

# Consumption of Fresh Vegetable Salad and Sanitation of Street Food Stalls at Four Locations in Bogor City

## Konsumsi Lalapan Segar dan Sanitasi Warung Kaki Lima di Empat Lokasi di Kota Bogor

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### Abstract

Consumption of fresh vegetable salad at street food stalls requires serious attention. This study was conducted to estimate the exposure probability of street food consumers to fresh vegetable salad consumption, measure the sanitation level of street food stalls serving the salad, and recommend a mentoring program for the vendors at four locations in Bogor City. This study was carried out at 16 stalls located at four locations in Bogor City. A total of 293 respondents surveyed through a food frequency questionnaire tool were determined by stratified sampling method. The survey results revealed that males consumed fresh vegetable salad more frequently than females, with an average of 47.12 gram/person/consumption and a frequency of 3.37 times/week ( $p$ -value < 0.05). Adults consumed fresh vegetable salad at the stalls most frequently by 3.05 times/week, and the average consumption was 44.59 gram/person/consumption ( $p$ -value < 0.05). All street food stalls were at Level IV of sanitary practices. Consequently, a food safety risk existed in consuming fresh vegetable salad at the stalls at the four locations in Bogor City. Males and adults had a high exposure probability to microbiological hazards caused due to the consumption of fresh vegetable salad at the stalls.

**Keywords:** Exposure, fresh vegetable salad, microbiological hazard, sanitation, street food stalls

### Abstrak

Konsumsi lalapan segar di warung kaki lima perlu mendapatkan perhatian serius. Penelitian ini bertujuan memperkirakan peluang paparan dari konsumsi lalapan segar pada konsumen makanan kaki lima, menilai kondisi sanitasi warung kaki lima yang menyediakan lalapan segar, dan merekomendasikan program pembinaan kepada pedagang warung di empat lokasi di Kota Bogor. Penelitian ini dilakukan pada 16 warung yang terletak di empat lokasi di Kota Bogor. Responden yang disurvei dengan alat survei *food frequency questionnaire* berjumlah 293 orang ditentukan dengan metode pengambilan sampel terstratifikasi. Survei menunjukkan bahwa jenis kelamin laki-laki mengonsumsi lalapan segar di warung dengan jumlah dan frekuensi yang lebih tinggi dibanding perempuan, dengan rata-rata konsumsi 47,12 gram/orang/konsumsi dan frekuensi 3,37 kali/minggu (nilai  $p$  < 0,05). Kelompok dewasa mengonsumsi lalapan segar paling sering dengan 3,05 kali/minggu dan rata-rata konsumsi 44,59 gram/orang/konsumsi (nilai  $p$  < 0,05). Seluruh warung diketahui masih berada pada level IV praktik sanitasi. Karenanya, terdapat risiko keamanan pangan dalam mengonsumsi lalapan segar pada warung kaki lima di empat lokasi di Kota Bogor. Jenis kelamin laki-laki dan kelompok dewasa berpeluang tinggi terpapar bahaya mikrobiologi akibat konsumsi lalapan segar di warung.

**Kata kunci:** Paparan, lalapan segar, bahaya mikrobiologi, sanitasi, warung kaki lima

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## Introduction

Consumption of fresh vegetable salad has become popular among Indonesian people.<sup>1</sup> Street food stalls serve fresh vegetables as a complement to the main dish. However, consumption at these stalls requires serious attention. These street food stalls pay less attention to their sanitation and are located in crowded streets with a high pollution level. The fresh vegetable salad served at these stalls has the potential to be contaminated by microbiological, chemical, and physical hazards. According to the Indonesian National Agency of Food and Drug Control, street food consumption resulted in 17% of foodborne illnesses in 2001–2006, which further increased to 21% in 2011–2013.<sup>2</sup> Another recent report of the agency mentioned that there were 20.34% of foodborne illnesses caused due to street food poisoning in 2016.<sup>3</sup> Microbiological agents are the primary cause of food poisoning in Indonesia, which allegedly resulted in 43.33% cases in 2016, whereas chemical agents allegedly resulted in 21.67% cases.<sup>4</sup> Therefore, this study investigated the microbiological hazards present in fresh vegetable salad served at street food stalls in Bogor City, Indonesia.

