

Food Hygiene and Sanitation in Six Food Providers at University X, South Sumatra

Higiene dan Sanitasi Makanan pada Enam Penyedia Makanan di Universitas X, Sumatra Selatan

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Abstract

Food provider at university is one of places that needs to implement standards of food hygiene and sanitation (FHS). This study aimed to evaluate and analyze practices of food hygiene and sanitation based on Decree of Health Minister No. 1098 of 2003 and best practices in six food providers at University X. This study used mixed method evaluation with sequential explanatory design through two stages. Stage I was in the forms of assessment on six food providers, food handlers and laboratory examination on food and beverage samples as well as on eating utensils. Stage II was in the form of focus group discussion (FGD) to deepen findings at stage I. The results of this study showed that 100% of food providers had not yet met the government's regulation. As much as 67% of eating utensils and 83% of food were contaminated with bacteria. Based on food handler examination results, 100% of food handlers were not yet to get medical checkups and training. FGD results indicated that findings at stage I were associated with a lack of knowledge among food handlers and the absence of special unit to oversee food hygiene and sanitation at campus. In conclusion, six food providers in the study area have not met the regulation.

Keywords: Evaluation, food, food provider, hygiene, sanitation

Abstrak

Penyedia makanan di universitas merupakan salah satu tempat yang perlu menerapkan standar higiene dan sanitasi makanan. Penelitian ini bertujuan untuk mengevaluasi dan menganalisis praktik higiene dan sanitasi makanan berdasarkan Keputusan Menteri Kesehatan No. 1098 Tahun 2003 dan praktik terbaik pada enam penyedia makanan di Universitas X. Penelitian ini menggunakan *mixed method evaluation* dengan desain *sequential explanatory* melalui dua tahap. Tahap I berupa penilaian pada enam penyedia makanan, penilaian penjamah makanan, dan pemeriksaan laboratorium sampel makanan dan minuman serta alat makan. Tahap II berupa kegiatan *focus group discussion* (FGD) untuk mendalami temuan pada tahap I. Hasil penelitian ini menunjukkan bahwa 100% penyedia makanan di Universitas X belum memenuhi ketentuan pemerintah. Sebanyak 67% alat makan dan 83% makanan terkontaminasi oleh bakteri. Berdasarkan hasil pemeriksaan penjamah makanan, 100% penjamah makanan belum pernah mendapatkan pemeriksaan kesehatan dan pelatihan. Hasil FGD menunjukkan bahwa temuan-temuan tahap I ada hubungannya dengan kurangnya pengetahuan pada para penjamah makanan dan belum adanya unit khusus yang mengawasi higiene dan sanitasi makanan di kampus. Disimpulkan bahwa enam penyedia makanan di tempat penelitian semuanya belum memenuhi peraturan.

Kata kunci: Evaluasi, makanan, penyedia makanan, higiene, sanitasi

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Introduction

Foodborne disease/foodborne illnesses/food poisoning in the form of food poisoning outbreak in Indonesia remains high. From 2010 to 2014, there were respectively 190, 177, 312, 233 and 306 numbers of incidence in which the highest number of death occurred in 2014 with case fatality rate (CFR) at 0.42%, which means that 1 person passed away in every 200 victims of food poisoning extraordinary incidence.¹ One of causes of the high food poisoning case is the low healthy food processing places in Indonesia. Monitoring application data and website-based evaluation (e-monev) of food sanitation hygiene 2013 in 33 provinces show that in 209 of 499 districts/cities (42%), as many as 21,113 of 23,566 food processing places (88%) had not yet met the health requirements.²

Food providers such as canteen at university is one of food processing places that must implement Decree of Health Minister No. 1098 of 2003 on hygiene and sanitation requirements in cook shop and restaurant and/or Decree of Health Minister No. 942 of 2003 on hygiene and sanitation guidance for snacks. However, Susanna, *et al.*,³ in 2012 reported that almost all (94%) of campus cafeteria/canteen at a university in Jakarta did not obey to the government's regulation.

