media, specifically Facebook, because the country has 82.67% Facebook users (Statcounter, 2020) of this platform that also allows for easy communication with the participants during this COVID-19 pandemic; must be preparing and cooking food products at home; must be 18 years old or above; must sell three or more food products and must be the one in-charge of purchasing, storing, preparing, cooking, packing and delivering of the food products sold online. Taking these criteria into account, the 196 participants were excluded because they do not meet one or two of the prescribed qualifications. The online dissemination and administration of the survey questionnaire covered a period of four months from May to August 2020. Participation of the respondents was voluntary, and they were afforded sufficient time to answer questions. Concerns and questions from the respondents with regard to completing the questionnaire were also accommodated and addressed by the researcher.

In order to gather the observed FSP of the participants, they were requested to participate in the researcher's onsite observations and field notes. There were 77 respondents who signified their willingness to be involved in the said data gathering procedures, but only 28 participants satisfied and agreed on the requirements set by the researcher. The criteria for participation in the observations include the strict preparation of food products at home, the representation of at least one food product being sold online, and the respondents' willingness to be observed during phases of food supply chain.

2.2. Questionnaire design

With the increasing number of displaced workers from various businesses in the country due to COVID-19 pandemic, people from various households need a source of livelihood to augment the needs of their families; thus engaging in online selling of foods that are prepared and cooked at home is one of the most practical solutions to survive during these trying times. With the increasing posts day-by-day on Facebook, the researcher made a survey questionnaire to gather data from the respondents on their FSP. It was translated into two languages—English and Filipino—so the participants could easily comprehend the content of the instrument, which may result in more valid findings. A native speaker who is experienced in the field of research translated the Filipino version of the questionnaire. In order to double check the accuracy of the translation, the original document was compared to the translated document by having two more independent native speakers examine the documents. The survey questionnaire consists of 52 items that were divided into five parts, namely: demographic characteristics, personal hygiene (PH), cross contamination prevention and sanitation (CCPS), food preparation (FP), and food delivery (FD). The questionnaire could be completed through a link that led to an online survey.

The questionnaire used 47 rating scale questions that assessed their FSP. For the respondents' self-reported practices, each of them was required to select from three options—always, sometimes, and never—to rate the frequency of applying the practices indicated in the survey questionnaire. The overall assigned score was calculated based on the mean scores of the self-reported and observed FSP which were categorized using this scale: 0.1–1.0 is never (disagree); 1.1–2.0 is sometimes (neutral); and 2.1–3.0 is always (agree).

Onsite observations and field notes of the food handlers at home FSP were conducted to triangulate and validate information relating to the

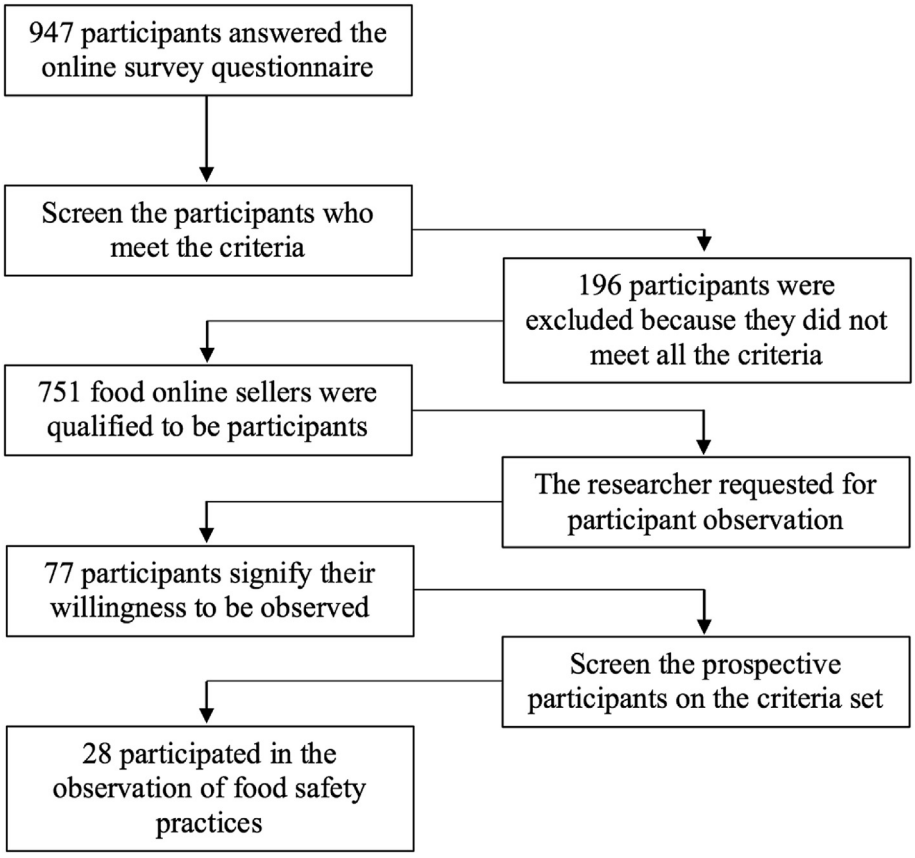

Fig. 1. Sample plan procedure.

self-reported practices of the respondents. The observation checklist guide contained similar set of questions that was used to gather the self reported FSP of the respondents. This was done for exact comparison purposes of their FSP and when performing statistical test.

