

Fish-based food vendor's compliance with good processing practices in Bogor, Indonesia

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Abstract

Food for school children may become unsafe if its raw materials and handling processes are not well controlled. This study aimed to determine the level of compliance of the vendors with good processing practices. The method used was the development of vendor compliance criteria, observation of vendors' behavior, and exploration of the source of the problem. The results of the study on 100 types of fish-based food product which are sold by 63 vendors in 50 schools (elementary schools, junior high schools, senior high schools, and universities) indicated only 46% of vendors were compliant and there was still 26% of vendors who did not carry out the good food processing practices. The problems identified were no access to running water to wash hands and equipment (100%), the absence of protective clothes for the workers (92%), and the filthy conditions on the surface of the booth (81 %), the display (65%), and the workers' hands (73%). The results obtained also indicated that the compliance level of the vendors did not correspond with their educational background. From the results of this study, it is suggested that local health authorities should conduct a more targeted extension program for fish-based food for school children vendors.

1. Introduction

Food-borne diseases are reported to significantly increased every year. Each year as many as 600 million people in the world fall ill after consuming contaminated food and caused 420,000 people to die. More than 50% of cases of diarrhea are also caused by contaminated food (World Health Organization [WHO], 2015). Fish-based foods are perishable and need to be handled very carefully. In the US, a total of 1,661 cases were caused by the consumption of fish and most of them were caused by scombroid or ciguatera intoxication (Centre for Science in the Public Interest [CSPI], 2001). In Jakarta, Indonesia, in 2016 there were 213 cases of food poisoning and 52.4% was caused by seafood and fishes (Mabruroh and Ciptaningtyas, 2017). This indicated a safety concern of fish-based foods and Bogor as Jakarta's satellite city likely shares a similar potential problem.

Fish-based foods are often found in a variety of foods for school children. Food for school children is ready-to-eat food that is sold at school yard can be

consumed directly at the purchasing site. It can be classified into four categories, which are main meals, snacks, beverages, and fruits. Food for school children is one of the main concerns of the Indonesian government because it is widely consumed by Indonesian children. The report of Monitoring and Verification of Food for School Children Safety Profile in 2008 showed nearly 100% of school children have the habit of buying and consuming foods at school (National Agency of Drug and Food Control [NADFC], 2013). This fact showed that foods for school children were very interesting for them. The availability of foods for school children in public places allows them to eat more of those foods.

Food vendors have a role in implementing good processing practices to ensure that their products are safe to eat. They also have to control the cleanliness of their stalls and the surrounding environment to protect the foods from cross-contamination. However, the implementation of good processing practices by fish-based foods for school children vendors has not become a common matter of concern. The previous study

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conducted in Ghana showed that food vendors in educational institutions generally adhered to good food hygiene practices with regards to regular medical examinations (93%), protection of food from flies and dust (55%), proper serving of food (100%), good hand hygiene (63%), and the use of personal protective clothing (52%) (Monneyl *et al.*, 2013). Yet, another study that took place in Yogyakarta, Indonesia, showed that about 64% of food vendors in elementary school had limited knowledge of prohibited substances for food and about 40% of the vendors had limited knowledge about food hygiene and sanitation (Nasikhin *et al.*, 2013). Therefore, it was considered important to do research that focused on fish-based foods for school children to know the vendors' compliance with good processing practices.

This study aimed to determine the level of compliance of the fish-based food vendors with good processing practices.

2. Materials and methods

This study was conducted in Bogor City in 50 schools, which comprised 21 elementary schools, 11 junior high schools, 13 senior high schools, and 5 universities. As many as 63 fish-based food vendors were observed in this study. The research process consisted of questionnaire arrangement; fish-based food vendor selection; questionnaire validation; interview and observation; data analysis; and level of compliance determination.

