



Escherichia coli in Food and Hands of Handlers in Catering service Group A1 and A2

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<p>Track Record Article</p> <p>Accepted: 18 October 2023 Revised: 13 December 2023 Published: 20 December 2023</p> <p>How to cite : Wulandari, W., Setiyaningrum, Z., Sunarto, Janametri, A. W. A., & Putri, S. R. S. (2023). Escherichia coli in Food and Hands of Handlers in Catering service Group A1 and A2. <i>Contagion : Scientific Periodical of Public Health and Coastal Health</i>, 5(4), 1296–1308.</p>	<p style="text-align: center;">Abstract</p> <p><i>Food hygiene was a controlling factor for food contamination that can cause foodborne diseases such as diphtheria, diarrhea, typhoid, and food poisoning. Several types of microbes that can cause food poisoning, one of which is Escherichia Coli. The purpose of this study was to analyze the relationship between personal hygiene, food hygiene, sanitation facilities, with Escherichia Coli food and hands of handlers in catering services of groups A1 and A2. This research method uses Cross Sectional study, sampling techniques in research using Accidental Sampling in catering service groups A1 and A2 in the Banyudono District. This research was carried out from May to June 2022, the research location was in catering service in the Banyudono district area. This sample in this study was 25 food handlers. The data analysis was done by Chi Square test. The results showed that the handlers had good personal hygiene by 52%, good food hygiene 72%, inadequate sanitation facilities 52%, Escherichia coli in food 56%, and Escherichia coli in hands 84%. There was no relationship between personal hygiene (p-value = 0.302) and food hygiene (p-value = 0.177) with the content of Escherichia coli in food. There was a relationship between sanitation facilities (p-value = 0.000) and the content of Escherichia coli in food. There was no relationship between personal hygiene (p-value = 0.096), food hygiene (p-value = 0.548) and sanitation facilities (p-value = 0.322) with Escherichia Coli on hands. Food service handlers already have personal hygiene and apply good food hygiene, but Escherichia coli is still found in the food and handlers hands. Sanitation facilities still do not meet the requirements, so it is necessary to utilize available sanitation facilities to reduce Escherichia coli contamination.</i></p> <p>Keyword: Personal hygiene, Hygiene, Sanitation, Escherichia coli</p>
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INTRODUCTION

Food is a human need that must be considered quality and feasibility with the aim that when consumed does not cause disease. Food can be guaranteed quality and feasibility when applying the principles of Food Hygiene and sanitation (Asyfiradayati et al., 2019). The application of sanitary hygiene can control the risk factors for food contamination from foodstuffs, food handlers, places and food processing equipment (Kemenkes RI, 2011).

Supervision of food hygiene and sanitation starts from taking ingredients, production processes, storage, transportation and distribution to consumers. One place that is considered to transmit *foodborne* diseases is catering service. Food management in catering is regulated in the regulation of the Minister of Health No. 1096 / MENKES / PERVI / 2011 on sanitary hygiene catering service.

Implementation of food sanitation hygiene that can prevent the occurrence of foodborne diseases such as hand hygiene practices, food handling training, and regular monitoring of food handling practices need to be carried out (Mengist et al., 2018). Food handlers should always dispose of garbage or waste as soon as possible, avoiding animals such as cats, rodents, and insects from entering the food preparation room so as not to contaminate raw foodstuffs (Fatimah et al., 2022).

Foodborne illnesses are caused by contamination by pathogenic germs that can come from humans or animals, and can also come from toxic substances or chemical elements of the food itself. Foodborne illnesses can be caused by pathogenic agents such as fungi, bacteria, chemicals and other heavy metals. Bacteria that cause foodborne disease itself such as *Salmonella*, *Campylobacter*, *Listeria*, *Clostridium Botulinum*, and *Escherichia Coli* (Centers for Diseases Control and Preventions, 2021). A study conducted at Warmindo found food samples containing *Escherichia coli* amount to 9,1% of the 33 food samples tested which was due to lack of food sanitation, sanitation facilities and personal hygiene (Abidin et al., 2021).

Foodborne diseases that commonly occur due to lack of Hygiene and sanitation include diphtheria, diarrhea, typhoid, and food poisoning (Asyfiradayati et al., 2019). A case of food poisoning occurred in February 2020 in Banyudono Boyolali which attacked 125 first and second grade students, in one of the Integrated Islamic Elementary School and Integrated Islamic Junior High School, students complained of nausea, vomiting, and diarrhea. Food poisoning can occur because, students consume snacks that have been provided by the school cooperative partner catering (Tata Rahmanta, 2020).