This study aimed to assess achievement level from five components of food hygiene and sanitation requirements (building, sanitation facility, equipments, food handlers and food management) and laboratory examination (faecal culture to identify *Salmonella spp* and *Shigella spp* from food handler's stool, contamination of faecal coli on food and beverage, as well as contamination of bacteria colony on eating utensils) and to evaluate all of the above assessment and examination results by conducting focus group discussion (FGD).

Method

Location of this study was canteen at University X as one of top state universities in Indonesia, which has two campuses. The first campus is located in Palembang, the capital city of South Sumatra Province, and the second campus is located in Indralaya, approximately 32 km away from Palembang City. This study was conducted from March to June 2016.

Population of this study was food providers including food handlers selected by the food providers that served lunch menus that were steamed rice and dishes, and had their own kitchens to cook the food. Samples were six canteens selected purposively based on the rank of largest number of study programs had by each faculty. These six food providers consist of one canteen at Palembang campus (Faculty of Medicine) and five canteens at Indralaya campus (Faculty of Teacher Training and Education, Faculty of Agriculture, Faculty of Engineering, Faculty of

Mathematics and Natural Sciences, and Study Program of Psychology Faculty of Medicine). A total of 30 food handler samples working at those six canteens were involved this study, however, 25 of them participated in stool culture examination. This study took 2 food samples, consisting of beverage sample, and 1 eating utensil wipe sample from each food provider.

This study used mixed method evaluation with sequential explanatory design through two stages. The first stage was conducted to identify percentage of achievement in the implementation of food hygiene and sanitation between terms/requirements and actual condition at six food providers, including their food handlers. This stage also calculated the number and the percentage of food handlers identified as carrier of *Salmonella* and *Shigella*, as well as the determined number and percentage of contaminated food, beverage and eating utensils. The second stage was in the form of FGD in aim to deepen findings at the first stage by inviting related parties in provision and implementation of food hygiene and sanitation.

Evaluation on six food providers was performed by observing every food provider, including kitchen and serving space, and interviewing managers of food providers that used checklist sheet as developed based on the Decree of Health Minister No. 1098 of 2003, and best practices referring to Five Keys to Safer Food guidelines from World Health Organization (WHO) and terms in the form of special recommendation for food consumers from National Disease Surveillance Centre (ND-SC), consisting of five main components of requirements that are building, sanitation facility, equipments, manpower, and food management.⁴⁻⁶ Assessment on the percentage of achievement was conducted by multiplying achievement score with value of every requirement detail, then the result was accumulated to be the total value of every main component of requirement divided by 100%. The minimum achievement that meets standards of stipulated regulation is at least 70%.

Specifically for manpower requirement (food handlers), checking in details was conducted in which demographic data of 30 food handlers were taken and data of disease records were taken by interview technique, then physical checkup was conducted through physical examination by general physician. Identification of food handlers as carrier of *Salmonella* and *Shigella* was determined through faecal culture examination in which food handlers were asked to give their feces samples. Feces given was the feces in the morning as much as 2 – 5 gram (by fingertip size) for solid feces, or 10 – 15 ml for liquid feces put into sterilized bottle as given on the day before. Method of stool sample collection was by keeping the samples not be contaminated and sent by no more than eight hours to the accredited laboratory in Palembang for

Salmonella spp and *Shigella spp* isolation.

Examination of food and beverage contamination was conducted through examination on food and beverage samples by coli fecal Most Probable Number (MPN). A lunch menu set of each food provider was taken consisting of 2 types of food and 1 drinking water (3 samples of every food provider). Selection of types of food was determined purposively in the form of foods, which were type of dish with protein source and type of vegetables. Meanwhile, the drinking water was selected in the form of drinking water cooked by themselves or water used for washing vegetable salad. As much as 150 gram samples were taken and put into plastic, then sent to the accredited laboratory in Palembang using cooler box within < 24 hours.⁷