2.3. Pilot study

The survey questionnaire used to gather data for this study was pilot tested to 30 respondents who are selling food items online. In order to examine the reliability of the instrument, Cronbach Alpha was employed as a statistical tool. A reliability coefficient index of 0.91 was obtained, which indicates that the instrument is reliable. Validation of the instrument was also sought from three food technology experts to improve its clarity, format, and content. All the experts' suggestions and comments, which were mainly on ordering of questions, using simple and correct words, grammar, and formatting, were incorporated in the improved instrument.

2.4. Data collection

All the items in the questionnaire were inputted to an online application form so that the respondents could conveniently provide their answers to the questions online, since physical contact between and among people during this pandemic is strictly prohibited. First part of the questionnaire was an informed consent form where the participants were given the time to read and affix their email addresses to signify their agreement to participate in the study. The survey questionnaire was floated using a link posted in social media for four months; such a way of administering the instrument enabled the researcher to reach online sellers from the different regions of the country. The onsite observations and field notes were conducted for the whole month of September 2020 to validate the participants' self-reported FSP which were carried out by three trained research assistants under the supervision of one certified food inspector. The three experts were selected based on the following criteria: must be a food technology graduate, must have at least three years of experience in a restaurant or food industry, must be 25 years old or above, and must be permitted to travel based on the implemented quarantine protocols. These three food safety experts were tapped to observe 28 participants in their respective houses to validate their self-reported FSP by conducting punctual onsite observations and field notes of handlers during their daily activities. Observation was done for a month for them to revalidate needed practices especially if the items in the questionnaire cannot be done in just one sitting. Each of the expert's observations lasted for an average of 2 h and 57 min. They observed the participants' FSP during phases of food supply chain. After all the observations were done, the experts convened to discuss their ratings for all the participants. There were no disagreements between and among the experts, so every rating in the items was finalized.

2.4. Data analysis

Descriptive statistics was used to summarize the demographic characteristics of the respondents. The data was analyzed using SPSS software for Windows, version (26.0). An independent *t*-test, and ANOVA was performed to determine whether the food handlers' FSP differed in demographic characteristics; and to determine whether there were significant differences between their self-reported and observed food safety practices. To test the agreement of the three raters, Fleiss kappa statistics was also performed.

3. Results and discussion

Fig. 2 shows the categories of food products the participants sold online. Baked goods and desserts has the most number of products

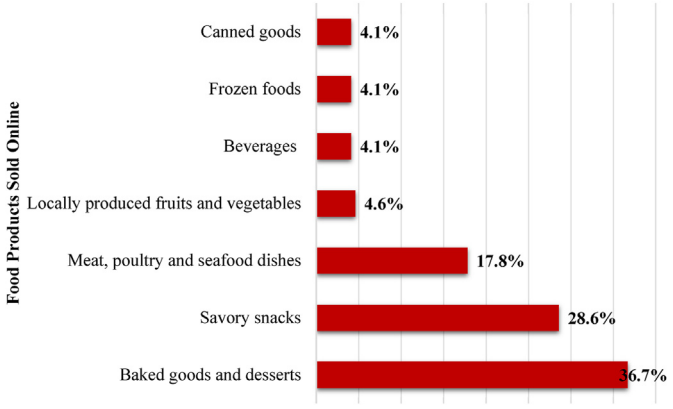

Fig. 2. Categories of food products sold online.

followed by savory snacks, meat, poultry and seafood dishes, and locally produced fruits and vegetables. Canned foods, frozen foods, and beverages have the least number of foods sold online. This shows that the respondents engaged in selling various food products produced, prepared and cooked at home. It also indicates that the participants are using their skills and experiences in cooking the products, and showcasing their innate talents in cooking various dishes. Participants believed that selling food products during this time would gain some money to augment their family expenses especially that the government subsidy only provided a little amount per month.

3.1. Comparison between the FSP of food handlers grouped according to their demographic characteristics

Table 1 presents the demographic characteristics of the respondents. Most of the participants are female, this is because females are more inclined to preparing and cooking meals at home. However, Wallace (2009) argued that both femininity and masculinity are essential aspects in attaining food safety. This is the case since the ability to work in teams, which is the characteristic of feminine cultures, and the focus on getting the work accomplished, which is typical of masculine cultures, are both significant in food safety. The large number of female food handlers is consistent with reports from similar past studies (Lee et al., 2017; Ncube et al., 2020). Almost all of the respondents are single, which is an indication that they can perform any of the following tasks using their own time: food supply chain, post products online, answer queries of the customers, and deliver the products. Majority of the respondents have no food safety training which indicates the need for training as was seconded by the following researches Samapundo et al. (2016) and Samapundo et al. (2015) – that training is essential to improve practices in keeping food safe. More than half of the respondents are college students who are eager to engage in food business with a little experience in handling food and need more amount of money for their online classes. For them this is the most convenient way of earning money during the pandemic as everything they need could be easily accessible at home, and the establishment of small online business does not require necessary permit or license to start.

