

Bacterial Screening and Food Handler Observation to Prevent Potential Outbreaks due to Food Provision in a University Canteen in Jakarta, Indonesia

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ABSTRACT

Objective. Tenants providing daily food in a big campus of approximately 50 thousand population are prone to an outbreak. This study aimed to observe the practice and compliance of food safety among the food providers.

Methods. In a food safety training done for tenants in a university canteen, participants were asked to fill an online questionnaire, then randomly selected for food examination in the laboratory to look for E. coli and coliform bacteria.

Results. Of the 500 tenants, 220 participated in the study but only 168 questionnaires were ready to be analysed. Male and female participants were approximately in similar composition, the same with food handlers and not food handler participants. Half of them finished high school; Higher education were observed among participants that were not food handlers. About ¾ of the participants were the owners who also worked as food handlers. The best food safety practice was washing hands compared to storing raw food, processing food, and storing processed food. Tenants who served uncooked food were significantly found to have higher E. coli, but no coliform containment found in the served food.

Conclusion. We found the best food safety practice was hand washing. The uncooked food menu contained more pathogens than the cooked ones, and were not associated with the knowledge and practice of food safety.

Keywords: university's canteen, tenants, food safety

INTRODUCTION

In the context of healthy university program for Asian universities, it is important to ensure food safety among the tenants in a university canteen, in order that they will provide healthy and safe food for the university's members. In this study, we would like to share our experience with the current issue in one university in Jakarta.

The university has two campuses in two provinces which are approximately 40 km apart. It comprises of 15 faculties and administrative buildings. In each building, the faculty and university provided a canteen. The food providers (tenants) rent kiosks from the faculty/university to sell food to students, staffs, and visitors of the university. There were more than 500 tenants all over the university. Most of them were the food handlers themselves.

Outbreak of diarrhea occurred in 2018 in that university. It was concluded that the outbreak was related with the practice of hand hygiene among the food handlers.¹⁻³ However, the university had a regulation that every tenant

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should be trained and practicing food safety to be food providers in the university.

Since food safety training was mandatory for all tenants before they opened their kiosk in the university’s canteen, it was unclear why an outbreak could happen, especially if it was related with the issue of food safety. In order to avoid similar problem, a training was conducted for the food tenants in the university. The training was followed up with field observation and laboratory test. This study described the findings of the observation and laboratory test to further identify potential outbreak by observing food safety practice.

METHODS

The design was a cross sectional study among participants in food safety training. Data were obtained through questionnaire, observation, and laboratory test. The study observed provision of food safety among the tenants while collecting food samples to check for E. coli and coliform. The study was in Jakarta and Depok, Jawa Barat province comprising all canteens in the 15 faculties and administrative buildings.

The outcome variables in this study were the practice of food safety, which were hand washing, keeping good storage for raw food, cooking, and storing the cooked food. The subjects of the study were the tenants who participated in the training. They had to fill in an online questionnaire. Each respondent was given 30 minutes to answer the questionnaire about the identity of the respondents and food safety practice.

Questions related with the respondent’s characteristics include sex, educational background, respondent’s role in the canteen, attendance to the food safety training, and the respondent’s role as the owner and/or food handler. The observation checklist for food safety practice was derived from the National Regulation of Standard Practice of Food Safety.⁴ The results were categorized as good or poor when they met more than 75% of the standard. The good practices were washing hands according to the six-steps of WHO,⁵ storing raw food in a refrigerator, washing raw food, cooking the raw food according to the menu, and using boiled water to make beverage. Storing food after cooking was considered good practice if they kept it in a close cupboard to avoid contamination by insects and air pollution. The observation was done once in this study, approximately 30 minutes for each observation.

Laboratory test for E. coli and coliform were done by randomly choosing two tenants from each campus. Food samples were randomly collected by the team who supervised the canteens. The samples were classified whether it was cooked or not according to the menu, i.e., raw food and cooked food.⁶ Beverages and ice cubes in the drinks were also collected and based on the source of water, we classified as cooked food i.e., if the tenants used boiled water. However, there was no clear information regarding water to make the ice cubes for cold beverage. Food samples were collected

in a 50 mL plastic bag and kept in an icebox to keep the samples fresh for further examination. The samples were brought to the laboratory of the Ministry of Health in Jakarta.

The data were verified and analyzed using SPSS IBM version 20. The study was reviewed and approved by the Ethics Committee of the Faculty of Medicine Universitas Indonesia.

RESULTS

From the 500 invitees who attended the training for food safety, 220 tenants participated and answered the questionnaire. However, only 168 questionnaires were completely filled in and underwent verification for further analysis. The respondents were 114 (67.9%) owners, 53% male, 73.8% finished 12-years of schooling and the rest underwent higher education. More than half (63.7%) of the respondents had attended a workshop about food safety prior to the study. There were 79 (47%) food handlers who only cooked and served food. The rest of the respondents were classified as owners. Owners occasionally helped to cook or serve, but mostly they were the decision makers. Out of the 168 respondents, 83 served uncooked food as in their menu, and the rest had to cook.

