

Original Research

THE EXISTENCE OF ESCHERICHIA COLI ON GRILLED INTESTINES (*SATE USUS*) AND ITS RELATED FACTORS IN A TRADITIONAL FOOD STALL AT MALIOBORO TOURISM AREA, YOGYAKARTA, INDONESIA

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ABSTRACT

Background: Grilled intestines (*sate usus*) is one of favorite foods in Yogyakarta, not only because of its delicious taste, but also because of its cheap price and unique shape. To ensure the food safety, the existence of *Escherichia coli* was examined.

Objective: To identify factors related to the existence of *Escherichia coli* on *sate usus* in one of traditional food stall (*angkringan*) at Malioboro tourism area.

Methods: This is a cross-sectional study involved 38 respondents selected using accidental sampling from April to May 2019. The determinants of the existence of *Escherichia coli* include the sellers' knowledge, behavior, personal hygiene, food serving practice, and sanitation facilities. The existence of *Escherichia coli* was tested using a laboratory test. The correlations between *Escherichia coli* and its determinants were analyzed using Chi-Square tests and simple logistic regression.

Results: The result of the laboratory test showed that 39.5% of *sate usus* positively contained *Escherichia coli* bacteria. Among all factors, only food serving practice was associated with the existence of *Escherichia coli*. The sellers who had poor food serving practice were three times more likely having *Escherichia coli* on their *sate usus* (OR= 3.30, 95% CI= 1.967-5.536).

Conclusion: These findings suggested that public health providers should design programs to provide training for food sellers in order to serve food well and healthily. This is crucial to do to ensure the food safety in the tourist areas in Indonesia.

Keywords: *Escherichia coli*, *sate usus*, *angkringan* stall, Yogyakarta

BACKGROUND

Food safety is a public health concern all over the world. World Health Organization states that 600 million people worldwide get foodborne diseases each year, and result in 420,000 deaths ([World Health Organization, 2015](#)). Food safety aims at protecting food in order not to be a source of disease, also known as foodborne illnesses that can be caused by food handlers including cross-

contamination between raw and processed food ingredients, storage and cooking of food in bad conditions, and contaminated equipment ([Al Suwaidi, Hussein, Al Faisal, El Sawaf, & Wasfy, 2015](#)).

Diarrhea is an infection by microorganisms that are usually present in the air contaminated with

human or animal feces, as well as poor sanitation. One of the microorganisms that cause diarrhea is *Escherichia coli*. *Escherichia coli* is a bacterium that lives in the intestines of humans or animals ([World health organization, 2018](#)). Acute diarrhea in adults is usually caused by bacteria, most commonly enterotoxigenic *E. coli* (ETEC) or one of the food-borne pathogens that usually attacks tourists ([Farthing & Kelly, 2007](#)). Some of the causes of *Escherichia coli* in food are due to the lack of hygiene practices such as sellers not washing hands with soap and running water when in contact with food, trash bins that are not handled properly i.e. without a cover causing flies to multiply and food served in an open state causes dust, vehicle, and vector smoke ([Susanna, Indrawani, & Zakianis, 2010](#)).

According to data from the Indonesian Health Profile in 2016, diarrhea that had been treated by Indonesia was 36.9%, with 8.5% in Special Region of Yogyakarta (DIY) ([Kementerian Kesehatan Republik Indonesia, 2016](#)). One of the main causes of foodborne outbreaks in the food service sector is food handlers ([Al-Kandari, Al-abdeen, & Sidhu, 2019](#)).

Food handling practice among food handlers is significantly influenced by marital status, food safety training, supervision by health professionals, routine medical checkup, and level of knowledge of food handlers ([Azanaw, Gebrehiwot, & Dagne, 2019](#)). This practice can also be carriers of organisms associated with foodborne diseases, such as salmonella, staphylococcus, and *E. Coli* ([NH, WM, NJ, & NH, 2015](#)). However, knowledge lead to good attitudes and even good practices in food processing ([Abdul-Mutalib, Syafinaz, Sakai, & Shirai, 2015](#)).

Attitude is an important factor that can influence food handlers' food safety practices, thereby reducing the incidence of foodborne illness ([Sani & Siow, 2014](#)). Sanitation facilities in food stalls are also an important role in influencing food hygiene. Previous research stated that sanitation facilities that did not meet the requirements were at risk of being contaminated with *Escherichia coli*. Ineligible facilities such as selling carts in dirty conditions, there is no separate place for groceries, equipment, and cooked food ([Riyanto](#)

[& Abdillah, 2012](#)).