Table 1 also shows the results of the self-reported FSP of the respondents grouped according to sex, marital status, and food safety training. The results show that no significant difference was noted on the FSP based on sex; marital status; training experience. This finding is consistent with the studies conducted by Abdul-Mutalib et al. (2012), Alqurashi et al. (2019), Farrish et al. (2009); Ncube et al. (2020), Woh et al. (2016) where no significant difference between participant FSP and demographic characteristics like sex and marital status was reported. This is because most of the respondents are female and are single. However, findings from the studies conducted by Lou et al. (2019); Mclyntyre et al. (2013); Moreb et al. (2017), Stein et al. (2010) are contrary to the aforesaid findings; they found that there is significant difference between FSP and demographic characteristics of the respondents due to the unequal number of respondents as to sex, marital status and food safety trainings attended. It is interesting to note that training is not statistically significant in this study, whereas all their responses in all items are below 50.0% which is an indication that the participants' self-reported FSP are biased and excessively positive. This indicates that the respondents reported what they think is correct and this does not represent what they do at home during the phases of food supply chain, hence observing their practices to confirm their self-reported FSP is indispensable. Studies of da Cunha et al. (2019) and da Cunha et al. (2014) highlighted the value of observation when studying food hygiene practices of food handlers, as these closely represent actual practice, and to be affected directly by knowledge and indirectly by attitude. There should be more studies that investigate the impact of demographic factors to the FSP of food handlers at home. Their self-reported FSP may be attributed to the participants' norm, and may

Table 1
Result of the difference of the self-reported food safety practices of the online food handlers at home.

Variables	n (%)	Self-reported Food Safety Practices in							
		PH		CCPS		FP		FD	
Independent *t*-test		*t*	Sig.	*t*	Sig.	*t*	Sig.	*t*	Sig.
Sex									
Male	205 (27.3)	-.401	.688	.193	.847	-.493	.665	−1.145	.253
Female	546 (72.7)								
Marital Status									
Single	615 (81.9)	.566	.572	-.519	.504	.593	.554	.096	.924
Married	136 (18.1)								
Food Safety Training									
With training	111 (14.8)	-.490	.625	-.921	.359	−1.44	.152	1.56	.122
Without training	640 (85.2)								
ANOVA		***F***	**Sig.**	***F***	**Sig.**	***F***	**Sig.**	***F***	**Sig.**
Level of Education									
High school	160 (21.3)	.296	.744	.129	.879	.327	.721	1.674	.188
College	411 (54.7)								
Graduate	180 (24.0)								
Age									
18-25	502 (66.8)	.383	.765	.819	.483	4.530**	.004	.881	.451
26-35	181 (24.1)								
36-45	45 (6.0)								
46 and up	23 (3.1)								

Note: PH-personal hygiene; CCPS-cross contamination prevention & sanitation; FP-food preparation; FD-food delivery; **p < .01.

also be due to the food safety culture, where their prevailing FSP is being impacted by national values and food safety governance (Nyarugwe et al., 2020).

Furthermore, results revealed (Table 1) that the FSP of the three groups of food handlers are not significantly different in each of the four categories. The computed value shows that the level of education of the online food handlers does not affect their FSP. Such a finding was similarly revealed in the studies conducted by Angolo (2011), Ncube et al. (2020), Stein et al. (2010), Stratev at al. (2017), and Teffo and Tabit (2020) which reported that the level of education among the participants is not statistically significant to their self-reported FSP. An individual's educational attainment does not determine his or her application of food safety practice, since in this study, online food handlers with higher levels of education did not differ in their self-reported FSP, as compared to those with lower levels of education. However, some studies negate this finding, Akabanda et al. (2017) and Lee et al. (2017) argued that an individual's level of education directly affects his or her application of FSP.

Table 2
Self reported and observed food safety practices according to four dimensions.