2.1 Questionnaire arrangement

The questionnaire was arranged with reference to the Book of Food Safety Counseling in Schools (Rahayu *et al.*, 2005), the National Agency for Drug and Food Control (NADFC) regulation on procedures for inspection of food production facility in home-industry (NADFC, 2012a), and Bogor Agricultural University canteen inspection report (IPB, 2012). The first reference became the source of information regarding good ready-to-eat food processing practices. The second reference provided required observation elements and standard of compliance of food producers. The gaps between the first and second references were analyzed and adjusted using the third reference. Then, the questionnaire was arranged based on the gathered information.

There were two main parts of the questionnaire, which were: 1) interview part (to gather information about the vendors' food processing practices) and 2) observation part (to determine the vendors' compliance to the good processing practices). The questionnaire was organized into distinctive sections which consisted of the

vendor's educational background, selling location (which kind of educational institution), selling place (inside or outside the school), supporting selling facility, type of food sold, treatment of processed food and condition of storage, the interaction between water needs for processing and water sources, type of waste container, and an observation checklist to determine compliance level with good processing practices.

2.2 Fish-based food vendor selection

The number of respondents was determined by using the Slovin formula (Sarwono, 2006). It was done based on the assumption that there was one vendor in every school (elementary school, junior high school, and senior high school) and three vendors in each university. Then sampling was conducted randomly using the stratified sampling method, which is the type of sampling method which divides the population into stratum (Setiawan, 2005).

2.3 Questionnaire validation

The questionnaire was tested for clarity and validity on 10 randomly selected vendors. The pretest result was used to revise the initial questionnaire. The final version of the questionnaire was used to collect data from the respondents.

2.4 Interview and observation

The interview and observation were conducted during the school hours, i.e. at 08.00-16.00. The questionnaires were filled out by the surveyors.

2.5 Data analysis

The data obtained were analyzed using frequency calculation function (descriptive statistics) using IBM SPSS version 20 program. The frequencies and the percentages of responses to each question were computed with Microsoft Excel.

2.6 Level of compliance determination

Table 1. Food vendors compliance level standard

Compliance Level	Maximum number of deviations		
	MI	MA	CR
Compliant	2	1-2	1-2
Partially compliant	2	3	3-5
Non-compliant	2	>3	>5

Information: MI (minor), MA (major), CR (critical)

The food vendor's compliance level standard could be seen in Table 1. This standard was arranged based on food inspection system for the food industry (Rahayu *et al.*, 2005; NADFC, 2012a). There were some modifications made to the standards, considering some gaps and differences between the food industry and the

Table 2. The selected elements of interview and observation in the questionnaire

No	Selected Elements	Category		
		Minor	Major	Critical
A Storage				
1	Raw materials and finished goods are stored separately			✓
2	The place to store/display food is clean		✓	
B The hands of workers and equipment				
3	Worker's clothes look clean			✓
4	Workers wear protective clothing/aprons	✓		
5	Worker's nails look clean and neat			✓
6	Worker's hands look clean			✓
7	There are no injuries in the hands of workers			✓
8	Workers do not use jewelry and watches when processing food			✓
9	The availability of running water that is used by workers to wash their hands and equipment used by workers to wash their hands		✓	
10	The availability of running water/water supply facilities for washing equipment		✓	
11	Cookware and cutlery are clean			✓
12	Worksurface cleaning tools and materials are available	✓		
C Cooking				
13	Cooking oil used is fresh			✓
D Selling location				
14	The working surface of the shop is clean		✓	
15	The location around the shop is clean		✓	
16	All equipment is protected from rain splashes		✓	
E Waste disposal				
17	Trash and waste bins are available in the nearby location			✓
18	No animals are roaming in the location			✓

vendors. The questions intended to evaluate the level of compliance were divided into three categories, which consisted of minor category (2 questions), major category (6 questions), and critical category (10 questions). The selected elements of interview and observation in the questionnaire as categorized as minor, major and critical are shown in Table 2. Each respondent's responses that did not conform with good processing practices were counted. Then, the level of compliance can be determined based on the sum and category of the deviations.