Examination of contamination on eating utensils was conducted by Total Plate Count (TPC) examination technique to determine the amount of colony forming unit per gram (CFU/gr). Six samples of eating utensil wipes from every food providers were taken by composite sampling (glass, plate, and spoon were taken by using one cotton bud on every surface of the glass, plate, and spoon as each was wiped 3 times consecutively in wide of 50 cm²). Then the wipes of eating utensils were placed on the bottle containing phosphate buffered saline and sent to accredited laboratory using cooler box. Coli fecal MPN of food and beverage as well as TPC of eating utensil wipes were according to Indonesian National Standard 2897:2008.⁸

Analysis of evaluation results was in the form of correlation test between average of every percentage of requirement achievement on six food providers with the total of coli fecal MPN on food and beverage samples, also with the amount of colony as results of eating utensil TPC conducted through Spearman/Person test.

FGD was conducted by recording response of every critical questions addressed to six selected respondents using voice and video recorder, then grouping answers of questions of participants and followed by taking conclusion presented narratively. Six FGD participants were

invited representatives of cooperation (the lessor of food provider at University X), the health office of district and city (as authorized party that controls/develops the implementation of food hygiene and sanitation at campus), experts of occupational health and environmental health (as parties that give suggestions), as well as managers of food providers simultaneously working at food providers observed.

This study had a license from university and ethical clearance, entitled “Hygiene and Sanitation Evaluation at Five Food Providers and Their Food Handler in University X” No. 063/kepkrsmhfkUnX/2016.

Results

Every canteen at faculty observed only had one food provider serving lunch menus, such as steamed rice and dishes. Five food providers prepared and cooked food at canteen, and only one of them did at the owner’s home.

Five food providers operating in Ogan Ilir Subdistrict and one food provider operating in Palembang City based on the University’s organizational structure were not listed in the structure, but managed seperately. Several food providers at University X in Ogan Ilir Subdistrict are managed by Employee Cooperative of the Republic of Indonesia, faculty, and even without any parties. Meanwhile, food providers in Palembang City are managed by women’s organization. Some operations of six food providers started since 24 years ago and some other started since 4 years ago. Information on general conditions of six food providers were presented in the following Table 1.

All food providers had not had license from the local Health Office. Results of assessment for construction requirement showed the percentage of achievement by six food providers in range of 15% - 28%. There was only one food provider with permanent construction, four food providers with semi-permanent constructions and one food provider with temporary construction (shelter). When the observation was conducted, the condition of food providers were found many houseflies flying, piles

Table 1. General Condition of Every Food Provider

General Condition	Food Provider					
	1	2	3	4	5	6
Year of start	1993	2009	1992	2012	1992	2010
Total of portion/day	500	100	40	100	50	40
Number of food handler	12	8	2	5	3	2
Business license	KPRI	None	Faculty	None	Faculty	Women’sorganization
Certificate of sanitation hygiene clearance	None	None	None	None	None	None
Ever got socialization of sanitation hygiene	Never	Never	Never	Never	Never	Never
Written regulation on trade rules	None	None	None	None	None	None

Note:

KPRI = Employees Cooperative Republic of Indonesia

of goods, unavailable food waste disposal system and uneven floor as many as floor at five food providers was that there were not yet cemented (still in the form of land). There was none of construction owned by all food providers having ceilings, no kitchen door which could close itself, no door and window be equipped with anti insect, still one lamp installed (one spot) and the kitchen was not yet complemented with work table/cupboard/a closed storage of ready-to-eat food and beverage.

After assessment on sanitation facility requirement was finished, the percentage of achievement was found far from the expected, which was 13%, even though there was one food provider that got 61%. All food providers had not yet provided handwashing place separated from the place to wash utensils and food materials. The handwashing place was not yet completed with soap and dryer. Moreover, they had not yet had hot water source, not yet provided toilet facility special for costumers and not yet provided waste disposal closed and separated between wet waste (organic) and dry waste. Based on examination results of clean water condition, one food provider had not yet had available sufficient water for operational needs. Then the water source of three food providers came from water managed by University X, two food providers got from well water and one food provider got from the Regional Water Company. Five food providers had not yet provided latrine and toilet.

