

Bacterial Assessment among Traditional Food Handlers and Their Behavior Related to Hygiene and Sanitation

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Abstract: The foodborne disease still become significant health problems in the developing region. As the primary school-age children were most affected, regulation to reduce its incidence is necessary. Food-handlers are one of the sources of transmission, particularly in a school environment. Our study aimed to provide bacterial assessment among traditional food-handlers in two different public primary schools, Public Primary School 064024, Prona Satu St and Public Primary School 066656, Karya Sembada St, in Medan Selayang sub-district, Medan, Indonesia. We conducted a descriptive study enrolled 22 traditional food-handlers and evaluated their behavior related to hygiene and sanitation by using fundamental principles rules released by the Ministry of Health of Republic of Indonesia No.942/MENKES/SK/VII/2003. We found that all food-handlers did not perform basic principles rules and categorized as ineligible. While, 18 of 22 (81.8%) traditional food-handlers carried bacterial pathogen species including *Escherichia coli* (50%), *Staphylococcus aureus* (22.72%), and *Klebsiella spp* (9.09%).

1 INTRODUCTION

Foodborne diseases are still becoming a significant problem for a specific population, especially school-aged children. School-aged children are vulnerable acquire food-borne diseases at school due to inappropriate behavior related to sanitation and hygiene of people around the school including food-handlers. World Health Organization (WHO) defines foodborne disease as infectious or toxic diseases and caused by agents entering the body via ingested foods, whether caused by microbes or other causes (viruses, parasites, freshwater or seawater algae, bacterial and non-bacterial toxins) (Scott, 2003). Generally, *Escherichia coli*, *Bacillus cereus*, *Salmonella*, Hepatitis, *Shigella*, *Staphylococcus aureus*, Rotavirus, *Brucella* and other enteric bacteria are the most common etiologic agent causing food-borne disease (Rane, 2011).

Statistically, due to economic reasons, poverty, and lack of adequate health care facilities, the frequency of foodborne diseases and its outbreaks in school still increases in Indonesia. In 2004, there were 19 incidents of food poisoning noted by the

Department of Health with a total of 575 children affected by the outbreaks. There was also a report from National Agency of Drug and Food Control (2011) in Samarinda, Indonesia, most cases of food-borne diseases are caused by food and drink contamination (39.92%). The increased prevalence of food-borne diseases prevents certain nations from achieving Millenium Development Goals (MDGs) 1, 4, 5, and 6 (Monney, 2013).

Therefore, the school circle starts from a teacher, principal, the parents, food-handlers, and the children should understand the quality of proper sanitation and hygiene to reduce the incidence of the foodborne diseases (Machado, 2014). The incidence of foodborne diseases will increase related to imperfect knowledge and behavior of people about sanitation and hygiene, particularly food-handlers. Food-handlers become potential sources in the chain of bacterial transfer into food and causing the disease. Consequently, by controlling the cleanliness of food-handlers become a cornerstone in preventing the transmission of foodborne disease (Unicomb, 2009). Nevertheless, only 6.6% food-handlers using an apron while working and there was also evident

that 11.1% of food-handlers had poor behavior in the specific part of Indonesia (Agustina, 2009). Several policies related to control and improve hygiene and sanitation has been established, for instances, UNICEF (United Nations Children's Fund) has also launched child-friendly school (CFS) model and also Indonesia's government policy by releasing several ground-rules related to hygiene and sanitation.

In our study, we identified the presence of bacteria in traditional food-handlers hand and evaluated their behavior related to hygiene and sanitation around the primary school environment. We also noted certain aspects that might interfere with the food-handlers' hygiene behavior mainly income and last education level.

2 METHODS

This study is our preliminary study for detecting bacterial among traditional food-handlers, nutritional status among primary school-aged children, their knowledge about hygiene and sanitation, and its relationship with several risk factors. Therefore, the study is still ongoing while we were completing this descriptive study. We enrolled 22 traditional food-handlers with no history of training about hygiene and sanitation. The study was conducted at two different public primary schools, Public Primary School 064024, Prona Satu St and Public Primary School 066656, Karya Sembada St, in Medan Selayang sub-district, Medan, Indonesia. We used total sampling, all food-handlers around the school should be included in this study without using any inclusion criteria. Before sampling, we explained the study and procedure then without coercion all samples give their consent.

2.1 Traditional Food-handlers Behavior

Based on the decision of the Minister of Health of the Republic of Indonesia No.942/MENKES/SK/VII/2003, there are several basic principles used to assess whether food-handlers behavior has met the requirements in the principle of proper hygiene and sanitation. All the principles established in the decision must be carried out by food-handlers. If the food-handlers did not perform only one principle, their behavior was declared as 'ineligible.'