Microbiological hazards comprise any type of microbial contamination, such as bacteria, virus, fungi, protozoa, and parasites.<sup>4</sup> Low sanitation practices at street food stalls could further increase the presence of microbiological hazards and contribute to foodborne illnesses.<sup>5</sup> The pathogenic bacteria *Escherichia coli* and *Salmonella* receive the most study attention as they potentially cause illnesses with a low infection dose. Enteropathogenic *Escherichia coli* has been found in some fresh vegetable salad products in Korea and Iran.<sup>6,7</sup> Other studies in Indonesia have also reported that some fresh vegetable salad samples at traditional markets and street stalls contain *Salmonella*.<sup>8–10</sup> The health risks caused by Shiga toxin-producing *Escherichia coli* (STEC) lead to life-threatening illnesses in children and the elderly.<sup>11</sup> *Salmonella* can cause salmonellosis with mild to severe symptoms.<sup>12</sup>

It has been reported that inadequate level of sanitary practices at street food stalls can increase the potential for microbiological contamination and contribute to food poisoning.<sup>5,13</sup> A survey of 100 stalls conducted by the World Health Organization showed that the primary safety issues pertaining to food served by the food stalls include raw or undercooked food, infected stalls, and low hygiene during processing and storage of food. Based on these issues, it is necessary to determine the potential for microbiological contamination in fresh vegetable salad caused due to inadequate sanitary practices of the stalls. To date, there have been no data regarding the sanitation level of the food stalls serving fresh vegetable salad in Bogor City. Furthermore, the exposure level of microbiological hazards to consumers of the food stalls in Bogor City still remains unknown because of the unavail-

ability of some of the supporting data, including the amount of fresh vegetable salad consumption and the consumption frequency at the stalls.

Therefore, this study was conducted to estimate the exposure probability of street food consumers to fresh vegetable salad, to measure the sanitation level of the street food stalls serving fresh vegetable salad, and to recommend a mentoring program for the stalls at four locations in Bogor City.

## Method

A descriptive study design involving a survey of fresh vegetable salad consumption and observation of sanitary practices at the street food stalls was used in this study. This study was conducted from June to August in 2017 at the following four locations in Bogor City: Padjadjaran, Sukasari, Ir. H. Djuanda, and Jembatan Merah. These locations were selected as they are known as culinary markets. In addition, there is a sufficient number of stalls serving fresh vegetable salad that are located nearby, thus facilitating the survey and observation. The survey conducted in Padjadjaran covers the area from the Azra Hospital to the intersection of Warung Jambu. Jembatan Merah covers Mayor Oking Jaya Atmaja Street (around the Istana Sepatu Shop to Ade Irma Suryani Park). The survey conducted in Ir. H. Djuanda covers the area in front of the Bogor Trade Mall, and Sukasari covers Siliwangi Street (around Dharmakaya monastery).

The inclusion criteria for the food stalls were as follows: should be located at the selected four locations in Bogor City and on the edge of the main street and the stall should be a temporary building (tent or pushcart) and serve fresh vegetable salad. A total of 16 stalls met the inclusion criteria, with an estimated, 1250 consumers/day. The inclusion criteria for the respondents were as follows: should be consumers of the selected 16 stalls at the four locations in Bogor City and should be eating at the stalls and willing to be a respondent. The respondents were selected from each location according to the stratified sampling method with proportional allocation and 95% confidence level. The survey tools were a food frequency questionnaire (FFQ) administered over the past week and an analytical balance, PA214 Ohaus Corporation Brand, with a weighing accuracy of 0.0001 g.