Observation conducted in terms of utensil requirement consisted of three assessment components that were place for washing utensils and food materials, cooking and eating utensils, and medium components. In the first component, all food providers had not yet had place for washing utensils separated with food material-washing place, not yet performed washing process as it should be, both in terms of washing technique and the use of cleaner material. In the second component, all food providers had not yet used cooking and eating utensils with food grade criteria, and all of them still used wood cutting board. Based on the observation results of the last component, none of food providers had medium with cover that could cover perfectly and put out hot air of food to prevent condensation. Based on assessment on the three components, the percentage of achievement by six food providers only reached 36% at the highest and 18% at the lowest.

Manpower requirement that was the fifth requirement also had not yet reached the minimum achievement as it was supposed to, in which in this requirement, the food providers that got the highest percentage was at 39%. None of worker, in this case food handler, had followed food hygiene and sanitation course. Also, no one ever got medical checkup periodically (once every 6 months). None of all food providers used plastic-made

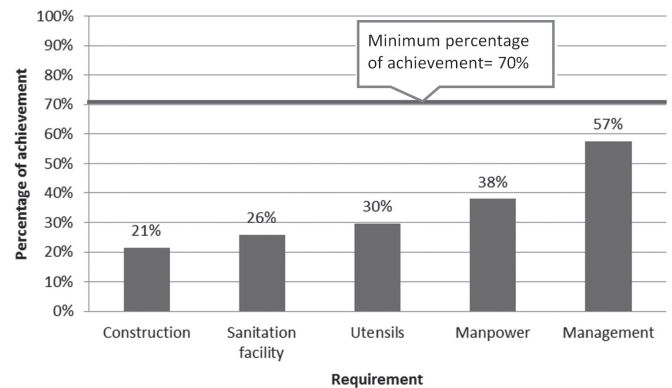


Figure 1. Average Percentage of Achievement in Food Hygiene and Sanitation Requirement

gloves, face mask, waterproof shoes, and they had not yet implemented the right handwashing practice at the time of cooking.

The observation conducted toward the implementation of food management requirement showed better results than other requirements, even though the percentage had not yet reached 70%, but in range of 50%-65%. Some requirements that all food providers had not yet met were actions to prevent risks of food contamination and insects coming in, understanding of thawing, and thermometer for food. All food providers had not yet done food storage to make the food kept warm or cool in accordance with types of foods served. Special transportation in the form of covered transport to carry any cooked food was also unavailable.

As percentage of achievement by six food providers at University X in South Sumatra, if average assessment for each requirement was conducted, all food providers had not yet reached the minimum achievement (70%), with the lowest percentage in construction requirement (21%) and the highest in food management requirement (57%). The average percentage of achievement of six food providers was presented in Figure 1.

Based on data specifically for workers namely food handlers, 90% of 30 food handlers working at six food providers were women, with most of education level was secondary school (53%), then followed by lower education level (37%) and higher education (10%). Age of food handlers was in a wide range of 17 – 59 years with average of 38 years, while the working period started from less than 1 year until 24 years with median value equals to 2.5 years. Results of interview to 30 food handlers showed that all food handlers admitted that they were not suffering from diarrhea and jaundice within the latest week. All food handlers never did medical checkup including rectal swab or fecal culture examination, also never got hepatitis A and typhus vaccines within the latest year.

Based on food handlers' physical checkups, all food

Table 2. Results of Laboratory Examination Based on Types, Sources of Samples from Six Food Providers

Food Provider	Type of Sample	Source of Sample	Coli Fecal*
1	Food	Indonesian vegetables salad with peanut dressing	39
	Food	Fish soup	460
	Beverage	Drinking water	2.2
2	Food	Fish soup	210
	Food	Vegetable salad	460
	Beverage	Drinking water	240
3	Food	Soup	0
	Food	Fried egg	15
	Beverage	Drinking water	12
4	Food	Vegetable salad	15
	Food	Fried fish	0
	Beverage	Drinking water	38
5	Food	Fried tempeh in sweet soy sauce	4
	Food	Stir fried vegetable dish/Cap cai	43
	Beverage	Water for washing vegetable salad	38
6	Food	Chicken in soy sauce	28
	Food	Vegetable tamarind soup	9
	Beverage	Water for washing vegetable salad	20

Notes:

*Most probable number per 100 ml; Estimation test used Lactose Broth media; Affirmation test used Brilliant Green Lactose Broth media.

handlers had normal temperature (in axilla). However, orofaring checkup showed that 7% of food handlers had inflammation/hyperemis condition, while examination of anterior and middle ear rhinoscope showed that 3% had inflammation. Examination on finger skin of food handlers found that 20% were suffering from cut wound. As much as 37% of food handlers had condition of long and dirty fingernails.