Indicators in the Four Dimensions	Self-reported FSP		Observed FSP		*t*	Sig.
	Participants (n = 751)		Raters (n = 3 × 28 = 84)			
	Agree n (%)	Score (mean ± SD)	Disagree n (%)	Score (mean ± SD)		
Personal hygiene					0.964*	.000
I wash my hands for at least 20 s with soap and running water.	441 (58.7)	2.53 ± 0.60	77 (91.7)	1.11 ± 0.34		
I wash my hands before and after preparing food.	391 (52.0)	2.31 ± 0.80	79 (94.0)	1.12 ± 0.45		
I wash my hands after sneezing and coughing.	280 (37.3)	2.16 ± 0.74	61 (72.6)	1.33 ± 0.56		
I wash my hands after handling garbage.	328 (43.7)	2.11 ± 0.87	79 (94.0)	1.12 ± 0.47		
I wash my hands after using the toilet.	152 (20.2)	2.09 ± 0.81	61 (72.6)	1.27 ± 0.43		
I cover my mouth when sneezing or coughing.	401 (53.4)	2.17 ± 1.00	67 (78.9)	1.25 ± 0.53		
I wear clean apron and clothing when preparing food.	222 (29.6)	1.84 ± 0.87	64 (76.2)	1.24 ± 0.43		
I change my clothing and apron when they get dirty.	376 (50.1)	2.16 ± 0.93	59 (70.2)	1.36 ± 0.59		
I remove any jewelry (e.g. bracelets, rings, chains, earrings, etc.) when preparing food.	174 (23.2)	1.62 ± 0.88	68 (81.0)	1.19 ± 0.39		
I take a bath before and after preparing food.	365 (48.6)	2.20 ± 0.90	69 (82.1)	1.18 ± 0.38		
Average	**313 (41.7)**	**2.12 ± 0.11**	**69 (82.1)**	**1.22** ± 0.08		
Cross contamination prevention and sanitation					0.815*	.000
I clean my working area before and after food preparation.	353 (47.0)	2.17 ± 0.86	79 (94.0)	1.07 ± 0.30		
I use the same knife to cut raw meat or poultry and vegetables.	176 (23.4)	2.17 ± 0.78	84 (100)	2.86 ± 0.35		
I sanitize knives used for raw foods before using them for other types of food.	17 (02.3)	1.18 ± 0.44	83 (98.8)	1.02 ± 0.22		
I use different chopping boards for raw meat, poultry, breads, fish, and fresh vegetable and fruit.	79 (10.5)	1.42 ± 0.68	67 (79.8)	1.23 ± 0.47		
I use sanitizer when washing service utensils (plates, mugs, and spoons).	303 (40.3)	2.11 ± 0.83	64 (76.2)	1.24 ± 0.43		
I wear my apron when I go in the restroom.	0 (00.0)	1.10 ± 0.35	63 (75.0)	1.27 ± 0.52		
I talk, sing, whistle during my preparation/cooking/packing.	258 (34.4)	1.71 ± 0.59	81 (96.4)	2.70 ± 0.46		
I eat during my preparation/cooking/packing.	432 (57.5)	1.42 ± 0.55	80 (95.2)	2.79 ± 0.41		
I handle money during my preparation/cooking/packing.	667 (88.8)	1.11 ± 0.43	79 (94.0)	2.79 ± 0.41		
I use my cellphone during my preparation/cooking/packing.	611 (81.4)	2.74 ± 0.64	78 (92.9)	2.96 ± 0.19		
I use gloves when handling raw foods.	12 (01.6)	1.17 ± 0.55	63 (75.0)	1.25 ± 0.43		
I change gloves between handling of raw and ready to eat foods.	0 (00.0)	1.13 ± 0.52	75 (89.3)	1.12 ± 0.32		
I use protective clothing (apron) when handling raw foods.	4 (00.5)	1.14 ± 0.57	63 (75.0)	1.25 ± 0.32		
I use cap when I handle foods.	8 (01.1)	1.15 ± 0.60	69 (82.1)	1.18 ± 0.38		
I use cap and mouth cover/spit guard/mask during handling of food.	1 (00.1	1.13 ± 0.61	85 (100)	1.00 ± 0.00		
Average	**195 (26.0)**	**1.52 ± 0.14**	**74 (88.1)**	**1.72** ± 0.13		
Food preparation					0.753*	.000
I practice first in and first out when handling food.	186 (24.8)	1.77 ± 0.82	64 (76.2)	1.24 ± 0.43		
I keep raw foods separated from cooked and ready-to-eat foods.	168 (22.4)	1.91 ± 0.73	58 (69.0)	1.35 ± 0.57		
I properly clean the food storage area before and after storing new products.	267 (35.6)	1.17 ± 0.88	71 (84.5)	1.19 ± 0.50		
I check the refrigerator's temperature before storage.	334 (44.5)	2.30 ± 0.70	71 (84.5)	1.20 ± 0.51		
I store cooked foods in the refrigerator separately with label.	21 (02.8)	1.75 ± 0.46	80 (95.2)	2.87 ± 0.34		
I leave the left overs at room temperature for a few hours and then freeze them.	291 (38.7)	1.85 ± 0.79	76 (90.5)	2.88 ± 0.32		
I thaw frozen fish, meat and poultry using running water.	259 (34.5)	2.00 ± 0.85	61 (72.6)	1.27 ± 0.45		
I use appropriate thermometer in checking the temperature of the food.	25 (03.3)	1.15 ± 0.50	63 (75.0)	1.25 ± 0.43		
I inspect raw materials before buying and using them in my food products.	66 (08.8)	1.74 ± 0.66	64 (76.2)	1.24 ± 0.43		
I check food expiry dates.	206 (27.4)	1.88 ± 0.86	62 (73.8)	1.26 ± 0.44		
I label my food products as to its ingredients.	29 (03.9)	1.15 ± 0.58	65 (73.8)	1.23 ± 0.42		
I label my food products as to its allergy risks.	34 (04.5)	1.17 ± 0.62	64 (76.2)	1.24 ± 0.43		
Average	**209 (27.8)**	**1.67 ± 0.14**	**67 (79.8)**	**1.52** ± 0.06		
Food delivery					0.794*	.000
I use insulator bag in delivering my food products.	93 (12.4)	1.88 ± 0.66	64 (76.2)	1.24 ± 0.43		
I maintain the required temperature of the food when delivering.	209 (27.8)	1.78 ± 0.81	62 (73.8)	1.26 ± 0.44		
I check the temperature control of the food product before delivery.	370 (49.3)	2.34 ± 0.73	63 (75.0)	1.25 ± 0.43		
I check the temperature control of the food product during delivery.	10 (01.3)	1.19 ± 0.44	65 (77.4)	1.24 ± 0.43		
I limit my delivery area as a way of preserving food temperature during delivery.	1 (00.1)	1.17 ± 0.41	65 (77.4)	1.23 ± 0.42		
I practice delivering the food for more than 4 h.	297 (39.5)	2.07 ± 0.86	59 (70.2)	1.29 ± 0.45		
I properly organize food items in the delivery bags based on food types.	260 (34.6)	1.95 ± 0.88	65 (77.4)	1.21 ± 0.41		
I use gloves when putting and removing food items from my delivery bag.	12 (01.6)	1.23 ± 0.52	60 (71.4)	1.30 ± 0.51		
I regularly clean and sanitize coolers or insulated bags in delivering foods.	215 (28.6)	1.93 ± 0.84	65 (77.4)	1.23 ± 0.42		
I regularly clean and disinfect the vehicle used in delivering foods.	2 (00.3)	1.25 ± 0.59	83 (98.8)	1.01 ± 0.11		
Average	**149 (19.8)**	**1.68 ± 0.17**	**65 (77.4)**	**1.23 ± 0.10**		
General average	**216 (28.8)**	**1.72 ± 0.69**	**77 (91.7)**	**1.63 ± 0.11**		