Yogyakarta is one of the cities on the island of Java, which is often a destination for trips from local and foreign tourists to travel and student destinations to continue their education. The number of universities and tourist attractions has an impact on the increase of food stalls in the Yogyakarta area. From small food stalls like *angkringan* to restaurants. *Angkringan* is a food stall using a cart usually consumed and quite popular among students and domestic tourists because the price is quite cheap. *Angkringan* provides snacks such as rice wrap, a variety of satays such as grilled intestine (*sate usus*), satay liver, and quail egg satay and fried snacks. The research area to be taken is the Yogyakarta Malioboro tourism area ([Keputusan Gubernur Daerah Istimewa Yogyakarta, 2011](#)).

A preliminary study revealed that the knowledge, attitude, and behavior of food handlers in *angkringan* stall is still very low, with proven food handlers have long nails and smoke while serving buyers. The *angkringan* sanitation facility has provided a trash bin, but the garbage bin is not waterproof and not closed, no food tongs are provided and the cart is in a dirty condition. Food is served openly and is not equipped with food cover, thereby increasing the risk of contamination from the air environment. *Sate usus* is a food that is much favored by *angkringan* visitors; besides its cheap price, the taste is also tasty. However, because the intestine (*usus*) is one of the digestive organs of chickens, so if it is not cooked and served correctly will increase the risk of contamination, especially *Escherichia coli* contamination. Based on these data, this study aimed to identify factors related to the existence of *Escherichia coli* on *sate usus* in *angkringan* stall at Malioboro tourism area, Yogyakarta Indonesia.

METHODS

Study Design

A community based cross-sectional study was carried out at *angkringan* stall in Malioboro tourism area, Yogyakarta from April to Mei 2019

Sample

The sample consists of *sate usus* and 38 respondents (sellers) selected using accidental sampling.

Instrument

The instruments in the study were a questionnaire and a check list. The questionnaire consisted of knowledge and attitude questionnaires. The knowledge questionnaire has 2 choices of 'right' and 'wrong' consisting of 9 questions on personal hygiene topics, ways of presenting, diseases resulting from incorrect presentations, and sources of contamination. The attitude questionnaire has 4 answer choices namely 'strongly disagree', 'disagree', 'agree' and 'strongly agree', consisting of 12 questions on personal hygiene, how to serve food, sources of pollution and sanitation facilities. Previously this questionnaire was tested on 30 respondents with a reliable value of 0.706 for the knowledge questionnaire and 0.823 for the attitude questionnaire. Check list in this study is a tool for observation of personal hygiene variables, ways of serving food and sanitation facilities in *angkringan*. The check list is adopted from the

Regulation of Ministry of Health of Indonesia No 1096/ MENKES/ PER/ VI/ 2011.

Data Analysis

Sate usus samples were taken aseptically then put in a sample bottle and tested at the Yogyakarta Health Laboratory Center (Certificate of results: 009058 to 009063/LHU/BLK-Y/04/2019). Outcome measurement was the existence of *Escherichia coli* on *sate usus* (yes, no). Descriptive statistics were used to determine the frequency, percentage, median and interquartile range for all variables. Chi-square test and simple logistic regression were used to examine associations between independent variables and the existence of *Escherichia coli* on *sate usus*.

RESULTS

Table 1 shows that majority of respondents was males aged 26-45 years. Most of them have been working for more than 5 years. 55.2% of the respondents had higher education levels, and only 26.3% of them had the sanitation hygiene training.

Table 1 Characteristics of Respondents

Characteristics of Respondents	Frequency	Percentage
Sex		
Male	31	81.6
Female	7	18.4
Age		
17-25 Years old	3	7.9
26-45 Years old	21	55.3
>46 Years old	14	36.8
Work period		
> 5 Years	25	65.8
≤ 5 Years	13	34.2
Education levels		
Lower	17	44.8
Higher	21	55.2
Sanitation Hygiene Training		
Ever	10	26.3
Never	28	73.7

As shown in the Table 2, the majority of the determinants were having good result, except in the sellers' personal hygiene who had good practice only 23.7%. On the other hand, the existence of *Escherichia coli* was about 36.8% on *sate usus*. In addition, Table 3 shows that the sellers' knowledge, behavior, personal hygiene,

and the sanitary facility were not significantly associated with the existence of *Escherichia coli* on *sate usus*. However, the poor food serving practice was a significant factor, and provided a chance of three times greater of being contaminated with *Escherichia coli* on *sate usus* (OR= 3.30, 95% CI= 1.967-5.536).