Results of laboratory examination on faecal culture among 25 food handler participants (5 persons were not willing to submit their feces) showed the results which entirely not as carrier of *Salmonella* and *Shigella*. Laboratory results of food and water samples as coli fecal MPN showed that 89% were positive coli fecal/100 ml. Table 2 showed the results of coli fecal MPN examination in all samples. The highest coli fecal contamination was found in food provider 2 as much as 240 coli fecal/100ml, while the lowest was found in food providers 1 as much as 2.2 coli fecal/100 ml.

Results of TPC laboratory examination on eating utensil wipe samples taken from each food provider showed that 67% of eating utensils were contaminated. Food provider with the highest colony contamination was from food provider 2 with 11.8x10³ CFU/gr, while food providers with negative or 0 result were from food providers 3 and 5 (Table 3).

Pearson/Spearman correlation statistical test between the amount of food and beverage contamination and the percentage of achievement in requirements found only construction requirement which significantly correlated (pValue = 0.023) with medium strength of correlation (r = 0.534) and negative correlation direction (Table 4).

Table 3. Results of TPC Examination on Eating Utensil Wipe Samples from Six Food Providers

Food Provider	Results of TPC (CFU/gram)
1	5.2x10 ²
2	11.8x10 ³
3	0
4	3.2x10 ³
5	0
6	3.7x10 ²

Notes:

TPC = Total plate count; CFU/gram = Colony forming unit per gram

Table 4. Results of Correlation Test on Total of Coli Fecal MPN that Contaminated Food in Every Requirement Element (n=18) among

Achievement Score	Total of Coli Fecal MPN	
	p Value	r
Construction	0.023*	-0.534
Sanitation facility	0.968	-0.010
Utensils	0.166	0.341
Manpower	0.252	0.285
Management**	0.988	0.004

Notes:

*significant, **n=16

A significant result was also found in results of Spearman correlation test between the amount of colony in eating utensil wipes and the percentage of achievement in requirements in which there was a significant correlation (p value = 0.032) in the percentage of achievement in construction requirement with r = -0.851 (correlation was very strong and the direction was inverse as shown in Table 5).

Table 5. Results of Correlation Test between Number of Colony and Percentage of Achievement in Requirement

Requirement	Number of Colony	
	p Value	r
Construction	0.032	-0.851*
Sanitation facility	0.463	-0.376
Utensils	0.824	0.118
Management	0.890	-0.074

Note:

*significant

Based on results of FGD analysis, factors related to the low achievement in every requirement were because of not yet known requirements stipulated by the government, and unavailable proactive system monitoring food hygiene and sanitation at levels of Health Office and University X as university. University X that had not yet had instruments in the form of unit/section controlling Health, Safety and Environment (HSE) problem underlied the low attention or control.

All FGD participants agreed that food handlers that had not yet got course and medical checkup was due to the low awareness of the importance of this matter. The supervision enforcement was also not yet implemented at the government level in addition to the absence of management efforts and/or facilitating action from University X that eased to hold training and medical checkup.

Discussion

Sample size in this study did not represent the existing food provider at University X, however, some findings in this study might be initiated for further study regarding food hygiene and sanitation measurement level.