There was no significant difference of proportion between the owners and food handlers based on their characteristics, beside their educational background. Table 1 showed a significant difference between the food handler and the owner. Most of them had 9-12 years of schooling, and those who were not food handlers had higher education.

The questions about practicing food safety were applied to both food handlers and owners though some owners did not help in cooking and serving food. Sometimes owners also did the work in the canteen and both roles were required to fill in the questionnaire. The food safety practice of the respondents was shown in Table 2. Most respondents understood and practiced good hand washing, stored raw food, cooked well, and kept the cooked food well. There was no difference in practicing food safety between the food handlers and not food handlers.

Table 1. Characteristics of the Respondents based on their Roles as Food Handler and Owner

Characteristics		Owner (n, %)	Food Handler (n, %)
Gender	Male	45 (50.6)	44 (49.4)
	Female	44 (55.7)	35 (44.3)
Educational background	Elementary and high school	56 (45.2)	68 (54.8)
	College and post-graduate	33 (75.0)	11 (25.0)
Roles of respondents	Owner	87 (76.3)	27 (23.7)
	Employee	2 (3.7)	52 (96.3)
Previous training	No	31 (50.8)	30 (49.2)
	Yes	58 (54.2)	49 (45.8)

*Significant difference, chi-squared ($p < 0.05$)

Table 2. Respondents' Food Safety Practice based on their Roles as Food Handlers and Owners*

Food Safety Behavior		Owner (n, %)		Food Handler (n, %)	
Hand wash	Poor	5 (62.5)		3 (37.5)	
	Good	84 (52.5)		76 (47.5)	
Raw food storage	Poor	5 (62.5)		3 (37.5)	
	Good	84 (52.5)		76 (47.5)	
Processing food	Poor	19 (65.5)		10 (34.5)	
	Good	70 (50.4)		69 (49.6)	
Processed food storage	Poor	63 (53.8)		54 (46.3)	
	Good	26 (51.0)		25 (49.0)	

*No significant difference of proportion was observed between the two groups.

In Table 3, we compared the food safety behavior among those who had to cook food and who had not. The proportion of good hand washing was significantly lower among those who did not cook food. Similarly, with storing raw food, the good practice was lower among those who did not cook food and the difference was significant. Related with processing food and storing the ready-to-serve food, there was also a lower proportion of good food safety practice, but the difference was not significant.

We did laboratory examination for coliform and E. coli for 33 food samples and beverages, consisted of 22 (66.7%) uncooked food (ice cubes, sauce, chili spice) and the rest were cooked food (soup). The result of the laboratory examination was compared to the food safety practice as shown in Table 4.

When we examined the ready-to-serve food, we classified the results into two groups, those with E. coli that exceed the threshold and those under the cut-off. A significantly different proportion (p=0.017) of E. coli in the platelet was found between the cooked and uncooked food (Table 4), but not for coliform platelet. However, it was more important to note that E. coli and coliform still existed even for those who provided good food safety practice. This finding indicated other source of E. coli that could not be eliminated by food safety practice only among the tenants.

Table 3. Respondent's Food Safety Behavior based on Cooked and Uncooked food

Food Safety Behavior		Owner (n, %)		Food Handler (n, %)	
		Uncooked	Cooked	Uncooked	Cooked
Hand wash	Poor*	3 (5.7)	2 (3.3)	2 (6.7)	1 (4.2)
	Good*	50 (94.3)	59 (96.7)	28 (93.3)	23 (95.8)
Raw food store	Poor [§]	4 (7.5)	0	3 (10.0)	1 (4.2)
	Good [§]	49 (92.5)	61 (100)	27 (90.0)	23 (95.8)
Processing food	Poor	9 (17.0)	12 (19.7)	6 (20.0)	2 (8.3)
	Good	44 (47.3)	49 (80.3)	24 (80.0)	22 (91.7)
Processed food store	Poor	36 (67.9)	40 (65.6)	24 (80.0)	17 (70.8)
	Good	17 (32.1)	21 (34.4)	6 (20.0)	7 (29.2)

*,[§] significant difference of proportion, McNemar Test (p< 0.0000)

DISCUSSION

Out of 500 booths in the canteen that provided food and beverages for approximately 50 thousand population in that university, 168 (33.3%) underwent observation for food safety practice. Among the participants, only 33 specimens of food and beverage in the canteens were examined and found positive results even though some of them were practicing good food safety.