Table 2 Distribution of Frequency of Determinants of the Existence of Escherichia Coli on *Sate Usus*

Determinants	Frequency	Percentage
Sellers' knowledge		
Poor	17	44.8
Good	21	55.2
Sellers' behavior		
Poor behavior	15	39.5
Good behavior	23	60.5
Sellers' personal hygiene		
Poor practice	29	76.3
Good practice	9	23.7
Food serving		
Good practice	5	13.2
Poor practice	33	86.8
Sanitation facilities		
Poor	14	36.8
Good	24	63.2
Existence of Escherichia Coli on the Sate Usus		
Positive	15	39.5
Negative	23	60.5

Table 3 Association Between Determinants and the Existence of Escherichia Coli on *Sate Usus*

Determinants	n	Escherichia coli on <i>sate usus</i>			P-value
		Yes%	No%	Crude OR (95% CI)	
Sellers' knowledge	38				
Poor	27	13.2	31.6	1	0.419
Good	21	26.3	28.9	0.62 (0.261-1.463)	
Sellers' behavior	38				
Poor behavior	15	15.8	23.7	1	1.000
Good behavior	23	23.7	36.8	1.02 (0.458-2.281)	
Sellers' personal hygiene	38				
Poor practice	29	36.8	39.5	1	0.061
Good practice	9	2.6	21.1	4.35 (0.659-28.642)	
Food serving	38				
Good practice	5	13.2	0	1	0.006
Poor practice	33	26.3	60.5	3.30 (1.967-5.536)	
Sanitation facilities	38				
Poor	14	18.4	18.4	1	0.503
Good	24	21.1	21.1	1.50 (0.694-3.243)	

DISCUSSION

Findings of this study showed that there was no relationship between knowledge of seller with the existence of Escherichia coli in *sate usus*. This is consistent with the previous study ([Osaili, Obeidat, Hajeer, & Al-Nabulsi, 2017](#)) which states that the errors in food management are associated with the occurrence of foodborne illness. Poor food management will increase the risk of the possibility of foodborne illness. In contrast, [Garayoa, Abundancia, Díez-Leturia, and Vitas \(2017\)](#) says that inadequate knowledge is

the cause of failure in developing food safety systems. As a result, incorrect food preparation practices such as poor hygiene (especially inadequate handwashing), cross-contamination between raw and cooked food, improper heating and or incorrect food storage are reported problems in the food processing sector.

In addition, this study also revealed that there was no relationship between attitudes about the food serving with the existence of Escherichia coli in *sate usus*. The seller's knowledge was not related with Escherichia coli, so neither the attitude was.

This was in accordance with a previous research revealed that knowledge would be related to the attitude of the seller. If knowledge is not related to hygiene then the attitude is not as well ([Suryani & Astuti, 2019](#)). Knowledge, attitudes, and behavior should be related to one another. Knowledge and attitude will produce behavior. However, knowledge and attitude will not always be followed by behavior ([Notoatmodjo, 2007](#)). The attitude of a good seller could be influenced by the experience of individual working, the longer they work, the more experience gained. Based on this study, food handlers who have more than 5 years' experience of 65.8% and less than or equal to 5 years of 34.2%. Work experience can affect the attitude of food handlers. Additionally, *Escherichia coli* contamination in *sate usus* which was sold and served in the *angkringan* food hall at Malioboro tourism area could be caused by the contamination during the presentation process. The presentation of *sate usus* in *angkringan* was placed in the open and at room temperature, thus accelerating the development of bacteria. [Isara, Isah, Lofor, and Ojide \(2010\)](#) states that the level of salad contamination can arise if stored for long periods of time in inadequate temperatures, which allows microorganisms to multiply. Food safety requires routine training/retraining and health education of food handlers in all aspects of hygiene. Special attention must be paid to the preparation, storage, and service of salads and the remaining salads that are not sold more than 6 hours after preparation must be discarded.

The results of this study also revealed that there was no relationship between personal hygiene with the existence of *Escherichia coli* in *sate usus*. These results indicated that personal hygiene is not necessarily a risk factor with consideration of *Escherichia coli* in *sate usus*. Based on the observations of the researchers, most of food handlers at *angkringan* were not the makers of *sate usus* they sold. This result is different from a statement of [Rodriguez et al. \(2011\)](#) that generally microorganisms in food are related to the application of inadequate care, inefficient cooking processes, cross-contamination, inadequate personal hygiene of food handlers, surfaces of equipment in contact with food, and the manufacture of food that is not appropriate. [Valero, Ortiz, Fongaro, Hernández, and](#)

[Rodríguez-Lázaro \(2017\)](#) also stated that microbial contamination in food handlers can be transferred to equipment in two directions. In particular, the Enterobacteriaceae in hand is directly correlated with microbial contamination found in equipment that is in contact with food handlers. This contamination correlates directly with the number of mesophilic bacterial microbes and the presence of Enterobacteriaceae in equipment in contact with food. Therefore, it can be concluded that the training and behavior of food handlers have a positive impact to avoid the spread of microbial contamination in the food supply. [Aziz and Dahan \(2013\)](#) shows that food handlers' training and level of knowledge in hygienic food preparation, processing, and food distribution are very important in the prevention of most types of foodborne illnesses.