It is very crucial to apply food hygiene and sanitation principles and practices among food providers at university as required since such of non-compliance of this rule could lead to the incidence of food poisoning outbreak. However, the finding that 100% of food providers in the study location is in line with finding by other researchers in canteen at state university in Jakarta and in Gorontalo that were not in accordance with principles of sanitation and hygiene which should be mainly concerned.^{3,9}

The low percentage of achievement by food providers in all requirements observed (21% - 57%) was reflected on the high level of coli fecal contamination based on the results of laboratory examination on food and beverage samples at 89%. The percentage of coli fecal contamination in food at food providers University X was reportedly higher than in study by Susanna, *et al.*,³ (51%) as well as in study by Puteri and Djaja,¹⁰ (42%) at canteens in state university in Jakarta. However, it was not much different with the reported by Harahap,¹¹ that 83.3% of

traditional Javanese salad food were contaminated by *E. coli* at canteen in Diponegoro University, Tembalang as well as on 77.8% fruit salad (*rujak*) samples sold around the campus area of Semarang State University.¹²

The high amount of colony in eating utensils reached 11.8×10^5 CFU/gram colony with the percentage of contamination in eating utensils at 67% as also reported by another researcher that found 70% level of contamination on eating utensils in eating place.¹³

Even though all requirements stipulated by the government were not met, the correlation test conducted to find significance showed that construction requirement had significant relation at very strong correlation level ($r = 0.851$), as well as medium correlation ($r = 0.534$) between the total of coli fecal contamination in food and water with provisions on construction requirement. However, Almira, *et al.*, reported that factors related to this bacterial contamination was not only because of environmental factor (construction), but also because of eating and cooking utensils.¹⁰

In this study, based on the interview results, all food handlers (100%) had no certificates of food sanitation and hygiene course and none of them ever took medical checkup. Likewise, the results of study conducted among employees in 10 restaurants at university located in Taipei, Taiwan showed that 78.2% workers had not yet got training.¹⁴ Study conducted by Abera, *et al.*,¹⁵ on 384 food handlers that no one ever took medical checkup.

This study also found none of food handler ever got hepatitis A and typhus vaccines within the last two years. The distribution of hepatitis A and typhus vaccines in perspective of Malaka should be granted as preventive action of hepatitis A and typhoid transmissions via food (oro-fecal) by food handlers infected or as carrier status.¹⁶

Food handlers who were being ill should not be allowed to work. However, based on physical examination, 20% of food handlers at six food providers were suffering from wounds in their fingernails while working, so they were supposed to get treatment and their wounds had to be covered by waterproof wound dressing. This is important due to potential distribution of *Staphylococcus aureus* bacteria transmission, and/or *Group A β-Haemolytic Streptococcus* that may cause food poisoning case.^{6,16}

Fecal culture examination on food handlers to isolate *Salmonella spp.* and *Shigella spp.* bacteria showed negative results. Examination results of *Salmonella spp.* in faecal culture were also reported negative in study conducted in one of Ethiopian cities with a total of 127 faecal examination samples and in Fayoum University with 158 faecal culture from healthy food handlers.^{17,18} However, study by Abera,¹⁵ showed a little bit different result that

6 of 158 food handlers (1.6%) were identified as *Salmonella* carrier. The negative result of *Shigella spp* isolation was also found in study conducted at cafeteria of Addis Ababa University, Ethiopia with 172 samples.¹⁹

Information obtained from FGD results were varied and useful in attempt to obtain more information and to determine any necessary actions. The importance of training were approved by all FGD participants. This is in line with statement said by another researcher that training for food handlers would improve knowledge of food safety as it gives positive effects in practicing food handling.^{20,21}

Type of training in FGD results was in-house training in cooperation with the health office of city/district to invite facilitator/trainer to relieve participants in optimizing time and cost uses considering the time of the holding while working hours and quite expensive training cost. The early phase of this training also should be specially provided to individuals at key positions, such as representatives of cooperation, women's organization, faculty, canteen manager, and University X Clinic, then it needs to involve representatives of University X chief.^{22,23}

Supervision on implementation of food hygiene and sanitation based on FGD results was a crucial matter and agreed by FGD participants, even though supervision techniques delivered were various, such as by the establishment of Health Safety and Environment unit under University X organization unit, and Health Office party could perform more proactive actions in performing supervision by conducting proper test in accordance with provisions arranged through Decree of Health Minister No. 1098 of 2003.