The FFQ consisted of the characteristics of the respondent, the list of fresh vegetables, and the amount and frequency of consumption. The respondents' age was in accordance with the age grouping of the Individual Food Consumption Survey (IFCS) of Indonesia Year 2014, i.e., adolescents (12–18 years), adults (19–55 year), and elderly (>55 years).<sup>14</sup> The education levels of the respondents were primary, secondary, and tertiary or higher education, and their occupations included students, entre-

preneurs, civil servants, and private employees. The income per month of the respondents was in accordance with the minimum wage of Bogor City in 2017 (IDR 3.2 million/month) and comprised lower than IDR 3.2 million, between IDR 3.2 and 6.4 million, and higher than IDR 6.4 million. The list of fresh vegetables consisted of 17 types of vegetables, namely cucumbers, basil, cabbage, watercress, long beans, *pohpohan*, tomato, bok choy, green and purple eggplant, black nightshade, *kenikir*, cashew leaves, torch ginger, coriander, turnip, and parsley. The amount of each fresh vegetable consumed at the food stall was determined by its consumption unit (slice/cut/stalk). Food frequency categories “per day/per week/per month/never” were used, in which the participants would be asked to provide a frequency within one of the categories. This open-ended frequency category format was used to allow for greater precision.

A total of 34 elements of the sanitary observation were designed referring to the Decree of Minister of Health No. 942 of 2003 on the Requirements of Hygiene and Sanitation of Snack Food and modified for use at the food stalls. The sanitation level of the street food stalls was determined by rating the nonconformities referring to the Regulation of National Agency of Food and Drug Control No. HK. 03.1.23.04.12.2007 Year 2012. There are three categories of nonconformities, namely major, serious, and critical. The number of nonconformity elements at Level I comprises two major findings. Level II consists of four to six major findings. Level III consists of one to three serious and more than eight major findings, and Level IV consists of more than one critical and four serious findings.

The FFQ was administered to 20 respondents with different characteristics (age, education, sex, and occupation). Concurrently, the sanitary observation was conducted on three food stalls. The trials were conducted to evaluate the ability of the survey to produce the appropriate data. Corrections to the FFQ and the sanitary observation elements were made as necessary until the final form of the FFQ and the sanitary observation was obtained.

The types of fresh vegetable salad used to determine the quantity of consumption included all fresh vegetable salads served at the 16 stalls in Bogor City. A total of eight types of fresh vegetable salads consisting of cucum-

bers, cabbage, basil, watercress, pohpohan leaves, green eggplant, tomatoes, and bok choy were found in the 16 stalls. At least eight samples per type of vegetables were collected from the stalls, weighed, and averaged into gram/unit of consumption. The amount and frequency of the consumption of fresh vegetable salad obtained from the FFQ survey were then processed together with the fresh vegetable weight in Microsoft Excel 2010 database to obtain the average consumption in gram/person/consumption, gram/person/day, and gram/body weight/day.

The exposure probability to microbiological hazards due to the consumption of fresh vegetable salad at the street food stalls was determined by multiplying the average consumption (gram/person/consumption) and the average consumption frequency (per week) in terms of sex and age groups, with the descriptive categories being low if < 50 gram/person/week, moderate if 50–100 gram/person/week, and high if >100 gram/person/week.

A mentoring program was proposed by considering the findings of the observation at each location. The Decree of Minister of Health No. 942 of 2003 regarding the Requirements of Hygiene and Sanitation of Snack Food and the Regulation No. 13 of 2005 regarding the Arrangement of Street Vendors in Bogor City were used as references for considering the mentoring program.

## Results

Regarding the characteristics of the street vendors observed at the 16 stalls, the vendors were predominantly males (90%). The number of vendors at each food stall ranged from one to five. Most of the street vendors were adults (77.5%) and high school graduates (70%). No vendors had a tertiary or higher education level. Only six food stalls had a sales turnover of more than IDR 2 million/day. About 50% of street vendors had been working for more than 5 years.