*Note: Scores; 0.1-1.0 = never(disagree); 1.1-2.0 = sometime(neutral)s; 2.1-3.0 = always(agree); Abbreviation: SD, Standard deviation; *p < .05.*

Moreover, the FSP of the food handlers in the different age groups revealed that significant differences exist between the FSP of the four age groups along FP where those with ages 36–55 tend to be more cautious and aware of the right procedures in handling food. Middle-aged adults at home have been exposed to various works in the household, especially when it comes to food preparation, hence, they apply better food safety practices, rather than those young food handlers who are not yet exposed to different food preparation tasks. Also, this sample has already obtained their education in a formal setting thereby they are more inclined to exhibiting better food safety practices. Anderson et al. (2011), and Safari et al. (2016) yielded the same finding in their studies where it was concluded that the older the respondent in terms of age, the more likely he or she is to follow the recommended and acceptable handling and preparation of food. On the other hand, no significant differences exist between the FSP of the online food handlers in the different age groups along PH; CCPS, and FD. These results signify that age is not a significant factor in the three dimensions that make a difference on the FSP of the food handlers at home.

3.2. Assessment of food handlers' self-reported FSP

Table 2 shows the self-reported FSP of food handlers at home along the four dimensions.

3.2.1. FSP towards personal hygiene

Along PH, the highest obtained score was 2.53 ± 0.60, which is under the item, properly washing of hands for at least 20 s using soap and running water. This shows that the respondents give importance to hand washing in order to prevent contamination. Directives from CDC (2020a), FSAI (2020), UNICEF (2020) and research conducted by Soares et al. (2012) emphasized that hand washing for at least 20 s is a paramount practice in food preparation to prevent contamination. The lowest score obtained from the table is 1.62 ± 0.88, which translates to 76.8% of the respondents never or sometimes remove their jewelry when preparing food. Pieces of jewelry may harbor bacteria, and so wearing them even during food preparation may contribute to the contamination of the ingredients (Fagernes and Lingaas, 2009; Patel, 2018). This malpractice may pose risk of causing foodborne diseases. In the production and/or preparation stage, any kind of jewelry may have the possibility of falling into the food that could be a choking hazard and may result in biological contaminants. Even if jewelry may not necessarily cause injury to the client, being able to find any foreign object in one's food could be a very distressing experience. Almost half of the respondents practice PH when preparing food at home like washing hands before and after preparing food (2.31 ± 0.80), washing hands after handling garbage (2.11 ± 0.87), covering mouth when sneezing and coughing (2.17 ± 1.00), and changing clothing and apron when they get dirty (2.16 ± 0.93), which are sometimes practiced. With these ratings, it is apparent that the respondents practice proper hygiene; a finding that is supported by studies, which found out that food handlers at home prioritize PH in food preparation (Adane et al., 2018; Moy et al., 1997; Ncube et al., 2020; Woldt, 2015). Giving importance to PH is required to ensure that food is safely prepared and brought to the consumers. Poor hygiene is a contributory factor to FBD (Azanaw et al., 2018; Carstens et al., 2019), and its consequences may result even in death among consumers (Feltes et al., 2017; Fung et al., 2018; WHO, 2020c). Taking the findings into consideration, it could be concluded that online purchasing of home-cooked food products may not necessarily be safe, as half of the respondents (58.3%) are not observing PH. Improving the PH of the food handlers at home engaged in online food business is necessary as this may contaminate the food they prepare for their consumers during the phases of food supply chain. Only through training, requiring a permit, mandatory onsite monitoring during preparation, and providing online infographics that can be posted in conspicuous places can help in avoiding or in putting a halt to cases of food handling malpractices. PH is a must for every food handler to keep away the bacteria and germs that can prevent FBD.

3.2.2. FSP towards cross contamination prevention and sanitation

Notably, only 26.0% of the respondents are practicing CCPS while preparing food at home. This is alarming as the participants are not aware of the possible adverse effects of their practice. Most FBD cases reportedly occur at home and if this is not prevented, outbreak may occur anytime. Most of the participants (98.4%) do not use gloves and do not change gloves when handling raw and ready-to-eat food. Todd et al. (2010) confirmed that wearing gloves at all times when preparing food at home prevents bacteria that cause FBD and avoids contact from potential sources of pathogens that can contaminate food (Agustina et al., 2013; Devamani et al., 2014; Nizame et al., 2016). It was also noted that 87.4% of the food handlers use their cellphones while preparing food. Operating cellphones while preparing food can lead to the accumulation of human pathogens that may bring about FBD (Egert et al., 2015; Meadow et al., 2014). Moreover, it was revealed that the respondents use the same knife in cutting poultry and vegetables (76.6%); talk, sing, and whistle while preparing food (65.5%); do not use protective clothing (99.5%); and do not use cap and mouth cover (99.0%). According to CDC (2017) and Xuan et al. (2018), cutting raw meat and chopping vegetables utilizing the same board and knife may result in cross-contamination. Without using mouth cover or spit guard when preparing food, saliva from the food handlers may fall into the food when they sneeze and/or cough, which may be the cause of contaminations and spreading of diseases (Agoot, 2020). These quantitative findings indicate that the participants practice unacceptable standards in CCPS when preparing food at home to be sold online. When food-related operations are implemented inappropriately, then consumers will most likely contract FBD. Increase in cases of FBD manifests inefficient practice in preventing cross-contamination and lack of training in food safety concepts and skills among food handlers of online food businesses (Al-Kandari and Jukes, 2009; Osaili et al., 2017). The findings necessitate the concerned agencies to include these food handlers at home engaged in food business to be accredited since they do not perform what is expected of a food handler, who should be strictly following food safety regulations.