All the principles were listed, for instance (a) Hand washing properly, before and after handling the food, (b) keep the nail always clean, (c) keep the

clothes clean, (d) there is no open wound on their hands, (e) using apron, (f) using head cover, (g) all equipment must be washed with soap and draining water, (h) food-equipment must be dried by using clean cloth, (i) equipment must be kept in sealed container, (j) when selling food was not allowed to smoke, (k) scratching the body, (l) no coughing and sneezing without covering nose and mouth. The interview was directly performed by a face-to-face method using rules that we mentioned before and observational checklist.

2.2 Swab Collection and Bacterial Identification

The swab obtained from the finger of the traditional food handlers by using cotton stick before meal preparation, then we transported the samples by using Brain Heart Infusion (BHI) media to our laboratory. In the laboratory, we swabbed the cotton stick on to McConkey and blood agar. Bacterial identification was made by using several techniques such as using agar and biochemical reaction after culturing the bacteria in agar (Blood agar and McConkey agar). Then, the output of the examination was a positive or negative growth of bacteria. After 24 hours of incubation, the bacterial colonies would appear. Hereafter, the bacterial identification was started by using gram staining and biochemical reaction including indole production, methyl red, Voges-Proskauer, Simmons citrate, urease, motility test, using Triple Sugar iron (TSI), gas and sulfur production, glucose, lactose, maltose, mannitol, and sucrose fermentation. All the process mentioned above was done in the Microbiology Department, Faculty of Medicine, Universitas Sumatera Utara, Medan, Indonesia from February until May 2018.

2.3 Ethical Consideration and Data Analysis

We also attained study approval from the Health Research Ethical Committee of Medical School of Universitas Sumatera Utara No. 265/TGL/KEPK FK USU-RSUP HAM/2018 and fulfilled the ethical principles of the Declaration of Helsinki (2008). After collecting all the samples, the data were presented using univariate fashion using a computer.

3 RESULTS AND DISCUSSION

We included 22 traditional food-handlers who all sold traditional snacks such as fried-tofu with filling, meatballs, sausage, and toast. All food-handlers marketed is processed by the food handlers themselves. Therefore, we also evaluated their behavior related to hygiene and sanitation. We found a significant result that all food-handlers were categorized as ineligible to be called as proper food-

handlers. We questioned all food-handlers by using ground-rules of hygiene and sanitation made of Ministry of Health of Republic Indonesia. The observation was also done in a short period, we observed all the food-handlers using the similar food storage container, plastic container or open container. Hand washing before and after food-handling, become one of the critical rules, was only performed by six food-handlers. While two food handlers did not keep the cleanliness of their nails.

Table 1: This caption has one line so it is centered.

Variables	Bacterial culture result		N (%)	p-value
	Positive N (%)	Negative N (%)		
Gender				
Male	16 (84.2)	3 (15.8)	19 (86.4)	0.470
Female	2 (66.7)	1 (33.3)	3 (13.6)	
Age				
≤ 50 yrs	10 (71.4)	4 (28.6)	14 (63.6)	0.254
> 50 yrs	8 (100.0)	0 (0.0)	8 (36.3)	
Last education level				
Primary school	8 (80.0)	2 (20.0)	10 (45.5)	0.080
Junior high school	1 (33.3)	2 (66.7)	3 (13.6)	
Senior high school	8 (100.0)	0 (0.0)	8 (36.4)	
No formal education	1 (100.0)	0 (0.0)	1 (4.5)	
Income				
≤ Rp 200.000,00	10 (76.9)	3 (23.1)	13 (59.1)	0.616
> Rp 200.000,00	8 (88.9)	1 (11.1)	9 (40.9)	

Table 2: This caption has more than one line so it has to be set to justify.

Principles	Bacteria culture result		N (%)
	Positive N (%)	Negative N (%)	
Handwashing before and after food-handling			
Yes	5 (83.3)	1 (16.7)	6 (27.2)
No	13 (81.3)	3 (18.8)	16 (72.7)
Cleanliness of finger and cloths			
Yes	17 (85.0)	3 (15.0)	20 (91.0)
No	1 (50.0)	1 (50.0)	2 (9.0)
Using apron and head cover			
Yes	0 (0.0)	0 (0.0)	0 (0.0)
No	18 (81.8)	4 (18.2)	22 (100.0)
Food equipment washed and dried using draining water			
Yes	0 (0.0)	0 (0.0)	0 (0.0)
No	18 (81.8)	4 (18.2)	22 (100.0)
Smoke habit while handling			
Yes	10 (83.3)	2 (16.7)	12 (54.5)
No	8 (80.0)	2 (20.0)	10 (45.5)
Access to clean water			
Yes	0 (0.0)	0 (0.0)	0 (0.0)
No	18 (81.8)	4 (18.2)	22 (100)
A cough and sneezing while handling			
Yes	1 (100.0)	0 (0.0)	1 (4.5)
No	17 (81.0)	4 (19.0)	21 (95.5)