The location details and the total number of street food stalls and respondents are presented in Table 1. A total of 293 respondents were involved in the consumption survey. Padjadjaran had the highest coverage with 113 respondents, whereas Ir. H. Djuanda had the lowest coverage with 41 respondents.

The list of fresh vegetable salads frequently consumed by respondents is shown in Table 2. The most frequently

Table 1. The Location and the Total Number of Street Food Stalls and Respondents

Location	Total Number of Food Stall	Estimated Total Number of Consumers/Day	Percentage	Total Respondents
Padjadjaran	8	482	38.56%	113
Sukasari	3	350	27.98%	82
Ir. H. Djuanda	3	174	13.99%	41
Jembatan Merah	2	244	19.45%	57
<b>Total</b>	<b>16</b>	<b>1250</b>	<b>100.00%</b>	<b>293</b>

consumed fresh vegetable salad was cucumber (48%), followed by cabbage (11%) and basil leaves (11%).

Table 3 shows the characteristics of the respondents and the amount and frequency of fresh vegetable salad consumption. Respondents were dominated by males (57.67%), adults (92.83%), having secondary education level (47.78%), entrepreneurs (49.83%), and having low income level (51.54%). Males had an average consumption of 47.12 gram/person/consumption and a frequency of 3.37 times/week. Females consumed fresh vegetable salad at an average of 40.61 gram/person/consumption and a frequency of 2.37 times/week. Consequently, males consumed more fresh vegetable salad and more frequently than females ( $p$ -value < 0.05). The amount and frequency of fresh vegetable salad consumption were also found to be significantly different among the groups in age category ( $p$ -value < 0.05). Adolescents had the lowest amount of consumption (38.44 gram/person/consumption) and moderate consumption frequency (1.82 times/week). Elderly respondents had the highest

amount of consumption (47.64 gram/person/consumption), but the frequency was the most infrequent among the other groups (0.86 times/week). Adults consumed fresh vegetables at the stalls most frequently (3.05 times/week), and the average consumption was 44.59 gram/person/consumption. The amount and frequency of fresh vegetable salad consumption were quite similar among the groups in terms of education and income categories ( $p$ -value > 0.05). Private employees had the highest average consumption among other occupations (47.10 gram/person/consumption), and entrepreneurs consumed fresh vegetables more frequently (3.53 times/week).

As shown in Table 4, the consumption of fresh vegetable salad among male respondents (22.65 gram/person/day) was significantly higher than that among female respondents (13.83 gram/person/day) ( $p$ -value < 0.05). Adults had the highest fresh vegetable salad consumption among other age groups, with an average of 19.78 gram/person/day ( $p$ -value < 0.1). Adolescents and elderly respondents had a very low average consumption of fresh vegetable salad, at 8.69 and 5.80 gram/person/day, respectively. There were no significant differences in the average consumption (gram/person/day and gram/body weight/day) among the groups in terms of education and income categories ( $p$ -value > 0.1). Entrepreneurs had the highest average consumption compared with other occupation groups, at 23.41 gram/person/day and 0.38 gram/body weight/day, respectively ( $p$ -value < 0.05).

The average sanitary nonconformities of the food stalls at all locations consisted of four critical, six serious, and one major findings. The total nonconformities at Ir. H. Djuanda were five critical, eight serious, and one major. In Padjadjaran, there were four critical, six serious,

**Table 2. The Most Frequent Fresh Vegetable Salad Consumed**

Fresh Vegetable Salad	Percentage(%)
Cucumber	48
Cabbage	11
Basil	11
Tomato	8
Watercress	5
Bitter bean	3
<i>Pohpohan</i>	3
Bok choy	3
<i>Jengkol</i>	2
Long beans	2
Papaya leaves	2
Eggplant	1
Black nightshade	1