3. Results and discussion

3.1 Characteristic of vendors

Vendors who became the respondents in this study had different educational backgrounds. The results indicated that most of the vendors (37%) were only had elementary school level education. However, not all vendors had a low level of education. Some vendors had studied at the diploma or undergraduate school (6%) (Figure 1). Education is expected to provide insight or knowledge to humans, including knowledge about food safety. Food safety knowledge is an important aspect that shows the level of the vendors' understanding of food safety (Anggitasari *et al.*, 2014). A person's knowledge of the importance of food safety greatly influence his

attitudes and practices in selecting, processing, and storing food (Andarwulan *et al.*, 2009). With more knowledge of food safety, it is expected that a person will have better attitudes and practices regarding the safety of food, and in terms of food vendors, it will encourage them to sell foods with good quality and nutrition (Anggitasari *et al.*, 2014).

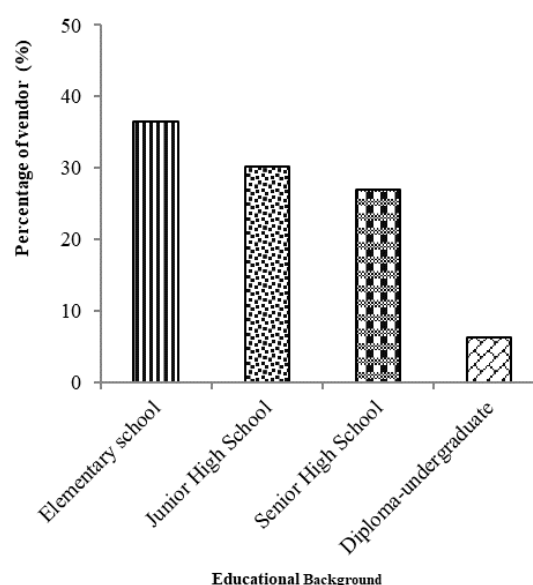


Figure 1. Vendor's educational background

Various kinds of food for school children are easily found in the school environment, whether in the form of snacks, main meals, beverages, or fruits. Fish-based

foods for school children are generally made into snacks and main meals. The fish-based main meals commonly sold are *siomay*, *batagor*, *pempek*, *takoyaki*, *okonomiyaki*, boiled green shellfish, steamed fish, fried fish, and so on. The raw material used to make those foods was not limited to one type of fish, but a variety of fish, shrimp, crab, octopus, and green shellfish. Those raw materials can also be processed to make snacks for school children, such as *otak-otak*, fried meatballs, and processed seafood which were generally served like satay.

Food for school children vendors sold their products not only in the school canteen but also in the schoolyard or outside the schoolyard. Those who vend in the school canteen commonly use means such as display windows or permanent buildings and desks, whereas those who were outside and inside the schoolyard generally used a cart, handcart, or motor vehicles. This condition was because the vendors outside the canteen cannot be settled, which the vendors in the canteen can do, so they used movable vending facilities (Figure 2).