and cloth. None of the food handlers used apron and head cover. Moreover, 22 food-handlers had a terrible habit of smoking while handling 18 of 22 (81.8%) traditional food-handlers are positively evident of bacterial pathogen growth in agar. From the identification process, we determined the bacteria species including *Escherichia coli* (50%), *Staphylococcus aureus* (22.72%), and *Klebsiella spp* (9.09%). Three of the bacteria is categorized as the agent of food-borne disease; therefore, we stated all food-handlers who was confident with the pathogen are at risk of becoming a source of transmission. We commonly found *Bacillus subtilis* and *Staphylococcus epidermidis* as normal flora among food-handlers.

Food-handlers are one of the sources of foodborne diseases transmission, their behavior directly related to the incidence of foodborne disease, we found 81.8% of food-handlers are positive with bacterial pathogen growth. A study conducted in Sari City, Iran (2017) showed more than 60% food-handlers are positive for different bacterial species including *Staphylococcus aureus* (46%), *Escherichia coli* (29.2%), *Coliforms* (18.2%), and *Pseudomonas aeruginosa* (6.6%) from their fingernail. We also obtained a similar result that *Staphylococcus aureus*, 40-50% found in the skin of healthy people, and *Escherichia coli* are the most common species found in our study. While some literature emphasizes *S.aureus* causing food poisoning and it is evident that its toxin is highly associated with food poisoning (Loir, 2003), (Møretro and Langsrud, 2017). Moreover, by coughing and sneezing *S.aureus* will transmit rapidly during food-handling since *S.aureus* colonized around the anterior nostril of the nose (Hennekinne, 2012). In our study, we found one participant who had coughing and sneezing habit while handling and it was positive with bacterial growth.

Besides, proper hand washing is one of the best ways to prevent foodborne diseases, and this small action is related to significant implication since our study found 13 participants (81.3%) without hand washing are positive for bacterial culture result. Hand washing is mandatory because of its association with the bacterial transmission, particularly among food-handlers. (Lambrechts, 2014) conducted a study to determine bacterial contamination among food-handlers, it showed only 18% of food-handlers had no detectable bacteria on their hands and they risk becoming a source of infections. It happened when most food-handlers did not perform proper hand washing technique. Hand

washing is very crucial since it removes all viable pathogen and resident microorganism, by using antimicrobial soap it can add to the antimicrobial effect of hand washing (Burton, 2011).

Using protection from outer garment while handling is also one of the principles of hygiene and sanitation released by the Ministry of Health. In our study, there were no food-handlers using apron and head cover. Meanwhile, (Assefa, 2015) found a significant association between bacterial hand contamination and cleanliness of outer garments ($X^2=7.653$, $p=0.006$). Besides, WHO also released international code of practice general principles of food hygiene, it recommends food-handlers using protection while handling such as head cover, apron, or equipment tools so that they do not touch the food directly using their hands (Codex Alimentarius, 2003).

(Allam, 2016) obtained positive result that by using interventional health education session, reduction in hand contamination was achieved. Therefore, several interventions to increase awareness of the foodborne disease among food-handlers are already implicated by specific organization and government. Indonesia's policy related to food safety has been ratified and released in 2011 consisted of several ground rules about food safety and quality. While the regulations came from the Ministry of Health No.1096 Year 2011 also stated basic principles hygiene and sanitation for food-handlers in improving food safety that we used to evaluate food-handlers behavior.

While UNICEF also launched the CFS program to regulate school in improving quality of hygiene and sanitation and it must become an implemented program worldwide. In this approach, a school will focus on providing proper sanitation and hygiene. One of the strategic approach to achieve the condition by using 'WASH' (Water, Sanitation, and Hygiene education) for all people around the school environment. Poor sanitation, water insufficient, bad water quality, and lousy hygiene behavior are a significant cause of mortality and morbidity for children. School-aged children who spend long hours in school should become the most affected group whether the condition did not improve in their school environment (Godfrey, 2012).

4 CONCLUSIONS

Our descriptive study showed several bad behaviors related to hygiene and sanitation among traditional food-handlers in two different public primary

schools in Medan, Indonesia. All stakeholder must understand the state of quality of hygiene and sanitation because primary school-aged children are the most affected population with this unaware behavior. From our evaluation, none of the traditional food-handlers categorized as eligible based on fundamental principles rules released by the Ministry of Health of the Republic of Indonesia. Our study is still ongoing and resulting from several variables that we do not mention here. Moreover, this study did not escape the limitation. Therefore, after completing our study, we attempt to determine the related risk factor and correlated them with bacterial hand contamination.

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