**Table 3. Characteristics of Respondents and the Amount and Frequency of Fresh Vegetable Salad Consumption at Street Food Stalls**

Variable	Category	n	Amount of Fresh Vegetable Salad Consumption*		Consumption Frequency**		p-Value
			Average	SD	Average	SD	
Sex	Male	169	47.12	23.99	3.37	3.56	0.002
	Female	124	40.61	22.21	2.37	2.52	
Age	Adolescent(13-18 years)	14	38.44	19.52	1.82	1.32	0.018
	Adults (19-55 years)	272	44.59	23.85	3.02	3.27	
	Elderly (>55 years)	7	47.64	12.18	0.86	0.99	
Education	Primary	28	47.34	16.71	3.72	3.88	0.614
	Secondary	140	43.47	21.39	3.17	3.13	
	Tertiary	125	44.71	26.77	2.51	3.08	
Occupation	Student	60	38.12	23.43	2.12	2.06	0.002
	Private employee	68	47.10	22.02	2.60	2.29	
	Entrepreneur	146	46.19	24.07	3.53	3.78	
	Civil servant	19	40.29	20.88	2.29	3.34	
Income	<IDR 3.2 million/month	151	42.41	23.80	3.03	3.10	0.434
	IDR 3.2-6.4 million/month	102	45.51	21.63	2.78	2.87	
	>IDR 6.4 million/month	40	48.84	26.13	3.01	4.25	

Note:

SD= Standard Deviation; \*gram/person/consumption, \*\*per week

Table 4. The Average Consumption of Fresh Vegetable Salad

Variable	Category	Average Weight	Average Vegetable Consumption				p-Value
			(gram/person/day)		(gram/body weight/day)		
			Average	SD	Average	SD	
Sex	Male		22.65	29.48	0.34	0.43	0.001
	Female		13.83	17.74	0.25	0.34	
Age	Adolescents (13–18 years)	50	8.69	7.81	0.17	0.14	0.08
	Adults (19–55 years)	62	19.78	26.40	0.32	0.41	
	Elderly (>55 years)	63	5.80	7.96	0.10	0.15	
Education	Primary		25.92	31.88	0.47	0.56	0.21
	Secondary		20.24	26.90	0.33	0.39	
	Tertiary		15.87	22.38	0.26	0.37	
Occupation	Student		10.55	12.64	0.18	0.23	0.001
	Private employee		17.98	18.96	0.31	0.37	
	Entrepreneur		23.41	31.36	0.38	0.46	
	Civil servant		14.14	22.60	0.22	0.34	
Income	<IDR 3.2 million/month		19.30	28.81	0.32	0.43	0.93
	IDR 3.2–6.4 million/month		18.17	20.29	0.30	0.36	
	>IDR 6.4 million/month		19.39	26.18	0.30	0.41	

Note: SD= Standard Deviation

Table 5. The Probability of Exposure to Microbiological Hazards Due to Fresh Vegetable Salad Consumption at Street Food Stalls

Variable	Category	Average Consumption of Fresh Vegetable Salad (gram/person/consumption)	Average Consumption Frequency (per week)	Exposure Probability (gram/person/week)
Sex	Male	47.12	3.37	High (158.79)
	Female	40.61	2.37	Moderate (96.24)
Age	Adolescents (12-18 years)	38.44	1.82	Moderate (69.96)
	Adults (19-55 years)	44.59	3.05	High (135.99)
	Elderly (>55 years)	47.64	0.86	Low (40.97)

Notes:

Exposure probability = the average consumption multiplied by the consumption frequency (low exposure if <50, moderate exposure if 50–100, and high exposure if >100)

and one major findings found at the food stalls. Jembatan Merah had four critical, three serious, and five major findings. Finally, Sukasari had two critical, six serious, and one major findings. As there were more than one critical and four serious findings, all the street food stalls located at the four locations in Bogor City were still at Level IV of sanitary practices.