In 2014, there was also a case of food poisoning in the village of Jembungan Banyudono Boyolali experienced by residents after consuming fruit ice at a party, poisoning victims as many as 104 people (Pusat krisis kesehatan, 2014). Hygiene and sanitation of food that is not applied and paid attention to the management of catering service, especially groups A1 and A2, can be a factor causing foodborne illness, one of which is food poisoning.

The application of food hygiene sanitation in catering service groups A1 and A2 is still not applied optimally, such as the presence of handlers who do not use headgear and aprons during food processing, talking while doing work, washing hands at certain times, and wiping hands using clothes worn. Identification of Hygiene and sanitation in catering service managers can be useful for other food provider managers to better maintain the quality and feasibility of food so as to reduce the risk of *foodborne* illness.

METHODS

This type of research is quantitative observational analytic using cross sectional approach. The research was conducted in Catering service, Banyudono Boyolali district in 2022. This research was carried out from May to June 2022. The sample of this study is in catering service banyudono sub-district. Accidental Sampling is a sampling technique used in research by means of handlers who coincidentally were carrying out food processing activities at the time of the study a total of 25 respondents and the number of food samples examined was 12 samples.

The consideration for using accidental sampling because in the time span of sampling not all Catering service carried out food processing, this research was carried out when catering service carried out food processing. The variables studied in this study were personal hygiene, food hygiene, sanitation facilities, *Escherichia coli on food*, and *Escherichia coli on hands*. Research instruments in the form of questionnaires containing questions about personal hygiene and food hygiene, as well as observation sheets to see sanitation facilities.

This study has passed through the stage of qualifying research ethics. *Escherichia coli* on food and hands was carried out in the microbiology laboratory, Faculty of Health Sciences Muhammadiyah University Surakarta. Procedure for taking hand swabs using sterile cotton skewers dipped in 0.9% NaCl solution on the hands of touchers who are often used in work. Food samples taken from catering service aseptically inserted in the sample container that has been sterilized examination of *Escherichia coli* in food and hands carried out in the laboratory.

Examination of *Escherichia coli* on food and hands was carried out in the laboratory using the compact dry method, the results of the hand swab were planted on EC compact dry agar media aseptically with 3 repetitions. EC compact dry agar media was incubated at 37°C for 24 hours. Likewise with food samples, food taken from catering services is aseptically placed in sterilized sample containers. Food was weighed weighing 10 grams and crushed and homogenized in 100 ml NaCl solution.

The dilution results were then planted on compact dry EC agar media and incubated at 37°C for 24 hours. After 24 hours, the number of purple E. Coli colonies was counted and recorded. Analysis test using Chi Square test with 95% significance using SPSS software and compared with Permenkes No. 1096 MENKES/VI/2011 on sanitary hygiene catering service.

RESULTS

Table 1. The Distribution Of Respondent Characteristics

Characteristics	n	%
Age		
36 – 40	3	12
41 – 45	5	20
46 – 50	8	32
51 – 55	7	28
56 – 60	2	8
Gender		
Female	23	92
Male	2	8
Education level		
No School	2	8
Elementary School	4	16
Junior High School	8	32
Senior High School	7	28
Diploma / bachelor	4	16
Duration working		
<5 years	9	36
>5 years	16	64

Characteristics of respondents in Table 1 shows that the majority of respondents have ages between 46 – 50 years as many as 8 respondents (32%), the largest gender is female, a number of 23 respondents (92%), Junior High School became the last Education taken by respondents at 32%. Judging from the length of service, most of them have worked > 5 years, there are 16 workers.

Table 2. Distribution of Research Variables

Variable	n	%
Personal Hygiene		
Poor	12	48
Good	13	52
Food Hygiene		
Poor	7	28
Good	18	72
Sanitation Facilities		
Poor	13	52
Good	12	48
E.Coli in Food		
Unqualified	14	56
Qualified	11	44
E. Coli on the Hands		
Unqualified	21	84
Qualified	4	16
Total	25	100

Table 2 shows that respondents based on personal hygiene have almost the same frequency distribution, namely 12 respondents (48%) have poor personal hygiene and 13 respondents (52%) have good personal hygiene. Food hygiene in catering service in the

Banyudono area is good, namely 18 (72%), but if we look at the sanitation facilities, 13 respondents (52%) have poor sanitation facilities. The presence of *Escherichia coli* in food still does not meet the requirements, as many as 14 foods (56%) and many *Escherichia coli* on handlers' hands also do not meet the requirements, namely 21 respondents (84%).