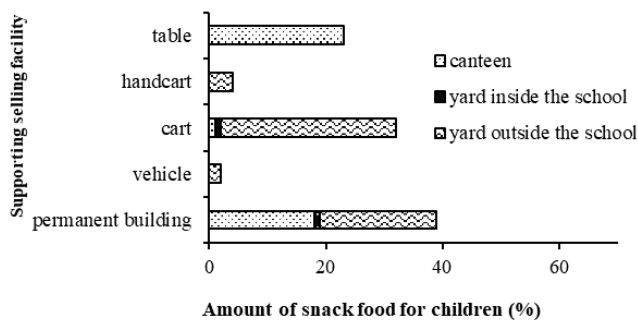


Figure 2. Interaction between supporting selling facility and selling place

The environmental condition of some vending site which was located at the roadside was crowded. The crowdedness was caused by parents who waited outside the school as well as the multitude of people and vehicles passing by. The road condition, which was quite narrow with only one car able to pass at a time, resulted in the distance between the vehicles with the displayed foods was very close (Yunita *et al.*, 2016). This condition causes a lot of dust around the food which contains a lot of microbes and contaminants. This indicated that there was a higher risk of biological and physical hazards contamination of foods sold outside the schoolyard than those in the canteen. The non-indigenous bacteria especially *Salmonella spp.* can be easily found in the environment. Salmonellosis due to *Salmonella spp.* infection result in diverse clinical manifestations such as typhoid fever, caused by *S. enterica* serovar Typhi and self-limiting diarrhea caused by the non-typhoidal *Salmonella* serovars (De Jong, 2012).

3.2 Processing condition

From the results obtained, all the vendors prepared the fish-based food for school children by separating raw and cooked materials. Separation of raw and cooked material was done to keep the raw materials from contaminating cooked foods or products that were ready to eat. This showed a high awareness of food vendors toward safe food handling. It is nearly always possible to detect a range of human pathogenic bacteria on any fish or fish product that has not received any bactericidal treatment. Some of these pathogens may constitute part of the natural flora on the fish (pathogens from the aquatic environment) or be there as a result of unavoidable contamination (pathogens from the general environment). Yet, it is common for these pathogens that some growth in the fish products is required to produce disease in humans (Raini *et al.*, 2004). The growth of pathogens in raw fish which intended to be cooked only gets a little safety concern. Only limited growth is possible before spoilage causing rejection and it is usually in borderline cases because cooking can destroy the pathogens. The growth of pathogens from animal or human reservoir gives no direct safety concern in raw fish which intended to be cooked before consumption as described above, but it may constitute a secondary hazard due to the increase of spread and contamination of the processing or kitchen environment with these pathogens (FAO, 2004).

The storing of food was performed differently by each vendor. Generally, the vendors had been prepared half-cooked food or processed food that was ready to be cooked on the vending site. Those foods were stored at first and then partially displayed. Mostly, the storage was done at room temperature, but some vendors stored the foods in the refrigerator or freezer (Figure 3). Microbes grow well in dangerous temperature area, which is between 5 and 60°C (Rahayu *et al.*, 2005). If the vendors want to keep the food for more than 4 hours, such as when they have to prepare the foods early or want to save the remaining food, it is important to ensure that the foods are stored at low temperatures (below 5°C) (Rahayu *et al.*, 2005).

Inappropriate temperature control on fish-based products may increase the risk of histamine poisoning. Histamine is biogenic amine compound that is formed from an amino acid called histidine because of the activity of histidine decarboxylase enzyme, which could be sourced from the fish's body and microbes exist in its gastrointestinal tract or other contaminating microbes. Histamine poisoning symptoms start a few minutes after consuming fish, which consist of vomiting, diarrhea, swollen lips, cramps, and burning throat (Rahayu *et al.*,

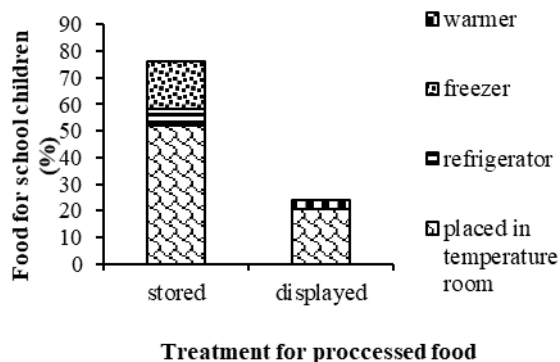


Figure 3. Treatment for processed food and condition of storage

2018). It can also cause the growth of the non-indigenous bacteria such as *Staphylococcus aureus*, *Salmonella* spp., *Shigella* spp. and pathogenic strains of *Escherichia coli* that can be found in domestic or industrial waste. Those bacteria can contaminate food and cause serious illness.