Conclusion

Food hygiene and sanitation at six food providers in the study area indicate that 100% of the food providers have not yet met all required by the regulation. Food hygiene and sanitation programs appropriately to be implemented are arranging standards in accordance with provisions by emphasizing a holding of in-house food sanitation hygiene training as well as the importance of regular supervision, both by University X and the local health office.

References

1. Subdit Penyehatan Pangan Direktorat Kesehatan Lingkungan Kementerian Kesehatan Republik Indonesia. Data tempat pengolahan makanan laik dan tidak laik higiene sanitasi pangan. Jakarta: Subdit Penyehatan Pangan Direktorat Kesehatan Lingkungan Kementerian Kesehatan Republik Indonesia; 2015 [cited 2015 Nov 24]. Available from: http://202.70.136.110/subdit_pp/portal/grafik-emonev#
2. Kementerian Kesehatan Republik Indonesia. Pilih pangan yang aman dan sehat [Internet]. Mediakom: Majalah Kemenkes Republik Indonesia. 2015 [cited 2015 Nov 24]. Available from: <http://mediakom.sehatnegeriku.com/pilih-pangan-yang-aman-dan-sehat/>
3. Susanna D, Indrawani YM, Zakianis, Eryando T, Lassie F, Oktaviana D, et al. Food handler's practise and Escherichia coli contamination in food and beverages in cafeteria in a campus. In: Public Health Challenge in the Asia Pacific Region: Building regional initiatives from local experiences and best practise. [Proceeding book the 47th Asia Pacific Academic Consortium for Public Health Conference]. Bandung: Faculty of Public Health Universitas Indonesia; 2015. p. 160.
4. Kementerian Kesehatan Republik Indonesia. Peraturan Menteri Kesehatan Republik Indonesia Nomor 1098/Menkes/SK/VII/2003 tentang persyaratan hygiene sanitasi rumah makan dan restoran. Jakarta: Kementerian Kesehatan Republik Indonesia; 2003.
5. World Health Organization. Five keys to safer food manual. France: World Health Organization Press; 2006. [cited 2015 Dec 16]. Available from: http://www.who.int/foodsafety/publications/5keys_manual/en/
6. National Disease Surveillance Centre. Preventing foodborne disease: a focus on the infected food handler. Ireland: National Disease Surveillance Centre; 2004. [cited 2015 Dec 14]. Available from: <https://www.hpsc.ie/a-z/gastroenteric/foodborneillness/publications/File,871,en.pdf>
7. Badan Pengawas Obat dan Makanan. Pengujian mikrobiologi pangan. Info Pengawas Obat dan Makanan Republik Indonesia. 2008; 9 (2). [cited 2016 Jan 30]. Available from: <http://perpustakaan.pom.go.id/KoleksiLainnya/Buletin%20Info%20POM/0208.pdf>
8. Badan Standardisasi Nasional. Metode pengujian cemaran mikroba dalam daging, telur dan susu, serta hasil olahannya. Standar Nasional Indonesia. Jakarta: Badan Standardisasi Nasional; 2008.
9. Abdullah I. Hygiene sanitasi dan kandungan mikroba pada kecap manis yang digunakan di kantin di lingkungan Universitas Negeri Gorontalo. Universitas Negeri Gorontalo 2012. Public Health Journal. 2012 [cited 2016 May 12]; 1(1): [about 6 p]. Available from: <https://www.neliti.com/id/publications/37220/hygiene-sanitasi-dan-kandungan-mikroba-pada-kecap-manis-yang-digunakan-di-kantin>
10. Puteri AR, Djaja IM. E. coli food canteen contamination in university of Jakarta. In: Public Health Challenge in the Asia Pacific Region: Building regional initiatives from local experiences and best practise. [Proceeding book the 47th Asia Pacific Academic Consortium for Public Health Conference]. Bandung: Faculty of Public Health Universitas Indonesia; 2015. p. 123
11. Harahap JA. Pengamatan kualitas bakteriologis makanan pecel di kantin Universitas Diponegoro Tembalang. Tembalang: Universitas Diponegoro; 2014 [cited 2016 May 12]. Available from: <http://eprints.undip.ac.id/44790/1/5026.pdf>
12. Setyorini E. Hubungan praktek higiene pedagang dengan keberadaan Escherichia coli pada rujak yang di jual di sekitar Kampus Universitas Negeri Semarang. Unnes Journal Public Health. 2015 [cited 2016 June 4]; 2 (3): 1-8. Available from: <http://lib.unnes.ac.id/18904/1/6450408151.pdf>
13. Cahyaningsih CT, Kushadiwijaya H, Tholib A. Hubungan higiene sanitasi dan perilaku penjamah makanan dengan kualitas bakteriologis peralatan makan di warung makan. Berita Kedokteran Masyarakat. 2009;25(4):180-8. [cited 2016 May 12]. Available from: <https://media.neliti.com/media/publications/163675-ID-hubungan-higiene-sani->