The exposure probability to microbiological hazards due to the consumption of fresh vegetable salad at the food stalls is presented in Table 5. This probability was estimated from the average fresh vegetable salad consumption (gram/person/consumption) and the consumption frequency (times/week). The amount of pathogen was not included in the determination of exposure probability, because the sanitary observation revealed that all the stalls were at Level IV. Therefore, this study used the assumption that the amount of pathogen at the food stalls was the same.

Males had a higher exposure probability than females (158.79 gram/person/week). Females had a moderate exposure of 96.24 gram/person/week. Adults had a high

exposure probability of 135.99 gram/person/week, whereas adolescents had a moderate exposure probability of 69.96 gram/person/week. The probability of exposure to microbiological hazards was quite low in elderly respondents (40.97 gram/person/week).

## Discussion

The consumption survey revealed that the respondents were dominated by males (57.67%). Previous studies have also demonstrated that more males eat outdoor food than females.<sup>15,16</sup> This is because males generally do not cook, and eating out is seen to be more practical.<sup>15,17</sup>

The consumption of fresh vegetable salad is popular among Bogor citizens. About 99% of respondents had ever consumed more than one type of fresh vegetable salad. Cucumbers, cabbages, and basil were the most frequently consumed fresh vegetables by the respondents.<sup>18</sup> These vegetables were the most commonly used complements in street food at the 16 stalls, including *nasi uduk* (Indonesian steamed rice cooked in coconut milk dish),



fried rice, fried catfish, fried or roasted chicken, and fried pigeon. Cucumber was available at 14 stalls, whereas cabbage and basil were available at 12 and 9 stalls, respectively. The food stalls also mentioned that the availability of vegetables in the market was one of the reasons for selecting the types of fresh vegetable salad to be served at the stalls.<sup>18</sup>

According to the 2014 IFCS, the total vegetable salad consumption of adults was 64.50 gram/person/day, whereas those for adolescents and elderly individuals were 45.80 and 63.70 gram/person/day, respectively.<sup>14</sup> Approximately 30% of the total vegetable salad consumption of adults at the four locations in Bogor City came from fresh vegetable salad consumed at the food stalls. The consumption of fresh vegetable salad by adolescents and elderly individuals was 16% and 9% of the total vegetable salad consumption, respectively, based on the 2014 IFCS. Intakes of other vegetables may be obtained from fresh vegetable consumption outside the stalls and/or from processed vegetables.

The sanitary observation revealed that all the food stalls were still at Level IV. This is the lowest level in which all the street food stalls still have not yet implemented a good sanitation practice. The education level of the vendors is likely to be associated with the low sanitation practices during handling and storage of food that may increase the risk of contamination in food.<sup>19</sup> This study showed that most of the vendors were high school graduates and none of them had obtained a higher level of education. This finding is consistent with other studies reporting that most of the vendors were low education graduates.<sup>10,19–21</sup>

The findings of this study indicated that all the food stalls had still not implemented sanitation practices on critical elements, such as not washing hands regularly with soap before and after handling food, not washing the equipment with running water and drying with a special cloth, not washing vegetables with running water, not using an appropriate container for storing food, and not using a permanent trash can with a lid. Previous studies conducted in some developing countries have also reported similar concerns.<sup>19,21,22</sup> As a result, the sanitation practices of the food stalls in Bogor City could potentially increase the risk of microbiological contamination in fresh vegetable salad.

Most of the vendors were aware of the need to wash hands with soap, but certain factors such as comfort and economy were the primary reasons due to which they ignored such sanitation practices.<sup>21,23</sup> Non-potable water provided from a water source by local companies was used for cooking and washing activities; however, the water source may not be close to every stall. Due to this limitation, the vendors prioritized the use of water for cooking and still had not yet washed the equipment and

vegetables with running water. Washing cooking utensils and vegetables by immersion in a bucket of water, as most vendors do, cannot guarantee the hygiene of the equipment and vegetables, and even dirt would accumulate in the washing water that can then be transferred to other utensils and vegetables. The condition would further worsen if the vendors do not change the washing water regularly.