3.2.3. FSP towards food preparation

The highest FP score was 2.30 ± 0.70, which refers to the checking of refrigerator's temperature before storing. This shows that 44.4% of the participants observe good storing procedures at the right temperature–this finding is in consonance with the FDA (2018) directives which was supported by studies of Moreb et al. (2017), and Dora-Liyana et al. (2018). Surprisingly, 97.2% of the participants do not label food when they store them. Non-labelling of food ingredients as to its ingredients (96.1%) and allergy risks (95.5%) is a common practice among the participants. Labeling is a crucial part of any home kitchen organization and safety as this could potentially reduce the risks of FBD. This is one of the reasons why FDA (2014), FSA (2018), and ITA (2020) require the proper labelling of food products, specifically indicating the products' ingredients and allergy risks. Another food preparation malpractice reportedly committed by the participants is the use of incorrect thermometer in checking food temperature (97.2%), which indicates that participants use their assumption skills in determining the doneness of the food. Studies conducted by Byrd-Bredbenner et al. (2013) and Soares et al. (2016) highlighted the same findings where their participants do not use the appropriate temperature requirement for foods when storing, preparing, or bringing them to the customers. FSIS (2011) posited that employing the preferred type of food thermometer is the only reliable way to ensure safety and to determine desired doneness of food. WHO (2017) confirmed that one of the reasons for FBD outbreaks is time-and-temperature control abuse during food handling. This shows that the self-reported FSP of the food handlers at home do not conform to the proper FP protocol set by various government agencies. In a similar vein Borda et al. (2014), and Kosa et al. (2014) disclosed in their studies that the majority of food handlers violate international food safety standards. According to the joint implementing rules and regulations (IRR) rule 4.1a of the Philippine Department of Agriculture and

Department of Health (DA-DOH, 2015), the country is not obligating the food industries for certification; it is the own initiatives of these companies that handle food to subject themselves to certifications. It is clear from the said IRR that online food businesses can operate without license and without passing through certifications, even amidst the COVID-19 pandemic where ensuring safe food is crucial. Food handlers at home engaged in online food businesses exhibit incorrect practices on the majority of the items in the questionnaire, which largely result from not requiring them to subject to any food safety certification. Malpractices in food handling in this context will continue to grow and FBD cases will constantly rise in effect if non-mandatory accreditation and certification of all food handlers whether at home or in restaurants are not implemented.

3.2.4. FSP towards food delivery

Almost all the participants (99.9%) do not limit the delivery areas as a way of controlling the temperature of the food, which is an indication that participants are not aware of controlling bacterial growth. During delivery, it is necessary that the food product stays at a safe temperature depending on the type of food to prevent bacterial growth causing consumer sickness (Byrd-Bredbenner et al., 2013; CDC, 2020b). 99.7% of the participants do not disinfect the vehicle used in delivering their products. This incorrect practice maybe attributed to the fact that when respondents deliver their food products to their target clienteles, then cleaning and sanitizing the vehicles or bags used for transferring food from the point of origin to the intended location are not prioritized. Hence, cleaning and disinfecting the delivery bag must be a top priority especially during this time of pandemic, where the COVID-19 disease could be contracted and/or transferred via contact with infected surfaces. Disinfecting the delivery vehicle must be a priority since this could help maintain high levels of hygiene for the transportation of food (Wood, 2020), and could help ensure that customers are safe from risks of contracting the COVID-19 disease. Wood (2020) opined that disinfecting the delivery vehicle must be a priority since this could help maintain high levels of hygiene for the transportation of food. Most participants (98.4%) deliver food without wearing gloves when putting food items in and removing them from the delivery bag. Putting food items in and removing them from the delivery bags with bare hands is contrary to the Food Code requirements (FDA, 2017), thus wearing of gloves when removing food to be delivered is a strict requirement. The frequently applied food handling practice is the checking of temperature control of food products before delivery (49.4%), using inappropriate thermometer. Using inappropriate thermometer may lead to incorrect assessment of temperature that may result in FBD. Another incorrect practice is when delivering, the food in the delivery bag may stay inside for more than 4 h (39.5%), which is a consistent practice with the other items where participants can deliver cooked food items up to 4 h without proper control. This may be attributed to the fact that they carry all their food products set for the day to deliver without observing intervention in every 2 h. FSIS (2017) recommends that food must not be out of refrigerator for over 2 h. This mechanism is utilized because bacteria could rapidly grow in the range temperatures between 5 °C–60 °C (40°F–140 °F). Organizing food items in the delivery bags based on food types, and regularly checking, cleaning and sanitizing the coolers and insulator bags, also received 1.95 ± 0.88 and 1.93 ± 0.84 both obtaining an interpretation of *Sometimes*. The self-reported FSP in FD shows major violations of the existing food safety standards in national like AO 153, RA 10611 and RA 7394 international such as Servesafe, USFDA 21, and Food Code. It also indicates that food handlers are unaware of all the necessary procedures required for sanitation, hence a need for an intensive training on specific components of food safety useful for online food businesses. The findings of the study strengthen the critical role of conducting food safety trainings involving food business owners—whether online or physical—so that food handlers are able to satisfactorily demonstrate acceptable food safety practices, resulting in a healthier food supply chain (Al Suwaidi et al., 2015).