One of the utilization of water by fish-based food vendors was as the heating medium in the processing stage, i.e. steaming. Although the water used was not directly mixed with the raw material, but the water must meet drinking water requirements (NADFC, 2012b). The water used by the respondents sourced from taps and wells (Figure 4). Clean water in wells did not always fulfill the standards applied in Indonesia, which are stated in the Minister of Health regulation No. 416.1990 (Minister of Health Regulation, 1990). The physical and chemical quality of water taps at 5 locations in some cities (Bogor, Jakarta, Depok, Tangerang, and Bekasi) met the criteria (91.65 %); only 8.35 % were not eligible (Raini et al., 2004). Pathogenic bacteria that are commonly found in water are pathogenic strains of *Escherichia coli*. *Escherichia coli* is commonly used to monitor the microbiological quality of drinking water. The common symptoms of *Escherichia coli* infection are diarrhea with or without fever (Odonkor and Ampofo, 2013).

3.3 Worker behavior

Worker behavior includes the behavior of vendors in terms of handwashing, utensils washing, sickness handling and the use of jewelry. There were 81% of vendors who did not wash their hands before processing the food. Yet, only 59% of vendors used soap to wash their hands. Vendors who washed their hands with non-flowing water (water in the bucket) reached 44% of all the vendors. The source of water used was PDAM (state water company) water (82%) and well water (18%). Vendors who provided wipes to clean hands were as much as 89% of the respondents.

Keeping hands and kitchen utensils clean is very important to prevent bacterial contamination, especially

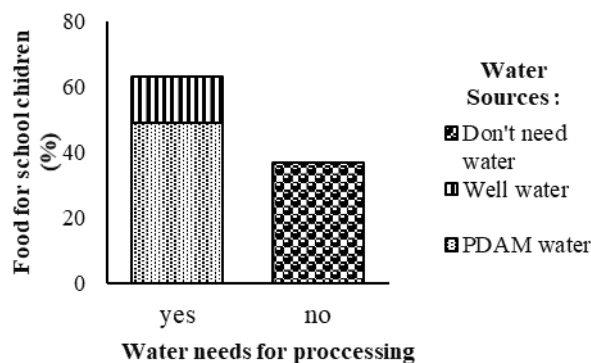


Figure 4. Interaction between water needs for processing and water sources

S. aureus. *S. aureus* is a normal flora on the skin and in the respiratory organs and generally found in 20-50% of the healthy population. *S. aureus* contamination in food can cause intoxication with symptoms that typically occur, i.e. nausea and vomiting, accompanied by abdominal cramps, sometimes followed by diarrhea. In severe cases, a person can suffer headache, muscle cramps and dehydration (Yunita et al., 2016)

Generally, the vendors only prepared plastic bags for waste disposal. This was due to the convenience of using plastic as a waste container because it did not require to be cleaned (Figure 5). Plastic in the open state may pose a risk because it can invite pests, which can invest hazards into food if it is placed near the food processing area. Rahayu et al. (2005) stated that pests can contaminate food and can be controlled in three ways, i.e. maintaining the cleanliness of the processing and handling place regularly, storing food in sealed containers, and closing disposal place.

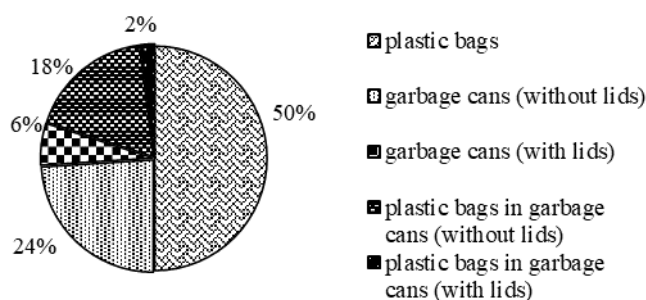


Figure 5. Type of waste container

About 98% of the equipment used to process food for school children were washed at first. The sources of water used were tap water (71%) and flowing water (27%). The vendors preferred to wash their utensils using flowing water/ tap water (60%) compared with non-flowing water (38%). All vendors provided wipes to clean their work surfaces. Only 51% of vendors who provided cleaning materials such as soap or detergent to clean their equipment. The apron was only used by 97% of the vendors. When handling food, workers who used jewelry on their hands reached 36.5%. Although physical hazards rarely cause serious injury, they are among the

