

The Relationship Between Food Handler Hygiene And The Presence of *Escherichia coli* Bacteria in Boba Ice

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Abstract. Food and beverage processing must be carried out hygienically, as it will affect the quality of the food and beverages served to consumers. This study aims to determine the relationship between food handler hygiene and the presence of *E. coli* bacteria in boba drink vendors in Kudus Regency. This study uses an observational analytic design with a cross-sectional approach. The population and sample in this study consisted of 20 boba ice traders. The instruments used include questionnaires, observation sheets, and laboratory tests to determine the presence of *E. coli* bacteria in boba ice. Data analysis in this study used the Spearman rank test. Based on the research results that have been conducted, 40% of boba drink vendors have adequate personal hygiene, while 35% have poor personal hygiene. Only 25% of the vendors have good personal hygiene. The presence of *E. coli* bacteria is only found in 40% of bubble tea. The results of the bivariate analysis indicate a significant relationship between personal hygiene and the presence of *E. coli*, with a p-value of 0.011 and a correlation coefficient of -0.557. Boba tea vendors have poor personal hygiene, which is supported by their low awareness of the importance of handwashing.

Keywords: Personal Hygiene, *Escherichia coli*, Boba Ice

INTRODUCTION

Food and drink are basic necessities for life. In food and beverages, there are compounds needed by the human body to maintain its metabolism. In addition to sufficient nutritional content, the food and beverages we consume are also expected to be in safe conditions and not pose any danger to human health.

Food and beverages can cause health disturbances due to two factors: the presence of toxic components (heavy metals and toxic chemicals) and contamination with pathogenic microorganisms in sufficient quantities to cause disease (*Salmonella typhosa*, *Shigella dysenteriae*, hepatitis virus, *Escherichia coli*, and others). Health disorders caused by exposure to these two components include digestive system disturbances such as nausea, stomach cramps, vomiting, and diarrhea. (2)

Escherichia coli is one of the bacteria often used as an indicator of contamination in food and beverages. This bacterium is a normal flora in the digestive tract of humans and animals. However, its presence will have negative effects if it enters other organs in the human body. Based on the Minister of Health Regulation Number 1096/Menkes/Per/VI/2022 concerning the Hygiene and Sanitation of Food Service Businesses, the *E. Coli* content in food and beverages produced by every food service business and restaurant must be 0/g. (3)

The Food and Drug Supervisory Agency (BPOM) in its report recorded a total of 6205 food poisoning cases throughout Indonesia, which included 2938 (47.34%) cases due to microbiological contamination, 819 (13.19%) cases due to beverages, 474 (7.63%) cases due to food, and 435 (7.01%) cases due to chemical exposure. The highest number of poisoning cases based on this report occurred mostly in West Java province with 2377 cases, East Java with 1312 cases, and DKI Jakarta with 943 cases.

E. coli bacteria can be found in food and beverages that are poorly managed. In a study conducted by Mufida (2022) on several types of vegetables sold in traditional markets, it was found that 91% of the vegetables contained *E. coli* bacteria, 84% contained *Staphylococcus aureus*, and 79% contained *Vibrio cholera* bacteria. Based on the analysis results, it was determined that the contamination of these vegetables occurred thru the soil medium. (5)

Boba ice is one of the trendy drinks that have emerged in Indonesian society in recent years. This drink is made from a mixture of tapioca flour and brown sugar, has a dark color, and a chewy texture known as boba. Boba drinks usually come in several flavor variations such as brown sugar, taro, green tea, chocolate, vanilla, and other flavors with added boba toppings. In addition to having a wide variety of flavors, boba drinks are also affordably priced. This has made boba ice drinks highly popular and much favored by children to teenagers. According to Eva, Arine, and Nuralatipah in their survey

conducted in Medan, North Sumatra, out of 39 respondents, 26 chose boba ice as their preferred drink compared to iced coffee. (6)

The main sources of food contamination come from food handlers, waste, equipment, vectors, and environmental factors such as air and water. Among these factors, poor personal hygiene of food handlers is the primary cause of contamination in food and beverages. (7)

The results of a preliminary survey conducted on several boba drink vendors in Kudus Regency revealed that food handlers do not pay much attention to personal hygiene, especially when serving boba drinks to consumers. Poor personal hygiene conditions will certainly increase the risk of health issues for consumers. Based on that background, the author is interested in conducting research on the relationship between the personal hygiene of food handlers and the presence of *Escherichia coli* bacteria in boba ice in Kudus Regency.