Our findings also showed that there was a significant relationship between serving food and the existence of *Escherichia coli* in *sate usus*. The sellers who had bad food serving had a 3 times greater chance of being contaminated with *Escherichia coli* than those with good food serving. This is supported by a previous research ([Kurniadi, Saam, & Afandi, 2013](#)) that serving does not meet requirements such as not using clean and dry containers when serving, not using tools when taking food, and not using covers on cooked foods. The presentation does not qualify for the chance of being contaminated with *Escherichia coli* 12 times compared to the presentation that qualifies. This is consistent with the theory that the presentation of food is the final stage of the food journey. Foods that are sold are cooked foods that pay attention to the principle of serving food and must use clean and dry equipment ([Kepmenkes, 2011](#)). Based on the results of our observations, most of the presentation of *sate usus* in *angkringan* has been more than 4 hours because *angkringan* is open from morning to night. It would be a risk to the growth of bacteria in food which can cause food disturbances. *Sate usus* served very rarely is reheated before eating. However, this food has been exposed to air, dust, vehicle smoke, and even insects.

Besides, the results also showed that there was no relationship between sanitation facilities with the

presence of *Escherichia coli* in *sate usus*. Based on our observations, most sellers have not yet provided a special equipment to clean the surrounding environment and *angkringan* carts. The dirty condition of the environment and facilities make it easier for food to be contaminated by dust or insects such as flies carrying pathogenic bacteria. [Güven, Mutlu, Gulbandilar, and Cakir \(2010\)](#) identified high levels of coliforms and the presence of various pathogens in street food in several countries. Street food has also been reported as an appropriate medium for transmission to people who are antimicrobial-resistant such as *Salmonella* spp. *Escherichia coli*, and *Staphylococcus aureus*. The result of this study was not supported by [Samapundo, Thanh, Khaferi, and Devlieghere \(2016\)](#), which states that of the 40 street vendors observed in Ho Chi Minh City, 40% of Vietnam sell their food on wooden carts that are roofed with a canopy. So, the sales system will increase the risk of food contamination due to the vector of flies and dust from the surrounding environment. The sellers on this cart do not have adequate waste collection and waste disposal facilities and dispose of their leftovers and wastewater next to their carts. As a result, it will attract flies as a fecal pathogen vector and be an indicator of poor hygiene and sanitation conditions in food processing facilities.

CONCLUSION

The result of the laboratory test showed that 39.5% of *sate usus* positively contained *Escherichia coli* bacteria. Among all factors, only food serving practice was associated with the existence of *Escherichia coli*. The sellers who had poor food serving practice were three times more likely having *Escherichia coli* on their *sate usus*. It is therefore recommended that public health providers should design programs to provide training for food sellers in order to serve food well and healthily. This is important to do in the interests of food health in the tourist areas in Indonesia.

Declaration of Conflicting Interest

None.