most commonly reported consumer complaints, because the injury occurs immediately or soon after eating, and the source of the hazard is often easy to identify (FAO, 2004). When vendors suffer disease, 86% of them prefer to get rest than to keep selling foods. Personal hygiene is important because according to Marriot (1985), human beings are the largest contamination sources of food. Handling with bare hands may result in cross-contamination, hence introducing microbes on food.

3.4 Compliance to good processing practices

The determination of the respondents' level of compliance indicated only 46% of vendors were compliant and there were still 26% of vendors who did not carry out the good food processing practices. Moreover, the observation done in this study showed that there were some main problem sources. The first one was all respondents had no access to running water to wash hands and equipment. Another source of the problem was the absence of protective clothes for the workers, which was found in 92% of the respondents. The last was the filthy conditions of the surface of the booth (81%), the display (65%) and also of the workers' hands (73%).

FAO stipulates that street foods raise concern to their potential for serious food poisoning outbreaks due to improper use of additives, the presence of adulterants and environmental contaminants, and improper food handling practices amongst street food vendors (FAO, 1997). Street food vendors practiced minimal hygienic and sanitary practices. The hygienic practices in question included food preparation, handling of utensils, the place for food preparation, personal hygiene, and methods of storing cooked food (Muinde and Kuria, 2014). According to Muinde and Kuria (2014), fish vendors in Nairobi prepared their food products in the stall. Up to 92.5% of the vendors did not have garbage receptacles, hence they disposed of their garbage just near the stalls. The study in Nairobi found that proper garbage collection and disposal were lacking and vendors had to put garbage in their place (Muinde and Kuria, 2014).

According to Contento (2007), a person with a higher level of education will be better at receiving, processing, interpreting, and using information. Nasikhin *et al.* (2013) had found that the education level of the vendor showed a positive effect on the knowledge of prohibited substances and food hygiene and sanitation. Yet, the results obtained in this study indicated that the vendors who had junior or senior high school education were mostly compliant while most of those whose educational background was diploma/ undergraduate were only partially compliant with good processing practices (Figure 6). This result showed that the

compliance level of food for school children vendors was not parallel with their educational background. Green (2008) revealed some behavioral studies, including food safety behavioral studies, which indicated that although knowledge of food safety was a component needed to change behavior, it was not enough. Egan *et al.* (2006) also revealed that knowledge alone was not enough to produce changes in food handling practices.

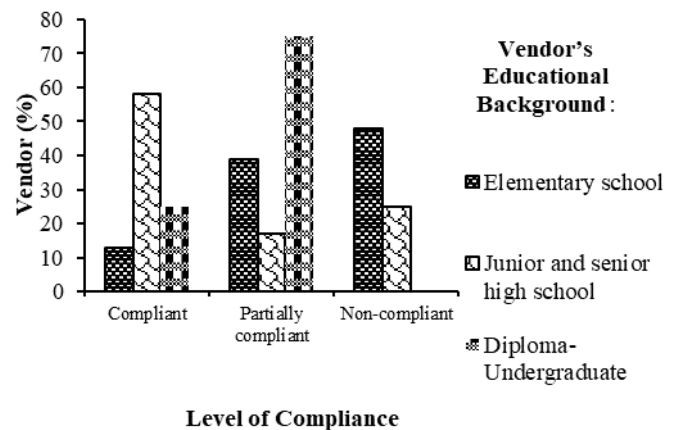


Figure 6. Interaction between the level of compliance of the vendor and the vendor's educational background

Most of the vendors who vend at the junior and senior high schools had high compliance levels while many vendors at the elementary schools had low compliance levels. Vendors who vend at the university environment were generally partially compliant (Figure 7). Kunkel *et al.* (2004) and Calvert (2008) stated that consumers in the children's age were unique because children were lacking the ability and cognitive skills compared with older adults. Lundberg *et al.* (2007) showed the opposite findings of the consumers in the children's age. They stated that children made decisions independently. The higher knowledge did not mean attitude taken would be more appropriate. On the opposite side, Mathews *et al.* (2005) stated that knowledge would influence the children's choice of food products.