In summary, the FSP of the four dimensions on PH, CCPS, FP, and FD obtained an average mean rating of 2.12 ± 0.11, 1.52 ± 0.14, 1.67 ± 0.14, and 1.68 ± 0.17, with interpretations between *Sometimes* and *Always practiced* respectively. This means that online food handlers at home inadequately demonstrate food safety protocols that are implemented in order to keep food safe from any risk or hazard, especially during this time of pandemic. When people are required to stay in their homes, and still work to sustain the needs of the family, cooking food products and then selling them online could help ameliorate the financial insufficiency. Apart from this, food delivery services become essential nowadays since movement of people is restricted due to quarantine guidelines being issued by the national government and strictly implemented by local government units. Despite potential health risks that could be brought about by unsafe practices applied by food handlers who sell their products online, the government has no concrete plan on how they could check and monitor these kinds of products. If this sector of food business is not given appropriate attention, then it may consequently be the point of origin of FDB in the long run (Azanza et al., 2018; Byrd-Bredbenner et al., 2013; Nesbitt et al., 2009; Redmond and Griffith, 2009). Moreover, the result shows that the FSP of the food handlers at home are below standards, which means that an intervention is needed so they could apply acceptable practices when handling and preparing food for public consumption. Through the implementation of an intervention the food handlers are also enabled to prepare, cook, and deliver food products without prejudice to consumers' health conditions. This further intensifies the need for a strict implementation and monitoring of a food safety training for this sample so that online consumers are assured that the food they buy from food handlers at home is clean, safe, and healthy. Food safety training must be delivered by the concerned government agency in cooperation with the non-government sectors. The government mandated the agriculture department and health department to be the responsible agencies in ensuring that food safety within the food supply chain is achieved. Food science and food safety professionals who are certified must also be invited to train these samples. Training must be done virtually since gathering is still not permitted as of this time. This intervention must be done with strict monitoring and supervision by the concerned agencies.

3.3. Assessment of the observed FSP of food handlers at home

The inter-rater reliability for the raters was found to be $\kappa = 0.81$ ($p < .05$). The results showed that there is a perfect agreement among the ratings of the three experts. For Landis and Koch (1977) and McHugh (2012) this would mean an almost perfect agreement, which indicates that the raters disagree with the self-reported FSP of the food handlers at home. This is indicated in the obtained means and standard deviation ranging from 1.02 ± 0.22 to 2.96 ± 0.19, which are all interpreted as sometimes to always practice. The overall percentage of disagreements to the FSP of the food handlers are 91.7% which means that only 8.3% of the practices are in compliance to the standards in food safety. These food handlers at home engaged in online food business are increasing according to reports, and if no feasible and strategic intervention is made available to them, FBD may occur, thus resulting in a more drastic effect. The observed reports in Table 2 further show that food handlers at home engaged in online food business do not meet national and international food safety standards. Moreover, observed FSP shows very poor practice of adherence to guidelines and indicated that the food handlers at home failed to account for potential health risks. Nevertheless, there are some aspects that need improvement. Rule number 14c.2 of the DA-DOH (2015) states that a food business that is found to be non-compliant with food safety regulations shall ensure to perform adequate and appropriate corrective and preventive actions – a rule that is not conducted during this pandemic as unessential mobility and/or transportation are not permitted. The need for mandatory food safety training is a necessary consideration in securing permits, especially now that the growth of small-and medium-sized online food handlers at home in the Philippines

during this pandemic continue to follow an upward trend. Authorities should not only require certifications and trainings, but should also propose enabling policies monitor and ensure the quality of food products sold online.

The researcher also examined the significant difference of the observed FSP to the four dimensions. According to Medeiros et al. (2017), actual FSP of food handlers should also be evaluated in order to ensure that food prepared meets quality standards. Findings from the expert observers show that the participants demonstrated unacceptable practices in food preparation like inadequate preparation, cross contamination, insufficient processing and poor hygiene. This finding contradicts the self-reported practices of the participants, which generated an overall positive result. The observed FSP of the participants stressed that the food handlers failed to apply standard ways of keeping food safe. Participants' failure to adopt appropriate FSP may have been caused by their low perception of risks as regards hand hygiene, inappropriate infrastructure of units or work overload, and prioritizing other activities over the observance of FSP (da Cunha et al., 2014), this is possible as they prepare and cook at home so they may have other priorities other than focusing on the food they sell online. Furthermore, it can be gleaned in Table 2 that the observers' ratings obtained significant differences with the FSP in the four dimensions. Apparently, participants in this study reported only what they believed is their own assessment as regards to their FSP, resulting in differences from the ratings provided by the experts during their onsite observations and field notes. In the study conducted by Souza et al. (2018), the same finding was drawn—although the food handlers selling their products reported that they meet food safety standards, the observed values reveal otherwise. Therefore, the conduct of a food safety training specifically intended for untrained food handlers is imperative (Samapundo et al., 2015, 2016) so that these sample could develop a positive culture relating to food handling and preparation (Rebouças et al., 2016). Based on a number of studies, effective training is critical in improving knowledge and perceptions (Ko, 2013), and should be actively participated in by food handlers (Sani and Siow, 2014), including workers by all sectors of food service – whether online or physical. The training should include role-or function-specific skills so that it is responsive to the contexts and needs of the participants (Cuprasitrut et al., 2011; Garayoa et al., 2011). Training food handlers on the knowledge and skills that they would certainly need in their workplaces empowers them to become responsible in their practices when preparing and handling food, and allows them to increase their efficiency and competencies in their workplaces (McIntyre et al., 2013). Trainings must be constantly offered as learning is a continuous process (Al-Shabib et al., 2016; Zanin et al., 2015); and should stimulate interest on the part of food handlers (Choudhury et al., 2011). Due to the fact that basic hygiene is the prerequisite of any food safety program, it is necessary to integrate basic hygiene and anchor new food safety programs on national (Luu et al., 2017) and even international regulations. The different complexities of food handlers at home are then ultimately achieved by a comprehensive training. Assessing the training should be an iterative process (Ansari-Lari et al., 2010; Soares et al., 2012), creating a feedback system that aims to determine areas of the intervention that need reinforcing and upgrading.