- tasi-dan-perilaku-p.pdf
14. Ko W-H. Food sanitation knowledge, attitude, and behavior for the university restaurants employees. *Food and Nutrition Science*. 2011 [cited 2016 Jun 4]; (2): 744-50. Available from: <http://www.SciRP.org/journal/fns>
 15. Abera B, Biadegelgen F, Bezabih B. Prevalence of Salmonella typhi and intestinal parasites among food handlers in Bahir Dar Town, Northwest Ethiopia. *Ethiopian Journal of Health Development*. 2010 [cited 2016 Jun 4]; 24 (1) : 46–50. Available from: <http://dx.doi.org/10.4314/ejhd.v24i1.62944>
 16. Malaka T. General principle of food hygiene: persyaratan higiene sanitasi makanan. Modul Hazard Analysis and Critical Control Points Training presented at: Hazard Analysis and Critical Control Points Training. Bandung: Expert; 2011
 17. Andargie G, Kassu A, Moges F, Tiruneh M, Huruy K. Prevalence of bacteria and intestinal parasites among food-handlers in Gondar Town, Northwest Ethiopia. *Journal of Health, Population and Nutrition*. 2008 [cited 2015 Dec 14]; 26 (4): 451–5. Available from: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2740691/>
 18. Bassyouni RH, El-Sherbiny N, Hefzy EH, Wegdan A-A. Perception of food safety and prevalence of Staphylococcus aureus and Salmonella species carriers among Fayoum University food handlers. *Life Science Journal*. 2012 [cited 2016 Jun 4] ; 9 (4) : 2934–40. Available from: <http://www.lifesciencesite.com>
 19. Aklilu A, Kahase D, Dessalegn M, Tarekegn N, Gebremichael S, Zenebe S, et al. Prevalence of intestinal parasites, salmonella and shigella among apparently health food handlers of Addis Ababa University student's cafeteria, Addis Ababa, Ethiopia. *BioMed Central Research Notes*. January 2015 [cited 2015 Dec 14]; 8 (1): 1-6. Available from: <https://bmcresnotes.biomedcentral.com/articles/10.1186/s13104-014-0967-x>
 20. Medeiros CO, Cavalli SB, Salay E, Proença RPC. Assessment of the methodological strategies adopted by food safety training programmes for food service workers: a systematic review. *Food Control*. 2011 [cited 2016 May 12]; 22:1136–44. Available from: <http://www.sciencedirect.com/science/article/pii/S0956713511000569>
 21. Monney I, Agyei D, Owusu W. Hygienic practices among food vendors in educational institutions in Ghana: The Case of Konongo. *Foods*. 2013 [cited 2016 June 5]; 2(3):282–94. Available from: <http://www.mdpi.com/2304-8158/2/3/282/htm>
 22. Sethi M. Institutional food management. New Delhi: New Age International (P) Ltd; 2004.
 23. Martins ML, Rocha A. Evaluation of prerequisite programs implementation at schools foodservice. *Food Control*. 2014;39:30–3. [cited 2016 June 5]. Available from: <http://www.sciencedirect.com/science/article/pii/S0956713513005720>