Another factor that related to the vendors' compliance with good processing practice was the selling place (Figure 8). The location of food production and sales should be properly maintained, protected from direct sunlight and the sources of contaminants. With a permanent canteen facility and adequate water supply, generally, the vendors can implement the good processing practices. On the other side, the vendors in or outside the schoolyard with minimum facilities and water supply, and also a higher risk of contamination from air exposure, were facing difficulties in implementing the good processing practices. The lack of water for washing and cleaning the tools and personnel hygiene was the largest obstacle. The handcarts or carts also had a high potential to be polluted by contaminants.

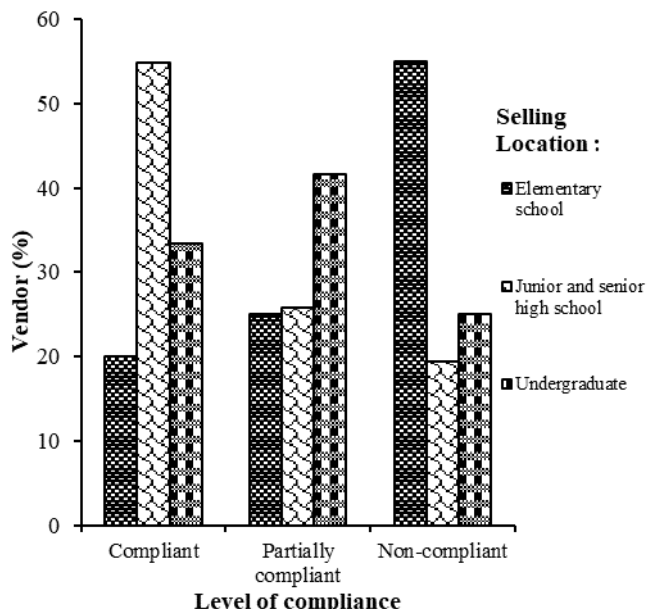


Figure 7. Interaction between the level of compliance of the vendor and selling location

Tools and facilities are the factors that allow the formation or changes in a person's behavior (Notoatmodjo, 2007). As mentioned before, supporting facilities used were adjusted to the vending place. Cart, handcart, and motor vehicle were commonly used to selling around. The moving and open conditions caused a higher risk of contamination, which was supported by minimum water supply, so it was more difficult for these vendors to comply with the good processing practices than vendors who settled. Vendors who settled generally use supporting facilities in the form of a permanent building or table (Figure 9).

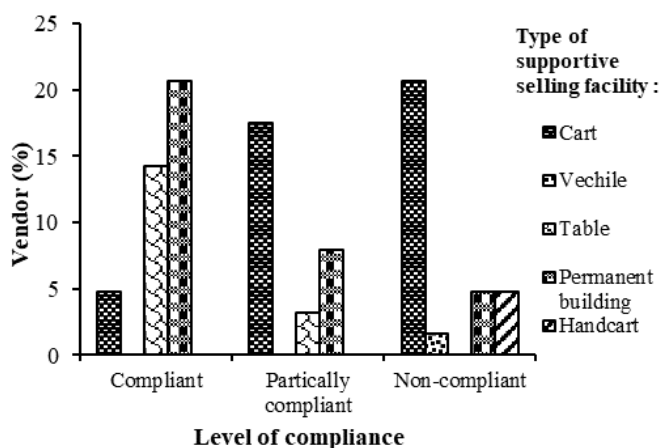


Figure 9. Interaction between the level of compliance of the vendors and supportive selling facility