METHODS

This research is an observational analytic study with a cross-sectional design. The research was conducted in Kudus Regency. The population in this study consists of all boba ice traders in Kudus Regency, totaling 20 traders. The boba ice traders who were made respondents in the study are those who sell ice on the roadside, not in permanent outlets. The boba ice variant used as a sample is brown sugar, because this variant has the most enthusiasts compared to other variants.

The instruments used include questionnaires, observation sheets, and laboratory tests to determine the presence of boba in the drinks. The laboratory test was conducted at the Kudus Regional Health Laboratory.

The tools and materials needed for the bacterial presence test include test tubes, beakers, Erlenmeyer flasks, analytical balances, autoclaves, ovens, microscopes, stirring rods, petri dishes, Bunsen burners, Endo agar media, distilled water, and aluminum foil. The analysis begins with sterilizing the bottle used for taking boba ice samples. Next, prepare the Endo agar medium, which serves as the bacterial growth medium. After the bacteria are introduced into the Endo agar medium, they are incubated for 24 hours. The bacteria can then be observed after the incubation period is complete.

The research data were analyzed using univariate and bivariate analyzes with the Spearman rank test. This test aims to determine the relationship between the hygiene variable of food handlers and the presence of *Escherichia coli* bacteria in boba ice. In addition, the results of this test can also show the correlation coefficient between the independent and dependent variables.

RESULTS AND DISCUSSION

Based on the results of the research that has been conducted, several pieces of information about the characteristics of the respondents were obtained in Table 1.

Table 1. Characteristic of Respondent

No	Variabel	Hasil Penelitian	
		Frequency	Prosentase (%)
1.	Aged		
	< 20 years	3	15
	20 – 30 years	14	70
	31 – 30 years	3	15
2.	Gender		
	Male	8	40
	Female	12	60
3.	Education		
	Elementary School	1	5
	Junior High School	4	20
	Senior High School	13	65
	Higher Education	2	10

Based on Table 1, it is known that the majority of respondents are aged 20-30 years (70%), while

those under 20 years (15%) and those aged 20-30 years (15%) are less common. Generally, the respondents are female (60%) and male (40%). The majority of respondents have a high school education (65%), 20% have a junior high school education, 10% have a college education, and only 5% of respondents have an elementary school education.

Table 2. Overview of Personal Hygiene and The Presence of Escherichia coli Bacteria

No	Variable	Hasil Penelitian	
		Frequency	Prosentase (%)
1.	Personal Hygiene		
	Good	5	25
	Moderate	8	40
	Poor	7	35
2.	Presence of E. coli		
	Positif	8	40
	Negatif	12	60

Based on table 2, it is known that the personal hygiene of boba traders is quite good (40%), 35% have poor personal hygiene, and 25% have good personal hygiene. As for the variable of E. coli bacteria presence in boba ice, it is known that 60% of boba ice contains E. coli bacteria, and only 40% of the ice is free from E. coli.

Based on the observations conducted by the researcher, many boba drink vendors still lack personal hygiene. This is due to the vendors' lack of awareness regarding hand cleanliness, even tho hands are the body parts most prone to food contamination. The use of gloves in food processing is still not common among traders. They argue that wearing hand coverings or gloves while serving or handling food or drinks is more difficult and less comfortable compared to not using gloves. In addition, there are also vendors who wear work clothes that do not meet standards, such as using head coverings that do not cover all parts of the head and the vendor's hair. Some vendors often remove their masks, claiming that the hot air makes it uncomfortable, which can lead to food contamination.