In accordance with the study's objective, we identified two roles in the compliance of food safety practice: owners and food handlers. There was no difference in the characteristics of both groups, especially in training to provide safe food. Thus, both groups were similar in terms of gender and exposure to a training before the study.

This university's environmental and occupational safety and health unit had routinely provided training for the new tenants. However, the attendees were more often the owners and not the food handlers. The food handlers were expected to attend the training to improve knowledge and practice, and to avoid bacterial and viral infections in three ways: food handlers, animals, and contaminated food.⁵⁻⁷ Food handlers and other vectors had higher chance of transmitting virus and bacteria to the food, when served without proper food safety handling, which is supposed to be the culture of the food handlers.⁸⁻¹⁰

It is worth noting that the food handlers had lower education than the owners. Some owners were academic and administrative staff that had higher education and hired food handlers to cook in the canteen. The education gap might result in different comprehension and practice of the new knowledge from the food safety training.

In Table 2, most of the respondents knew and practiced good hand washing (95.2%), good storage of raw food (95.2%), and how to cook food (85.7%), however most of them did not keep the cooked food well for serving (69.6%).

Table 3 showed there was no significant difference between the food handlers and not food handlers when complying with the food safety practice. This means the two

Table 4. Laboratory Result of E. coli Platelet and coliform among 33 Tenants of a University Canteen

Processed food		Food Safety Practice	
		Poor	Good
E. coli Platelet	Lower limit*	5 (50.0)	5 (50.0)
	Upper limit*	17 (73.9)	6 (26.1)
Coliform	Lower limit	5 (38.5)	8 (61.5)
	Upper limit	17 (85.0)	3 (15.0)

* Significant difference of proportion, McNemar Test (p< 0.0017)

groups were similar in this context; therefore, there was no need to distinguish the two in further analysis. Other research proved that collective actions, education, and training in food safety practices and programs play an important role in improving food safety practices.¹¹

Table 3 shows a significant difference in how to wash hands between providers of cooked food and those who are not. This was a potential source of food contamination which may result in an outbreak if a certain community is affected. One study described the constraints for hand washing: time, lack of facilities, and inadequate supervision.¹² In a study in China, – a village which were interfered with hand washing for two years had only 2% of the population contaminated with coliform on their hand swab, much lower than the control group without any intervention (9.45%). Coliform consisted of fecal coliforms, enteric pathogens (such as *Salmonella*, *Shigella*, *Campylobacter*, *Yersinia*, *Escherichia*, *Vibrio*, and *Listeria*), *S. aureus*, *Enterococcus*, aerobic bacteria, and yeast which were used as indicators of fecal contamination and the quality of sanitation.¹³ One study in Ethiopia showed that those who feed raw vegetables, and who did not wash hands with soap before the meal and after using the toilet had higher odds of acute bacterial diarrhea.¹⁴

Table 4 showed that the coliform containment on the platelet of the uncooked food was statistically significantly higher than the cooked food. Though coliform means all bacteria which has similar form as *E. coli* they are not pathogens. However, some coliform bacteria, which were not pathogens produce lactic acid (i.e. *Enterobacter cloacae*, *E. coli*, *Erwinia herbicola* with other coliform bacteria) which l activates the growth of lactic acid bacteria. These kinds of bacteria had the potential to grow as pathogens in the end. Such epidemic once occurred in Canada and US. There were 853 cases of hemolytic-uremic syndrome that caused 53 deaths in 14 countries in Europe, US, and Canada. It was a rare strain of *E. coli* (O104:H4) that produced Shiga toxin. The epidemic in May to July 2011 caused economic crisis among the farmers.^{17,15} The cases of *E. coli* that produced Shiga toxin were found years after that epidemic.¹⁶

Food storage before cooking or serving influenced the process of degradation by microbes. A proper storage or cold storage should prevent airborne bacteria, virus, or parasites. In Table 3, we found that those who served uncooked food had significantly poorer storage of raw food and ready-to-serve food.

With this data and information, there was a need to train on food safety, which the owners and the food handlers should attend to ensure good food safety practices. The training should be tailored so the less educated food handler will understand and practice good food safety.

There was also a need to observe the facilities and check whether they were sufficient to provide and keep food safe, i.e., refrigerators to keep raw and uncooked food. The university should make specific food safety training for tenants who serve uncooked food, especially because there

is evidence of *E. coli* and coliform in some of the uncooked food samples (i.e., ice cubes).

CONCLUSION

In this study, we showed the importance of routine monitoring of the tenants in a campus with a big population to prevent an outbreak. It is an important action aside from setting up a standard and regulation, followed by regular training.

Statement of Authorship

Both authors contributed in the conceptualization of work, acquisition and analysis of data, drafting and revising, and final approval of the version to be published.

Author Disclosure

Both authors declared no conflicts of interest.

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