The most favorite fish-based food for school children was *siomay*, while the food purchased most infrequently was *bakso* (meatballs). The level of vendors' compliance may be affected by the interest of consumers toward their products. *Siomay* vendors had the highest levels of compliance (Figure 10). This may happen because the vendors were aware that their products were the most favorite ones, so they vied to comply with good

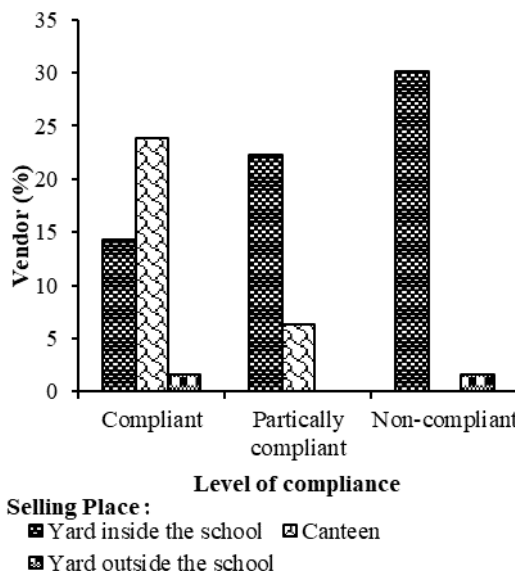


Figure 8. Interaction between the level of compliance of the vendors and selling place

processing practices so that their product would not lose its competitiveness in the market. It was different from fried meatball vendors, which were all non-compliant vendors. It can be caused by lower consumer interest compared to other kinds of food for school children. Fan and Li (2009) stated that children had a sequence of product attributes that were important in the purchase of food. These attributes were taste, price, brand, and promotion. These many different attributes on each food might lead to different levels of compliance.

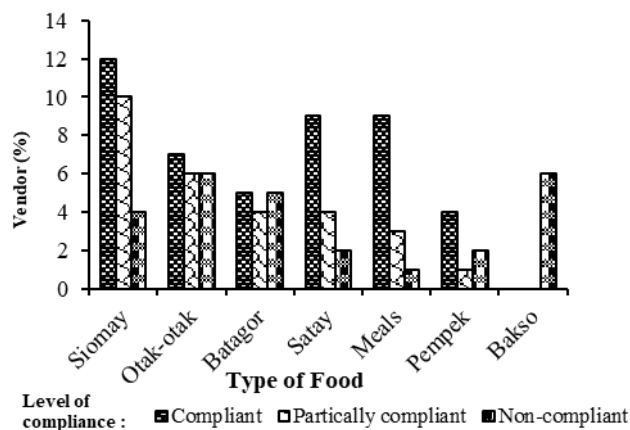


Figure 10. Interaction between the level of compliance of the vendors and type of food for school children

4. Conclusion

The compliance level of food for school children vendors was not parallel with their educational background. The vendors who had junior or senior high school education were more obedient to good processing practices compared to those whose educational background was diploma/undergraduate. Most of the vendors who vend at the junior and senior high schools had higher compliance levels compared to those who vend at

the elementary school. Other factors related to the vendors' compliance were the selling place and the type of products. Consumers' awareness of buying safe food products also plays an important role that affected food vendors' compliance. The major issue for the food safety mostly were no access to running water, the absence of protective clothes, the filthy conditions of the surface of the booth, the display and the workers' hands. This can be the source of pathogen cross-contamination that cause foodborne illness to the consumers. Bacteria that cause food poisoning may be various such as *S. aureus* found in unclean hands, *E. coli* in water and *Salmonella spp.* in the environment. Based on this study, to improve vendors' compliance with good processing practices, the change of vendors' habits and mindset urgently needs to be done. It is necessary to conduct further food safety extension for the vendors to encourage them to provide proper equipment and method in processing fish-based food products.

Conflict of interest

The authors declare no conflict of interest.

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