The results of this study are in line with the research conducted by Juliana (2024) on orange juice vendors in Batam. In her study, Juliana found that 75% of respondents had poor personal hygiene conditions, and none of the respondents had good personal hygiene. This condition has a high potential to cause contamination in the orange juice sold by those vendors. (Juliana, 2024).

The research conducted by Tri Khuswataningrum (2017) on fruit juice vendors in Sekaran Gunungpati Sekaran also yielded similar results. On the variable of handwashing practices, it was found that 46.7% had poor handwashing habits and 53.3% had good handwashing habits. The interview results revealed that in soap usage, 73.3% of respondents used soap when washing their hands and 26.7% did not use soap. When washing their hands, 26.7% of respondents used running water and 73.3% did not use running water, only using water that had been collected in a bucket for washing their hands. (Khuswataningrum, 2017)

Based on the research results, it can be concluded that the presence of Escherichia coli bacteria in boba ice in Kudus Regency is 40% non-compliant and 60% compliant. Personal hygiene is poor at 35%, moderate at 40%, and good at 25%. Based on the examination results of the boba ice samples, data from 20 boba ice samples were examined, and Escherichia coli bacteria were found in 8 boba ice samples. This indicates that the boba ice drinks sold at boba outlets in Kudus Regency do not meet health standards according to Permenkes RI No.492/Menkes/PER/IV/2010 regarding drinking water quality requirements, which do not allow Escherichia coli to exceed 0 in 100 ml of water.

This is also in line with the research conducted by Fuadiyah (2026) on the food served in the kitchen of the Darul Hijrah Puteri Martapura Banjarmasin Islamic boarding school. In this study, the laboratory test results indicated that only 23.8% were positive for Escherichia coli, while 76.2% were negative for Escherichia coli bacteria. (Fuadiyah, 2026)

Based on the researchers' observations, another factor that contributes to the possibility of Escherichia coli bacteria in boba ice, aside from personal hygiene, is that vendors use crystal ice and also use refill water (DAMIU) as a mixing water for making boba ice.

Ice cubes are a complementary product often served with bubble tea and are considered safe for consumption. The water used in the production of ice cubes must be hygienic and meet sanitation

standards. Until now, there are no standardized regulations for granting permits or recommendations for the feasibility of ice-making businesses in terms of hygiene and sanitation, so their hygiene and sanitation are still questionable (Basri Hadi, 2015).

All boba ice traders use refill water (depots) as a mixing water for making boba ice. However, not all refillable drinking water depots (DAMIU) have good water quality. This is shown by the research conducted by Oka (2018), which found that many water depots have not guarantyd their quality. Not a few were found to have Coliform bacteria in the drinking water depots. Research in the Mejobo Kudus area in 2018 found that out of 8 total samples examined, 4 DAMIU met the physical suitability criteria while 4 DAMIU did not meet the physical suitability criteria, with an average sanitation hygiene assessment score of 68. The number of Coliform bacteria in DAMIU that met drinking water quality standards was 3 DAMIU, while 5 DAMIU did not meet drinking water quality standards. The average number of Coliform bacteria was 4.2/100 ml (Okka & Caesar, 2018).

Bivariate analysis is an advanced analysis of univariate analysis aimed at examining the relationship between independent and dependent variables. The test used to examine the relationship between the personal hygiene of traders and the presence of *Escherichia coli* in boba ice is the Spearman Rank Correlation Test, the results of which are explained as follows:

Table 3. The Relationship between Personal Hygiene and The Presence of *E. coli* Bacteria

Variable	Mean	P-Value	Correlation Coefficient
Personal Hygiene	2,25	0,011	-0,557
Presence of E.Coli	1,38		

From table 3 above, it shows the results of the Spearman Rank Correlation test with a significant p-value of 0.011. Since $p = 0.011 < 0.05$, H_0 is rejected. Thus, it means there is a significant relationship between personal hygiene and the presence of *Escherichia coli* bacteria. Coefficient value is -0.557, which means the strength of the relationship is quite strong and negative, indicating that the higher the personal hygiene, the lower the presence of *Escherichia coli* bacteria.