4. Practical implications

The findings of this study could generally be an eye opener for the Philippine government to implement necessary interventions intended to prevent FBD, and involving food handlers at home engaged in online food businesses. Specifically, the following recommendations are offered:

Production of networked food safety materials for food handlers engaged in online food businesses is a need. This could allow them to access the materials during this pandemic more conveniently, at any time and in any place. Creating core groups in the different regions of the Philippines should be conducted, where selected food safety experts will become committed members of groups that specialize in food safety. These specialists will then be assigned to spearhead trainings and workshops on food safety involving the population.

Developing food-safety-related certification exams, specifically food handlers at home engaged in online food businesses, should be prioritized. Such certifications would empower the said food handlers in the preparation of their food products at home since this will include food safety concepts and principles. Moreover, they have an edge when they plan to become part of industries that manufacture food or offer food to consumer.

Requiring these food handlers to secure sanitary, business permit and license to operate are of paramount importance to ensure the safety of the consumers in buying their products through online platforms. Trainings and regular ocular visits are also a must for this population before approving their permit applications. Government and non-government organizations must join forces together to address health issues regarding food safety.

Seeing the need for food safety training and certification, the researcher recommends that this study be translated into a house bill which shall be presented to the Philippine legislative body for enactment. The researcher strongly argues and agrees that it is only through legal intervention that food safety trainings and certifications can penetrate all the food handlers in the country. Bold a move as it is, the researcher believes that what this country needs to prevent the outbreak of foodborne diseases is educating the food handlers on food safety in a national scale. Through this, a generation of Filipinos who are highly aware on the importance of keeping food safe becomes a present reality, and will continue to become a reality in the generations ahead.

5. Study limitations

It is important to note that this study is the first in the country to conduct an online survey on the FSP of food handlers at home engaged in food business during the COVID-19 pandemic. Respondents who participated in the study were from various provinces in the Philippines. Data gathered from the online survey apparently demonstrated response bias because the participants did not report their actual FSP. Such a limitation led the researcher to conduct observations involving food safety experts as the observers. The number of samples involved in the observation stage was low due to mobility and transportation restrictions brought about by the pandemic, hence a weak result was yielded. Observers were required to be quarantined for 14 days if the observation activities including different participants in various regions and provinces were pushed through. Since such an arrangement could not be accommodated, observation procedures were limited. Current study may not represent the whole population of food handlers at home engaged in online businesses.

6. Conclusion

This study revealed that the self-reported food safety practices of the food handlers at home engaged in online businesses in terms of personal hygiene, cross contamination prevention and sanitation, food preparation, and food delivery violate national and international food safety standards. Awareness and application of food safety protocols are of paramount importance in putting a halt to FBD in the country, particularly during this time of COVID-19 pandemic when people primarily consume food products generated by online businesses that prepare their items in their respective homes. Several studies revealed that the home kitchen is generally the point of origin of food contamination, which may happen at any point of the food supply chain. Food can be mishandled consciously or unconsciously at several points in this chain. Therefore, training of concerned individuals, regarding the acceptable procedures, becomes crucial in reducing if not eradicating incidences of foodborne disease outbreaks. There were no significant differences between food safety practices in all the four dimensions when taking the participants'

demographic characteristics into account. However, age posted a significant difference in the four age groups along food preparation. The observed food safety practices drawn from data gathered during the expert observations yielded significant difference when considering the self-reported practices of the participants. These demographic characteristics are essential as they may directly influence measures or interventions to improve the food safety practices of food handlers at home engaged in online businesses. With these findings in mind, regulations that monitor and control the food production and transportation among online businesses should be established and standardized in order to ensure that food products sold online are brought to the consumers with generally high quality, with low if not no potential to cause FBD. The findings of this study recommend that researchers, educators, food safety communicators, and the media should invest their efforts and energies towards the conceptualization and creation of programs that educate online food sellers about food safety practices, and allow them to translate their learning to real-life contexts.

CRediT authorship contribution statement

Mark Raguindin Limon: Conceptualization, Data curation, Formal analysis, Methodology, Project administration, Supervision, Validation, Visualization, Writing - original draft, Writing - review & editing.

Declaration of competing interest

I wish to confirm that there are no known conflicts of interest associated with this publication and there has been no significant financial support for this work that could have influenced its outcome.

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