REFERENCES

- Abdul-Mutalib, N., Syafinaz, A., Sakai, K., & Shirai, Y. (2015). An overview of foodborne illness and food safety in Malaysia. *International Food Research Journal*, 22(3).
- Al Suwaidi, A., Hussein, H., Al Faisal, W., El Sawaf, E., & Wasfy, A. (2015). Hygienic practices among food handlers in Dubai. *International Journal of Preventive Medicine Research*, 1(3), 101-108.
- Al-Kandari, D., Al-abdeen, J., & Sidhu, J. (2019). Food safety knowledge, attitudes and practices of food handlers in restaurants in Kuwait. *Food Control*, 103, 103-110.
- Azanaw, J., Gebrehiwot, M., & Dagne, H. (2019). Factors associated with food safety practices among food handlers: facility-based cross-sectional study. *BMC Research Notes*, 12(1), 683.
- Aziz, S. A. A., & Dahan, H. M. (2013). Food handlers' attitude towards safe food handling in school canteens. *Procedia-Social and Behavioral Sciences*, 105, 220-228.
- Farthing, M. J., & Kelly, P. (2007). Infectious diarrhoea. *Medicine*, 35(5), 251-256.
- Garayoa, R., Abundancia, C., Díez-Leturia, M., & Vitas, A. I. (2017). Essential tools for food safety surveillance in catering services: On-site inspections and control of high risk cross-contamination surfaces. *Food Control*, 75, 48-54.
- Güven, K., Mutlu, M. B., Gulbandilar, A., & Cakir, P. (2010). Occurrence and characterization of *Staphylococcus aureus* isolated from meat and dairy products consumed in Turkey. *Journal of Food Safety*, 30(1), 196-212.
- Isara, A., Isah, E., Lofor, P., & Ojide, C. (2010). Food contamination in fast food restaurants in Benin City, Edo State, Nigeria: Implications for food hygiene and safety. *Public Health*, 124(8), 467-471.
- Kementerian Kesehatan Republik Indonesia. (2016). Data dan Informasi profil Kesehatan Indonesia. Kementerian Kesehatan Republik Indonesia
- Kepmenkes. (2011). Peraturan Menteri Kesehatan Republik Indonesia Nomor: 1096/Menkes/Per/VI/2011 tentang hygiene sanitasi jasaboga. Kementerian Kesehatan Republik Indonesia
- Keputusan Gubernur Daerah Istimewa Yogyakarta. (2011). Keputusan Gubernur DIY No.186/KEP/2011 tentang Penetapan Kawasan Cagar Budaya. Gubernur Daerah Istimewa Yogyakarta
- Kurniadi, Y., Saam, Z., & Afandi, D. (2013). Faktor Kontaminasi Bakteri *E. Coli* Pada Makanan Jajanan Dilingkungan Kantin Sekolah Dasar Wilayah Kecamatan Bangkinang. *Jurnal Ilmu Lingkungan*, 7(1), 28-37.
- NH, N. R., WM, W. M., NJ, N. I., & NH, N. N. (2015). Validity and reliability of food safety knowledge and practices questionnaire among food handlers. *Health*, 6(1), 11-30.
- Notoatmodjo, S. (2007). Promosi kesehatan dan ilmu perilaku. Rineka Cipta
- Osaili, T. M., Obeidat, B. A., Hajeer, W. A., & Al-Nabulsi, A. A. (2017). Food safety knowledge among food

- service staff in hospitals in Jordan. *Food Control*, 78, 279-285.
- Riyanto, A., & Abdillah, A. D. (2012). Faktor yang memengaruhi kandungan E. coli makanan jajanan SD di wilayah cimahi selatan. *Majalah Kedokteran Bandung*, 44(2), 77-82.
- Rodriguez, M., Valero, A., Carrasco, E., Pérez-Rodríguez, F., Posada, G., & Zurera, G. (2011). Hygienic conditions and microbiological status of chilled Ready-To-Eat products served in Southern Spanish hospitals. *Food Control*, 22(6), 874-882.
- Samapundo, S., Thanh, T. C., Xhaferi, R., & Devlieghere, F. (2016). Food safety knowledge, attitudes and practices of street food vendors and consumers in Ho Chi Minh city, Vietnam. *Food Control*, 70, 79-89.
- Sani, N. A., & Siow, O. N. (2014). Knowledge, attitudes and practices of food handlers on food safety in food service operations at the Universiti Kebangsaan Malaysia. *Food Control*, 37, 210-217.
- Suryani, D., & Astuti, F. D. (2019). Higiene dan Sanitasi pada Pedagang Angkringan di Kawasan Malioboro Yogyakarta. *Jurnal Kedokteran dan Kesehatan*, 15(1), 70-81.
- Susanna, D., Indrawani, Y. M., & Zakianis, Z. (2010). Kontaminasi Bakteri Escherichia coli pada Makanan Pedagang Kaki Lima di Sepanjang Jalan Margonda Depok, Jawa Barat. *Kesmas: National Public Health Journal*, 5(3), 110-115.
- Valero, A., Ortiz, J. C., Fongaro, G., Hernández, M., & Rodríguez-Lázaro, D. (2017). Definition of sampling procedures for collective-eating establishments based on the distribution of environmental microbiological contamination on food handlers, utensils and surfaces. *Food Control*, 77, 8-16.
- World Health Organization. (2015). *WHO estimates of the global burden of foodborne diseases: foodborne disease burden epidemiology reference group 2007-2015*: World Health Organization.
- World Health Organization. (2018). *Escherichia coli*. World Health Organization.

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