The results of the bivariate analysis using the Spearman Rank test showed that personal hygiene has a significant relationship with the presence of *Escherichia coli* bacteria ($p = 0.011$). Where the research results showed that 35% had poor personal hygiene and 40% had the presence of *Escherichia coli* bacteria that did not meet the standards. The correlation coefficient value was -0.557, indicating a fairly strong and negative relationship.

The results of this study are in line with the research conducted by Garmini (2024), which states that there is a significant relationship between personal hygiene and the presence of *Escherichia coli* in cappuccino ice in the city of Palembang. The *Escherichia coli* bacteria are one of the normal flora in the human body and can cause disease if they enter other organs. However, this bacteria is also commonly found in human and animal feces. If it enters food, it poses a risk of causing foodborne illnesses (Garmini, 2024).

The research conducted by Arumsari (2020) sought to find the relationship between the sanitation hygiene of drinking water depots and the presence of *Escherichia coli* bacteria in Mondokan District, Sragen, stating that there is a significant relationship between the hygiene of handlers and the presence of *Escherichia coli* bacteria in the refill water with a p-value of (0.016). In this study, it was found that the employees did not practice handwashing before working. This poses a risk of contamination to the drinking water being filled at the water depot.

Based on the research conducted by Hasnidar (2020), it is also known that personal hygiene plays a very important role in the sanitation of food and beverages because handlers have the potential to transmit diseases originating from food and beverages, that is, from themselves to the food and beverages that are processed and served to the consumers, commonly known as cross-contamination (Hasnidar, 2020).

Based on the research observation results, the majority of vendors do not have handwashing facilities. If there is a handwashing station, it does not come directly from running water but rather from a bucket filled with water that is used multiple times. Additionally, the vendors do not use soap when washing their hands, only water. And many vendors do not wear plastic gloves when handling food or drinks, wear jewelry, do not wear masks, and do not wear head coverings.

It is known that the lack of awareness among traders to always wash their hands is caused by the

handlers not being accustomed to washing their hands and considering that washing hands is not necessary as long as their hands still look clean. In addition, the lack of knowledge among traders about the importance of soap for washing hands before handling food. The situation indicates that personal hygiene is still poor, therefore, vendors should pay more attention to personal cleanliness and wash their hands before handling food or beverages.

The results of this study are also supported by Dwi Apriany's research in 2019, which shows that 80% of doger ice samples contain *Escherichia coli*, and is backed by the fact that out of 10 respondents, only 2 met the requirements while 8 did not, all due to the sellers' lack of awareness. Sellers consider that not wearing gloves and not washing their hands is a common practice and does not cause serious issues, whereas the sellers' lack of understanding and awareness can inadvertently lead to the presence of bacteria. *Escherichia coli* bacteria can grow from hands that are not washed with soap, and also from the seller's long and dirty nails. (Apriani, 2019)

CONCLUSION

1. The majority of personal hygiene among boba tea vendors in Kudus Regency falls into the moderate category, which is 40%, followed by the poor category at 35%, while only 25% fall into the good category. This is because most vendors have already implemented personal hygiene practices well.
2. The majority of *Escherichia coli* bacteria presence in boba ice in Kudus Regency has met the requirements, which is 60%, and only 40% did not meet the requirements.
3. There is a significant relationship between personal hygiene and the presence of *Escherichia coli* in bubble tea in Kudus Regency. The p-value is 0.011 with a correlation coefficient of -0.557, indicating a strong negative relationship, meaning that the higher the personal hygiene, the lower the presence of *Escherichia coli* bacteria.

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