Table 3. The Relationship between personal hygiene, food hygiene, sanitation facilities and *E. Coli* on food

Variable	<i>E. Coli</i> in Food				Total		<i>p-value</i>
	Unqualified		Qualified		f	%	
	f	%	f	%			
Personal hygiene							
Poor	8	66,7	4	33,3	12	100	0,302
Good	6	46,2	7	73,8	13	100	
Food Hygiene							
Poor	2	28,6	5	71,4	7	100	0.177
Good	12	66,7	6	33,3	18	100	
Sanitation Facilities							
Poor	12	92,3	1	7,7	13	100	0,000
Good	2	16,7	10	83,3	12	100	

The results of the analysis using the fisher's exact test in Table 3. obtained that there is a relationship between sanitation facilities and the presence of *Escherichia coli* in food with a *p-value* of 0.000. While there was no relationship between *personal hygiene* (*p-value* = 0.302), food hygiene (*p-value* = 0.177) and *Escherichia coli* in food.

Table 4. The relationship of personal hygiene, food hygiene, sanitary facilities with *E.coli* on hand

Variabel	<i>E. Coli</i> on Hand				Total		<i>p-value</i>
	Unqualified		Qualified		f	%	
	f	%	f	%			
Personal hygiene							
Poor	12	100	0	0	12	100	0,096
Good	9	69,2	4	30,8	13	100	
Food Hygiene							
Poor	5	71,4	2	28,6	7	100	0,548
Good	16	88,9	2	11,1	18	100	
Sanitation Facilities							
Poor	12	92,3	1	7,7	13	100	0,322
Good	9	75	4	83,3	12	100	

Analysis of the relationship of personal hygiene, food hygiene, sanitation facilities with *E. Coli* on the hands using Fisher's exact test obtained the results that there is no relationship between personal hygiene (*p-value*=0.302), food hygiene (*p-value*=0.177), sanitation facilities (*p-value*=0.00) with *Escherichia coli* on the hands of food handlers in catering service groups A1 and A2.

DISCUSSION

Contact personal hygiene with *Escherichia coli* in food in catering service Group A1 and A2

Lack of personal hygiene among food handlers can cause *Escherichia coli* contamination in food, such as handlers not washing their hands with soap before handling food, using accessories (ring or bracelets), not wearing head coverings. However, based on field results there is no significant relationship between personal hygiene and the presence of *Escherichia coli* in food. As many as 73,8% of handlers have good personal hygiene and the food handled also meets the requirements.

Meanwhile, as many as 46,2% of handlers have good personal hygiene but based on *Escherichia coli* testing on food they do not meet the requirements, this could be caused by other factors such as lack of cleanliness of the equipment used in serving. This study is in line with research conducted by Azzahroh et al., (2021) which states that personal hygiene is not related to *Escherichia coli* in salad made of blanched vegetables with peanut sauce.

Food handlers who do not pay attention to personal hygiene, such as not wearing an apron, not wearing a head covering, or holding money when serving food can be a factor in food contamination (Johnson et al., 2020). Personal hygiene of food handlers in the catering service business is something that needs to be considered in organizing food. Personal hygiene is a part of food hygiene that aims to maintain cleanliness and protect food from contamination. Lack of *personal hygiene* food handlers can be a factor in the contamination of food *Escherichia coli* bacteria (Tuglo et al., 2021).

Based on the results of personal hygiene research in food handlers, Class A1 and A2 Banyudono district area is almost the same between those who have less personal hygiene and good. Handlers who have poor personal hygiene as many as 12 respondents (48%) and good as many as 13 respondents (52%), it shows that there are still handlers who pay less attention to personal hygiene.

There is no relationship between the personal hygiene of handlers in catering services of groups A1 and A2 with the content of *Escherichia coli* in food. based on the data obtained, handlers had poor personal hygiene and resulted in food containing e. coli is as many as 8 respondents (66.7%). This shows that lack of personal hygiene of the handlers can be at risk of contaminating food, especially biological contamination such as *Escherichia coli*. The level of *Escherichia coli* contamination is caused by poor personal hygiene from food handlers and food safety awareness from food handlers (Yenew, 2020).