A plastic bag or a bucket is commonly used for garbage collection.<sup>21</sup> However, some vendors reportedly also used gunny bags for waste collection.<sup>19</sup> The use of plastic bags can scatter the garbage because the plastic can be torn or damaged by animals such as cats and rats.<sup>22</sup> In addition, the use of uncovered buckets may also pose a risk for food hygiene, since insects such as flies may act as vectors that transmit enteric pathogens such as *Salmonella*, *Shigella*, and *Escherichia coli* from waste to food.<sup>24</sup>

An exposure assessment indicates the process of estimating or measuring the magnitude, frequency, and duration of exposure to a microbial hazard, along with the number and characteristics of the person or population exposed.<sup>25</sup> In this study, the exposure probability was estimated from the amount and frequency of fresh vegetable salad consumption at the food stalls. The survey results revealed that males were at risk of being exposed to microbiological hazards with a high probability of 158.79 gram/person/week compared with females with a moderate probability of 96.24 gram/person/week. The higher the amount of the fresh vegetable salad consumed, the higher the estimated amount of bacteria ingested. A high consumption frequency will substantially contribute to the total number of predicted cases of illnesses.<sup>26</sup> Adults were most likely to get exposed to microbiological hazards, whereas elderly individuals had the lowest likelihood of exposure. However, these individuals fall into the vulnerable group. A low exposure to microbiological hazards can result in a serious impact on the health of elderly individuals compared with the normal group; for example, *Salmonella spp.* is an important cause of gastrointestinal illness in humans and pathogenic *Escherichia coli* is also associated with diarrhea, which is a significant cause of morbidity and mortality in the elderly.<sup>27</sup>

The low sanitation practices at the street food stalls must be improved through a mentoring program for the street vendors. Ensuring the implementation of food safety at the stall level will be more cost-effective than spending on the treatment due to food poisoning.<sup>19</sup> The local government must communicate the Regulation No. 13 of 2005 regarding the Arrangement of Street Vendors in Bogor City to all the street vendors. Cooperation between the local government and the local health agencies is needed to socialize sanitation practices in accordance

with the Regulation of Minister of Health No. 942 of 2003. The communication can be made in the form of training on food safety and sanitation practices at the food stall, such as the importance of handwashing and proper handwashing practices, the importance of using clean water to wash food and equipment, the comprehension of proper handling, processing, and serving and storage procedures for food and equipment, sanitation of the building, and waste management.

The local government must also consider the arrangement of street food stalls in accordance with the existing Regulation No. 13 of 2005, because if this regulation is implemented and socialized, it can avoid the emergence of ineligible stalls. Before the vendors run their business, they must have obtained the permit and fulfill the requirements for establishing a street food stall.

Awareness of the street food vendors is a must to ensure the complete implementation of the regulation. Vendors are expected to comply and obey the rules. The sanitary nonconformities found at all food stalls are basically related to the personal behaviors that represent the lack of the vendors' awareness to comply with existing regulations. Firm actions should be taken by the government against vendors who still violate the rules. The action could be a revocation of business permit and relocation of the street food stalls.

## Conclusion

The sanitary level of the street food stalls at the four locations in Bogor City is still at Level IV. All the stalls have still not implemented a good sanitation practice. Males and adults had a higher probability of exposure to microbiological hazards than other groups in this study. A mentoring program is proposed to all the street food stalls to improve their sanitary level. The program should be focused on the communication and implementation of regulations pertaining to the arrangement of street vendors and sanitation practices at the stalls, stimulation of the street vendors' complete awareness in complying with the regulations, and taking firm action against the vendors who still violate the rules.

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