The hygiene of handlers in the process of food handling is still poorly maintained, this can be seen from the results of research there are still handlers who chat and eat when handling food, do not use gloves, and wear rings. Lack of personal hygiene behavior in the process of handling food is still common in food handlers, this is possible because of the knowledge of the handlers. This is in line with research that states that handlers with good behavior have good knowledge, and vice versa (Diyanah et al., 2021).

The relationship of food hygiene with *Escherichia coli* in food in jasa boga groups A1 and A2

Lack of food hygiene can be a factor in the presence of *Escherichia coli* in food. Food hygiene includes separating food ingredients according to their type, storing food ingredients that are protected from vectors, washing food ingredients with running water before processing, storing cooked food not close to food ingredients, serving food in clean containers, and covering food.

However, research result show that 66,7% of catering services that have good food hygiene have *Escherichia coli* in food. Food hygiene in this study is not related to *Escherichia coli* in foods in catering service group A1 and A2 Banyudono region. the results showed that food hygiene in each catering service is good, this can be seen from all respondents or 100% have chosen food ingredients in good condition, fresh and cooked food stored in different containers.

There are still food handlers in Catering service who do not wash food ingredients with running water, usually food ingredients are washed using a container filled with water and dipped. This research is in line with research conducted by (Rulen & Intarsih, 2021) which states that the habit of handlers who use holding containers and use them repeatedly can cause bacterial contamination. Good food hygiene can prevent *Escherichia coli* contamination in food, because food acts as a medium for growth and bacterial proliferation (Rorong & Wilar, 2020).

The way to reduce bacterial contamination is to store cooked food in closed containers and separate from the storage of foodstuffs, in this research there are 80% of handlers in Catering service had done good food hygiene such as not putting cooked food adjacent to foodstuffs. Preparing food in unhygienic conditions can pose health risks for consumers such as being susceptible to foodborne diseases (Birgen et al., 2020).

As many as 96% of catering service handlers also discard and separate damaged/rotten food from food that is still good. Other studies have shown that food hygiene such as separating

spoiled /rotten food from good food is also done by food merchants, poor food handling can be a breeding ground for microorganisms (Wardani & Setiyaningrum, 2019). Food contamination can occur through unhygienic seller, lack of proper food coverings, and storing raw and cooked food in the same place (Krishnasree et al., 2018).

The relationship of sanitation facilities with *Escherichia coli* in food in catering service Group A1 and A2

The availability of inadequate sanitation facilities is an inhibiting factor for handlers to implement good personal hygiene, which can cause *Escherichia coli* contamination of food. This is in accordance with research results which show that inadequate sanitation facilities in catering service are a contributing factor to the presence of *Escherichia coli* in food. Based on observation, 52% of catering service have provided sanitation facilities but are still categorized as poor such as wastewater disposal conditions is still open, trash cans are available without lids and are not in accordance with the type.

Lack of sanitation facilities such as rubbish disposal causes handlers to throw rubbish around food handling areas which can attract flies and other animal vectors. Handlers lack of awareness of the availability of sanitation facilities can pose a risk of food contamination (Birgen et al., 2020). These poor sanitary conditions make breeding grounds for vectors such as flies that can contaminate food. The results showed that 92.3% of food was contaminated with *Escherichia coli* due to poor sanitary conditions.

The availability of clean water is good, but based on observations in the field, food handlers still do not apply good personal hygiene, such as washing hands every change of the food handling process, washing hands which are then dried on clothes/aprons used instead of special aprons. The results of this study are in line with research of de Freitas et al. (2019) who showed that there are still workers who do not wash their hands first when touching food and dry their hands in cloth aprons.

Sanitation facilities are an effort to prevent and protect environmental cleanliness to reduce contamination of microorganisms that cause food poisoning (Mustika, 2019). Food contaminated by bacteria, especially *Escherichia coli*, can cause severe diarrheal disease (Herawanto et al., 2020). Therefore, food to be served should not contain bacteria, according to regulation of the Minister of Health No. 1096 of 2011 concerning Sanitation Hygiene of Catering service, namely food consumed is free from *Escherichia coli* contamination with the inspection results show 0 (zero).

The relationship between personal hygiene and *Escherichia coli* on hands catering service in group A1 and A2

Escherichia coli on handlers' hands can be caused by food handlers lacking in maintaining personal hygiene such as not washing their hands with soap and running water. Hands of handlers identified with *Escherichia coli* can contaminate food if handlers do not pay attention to personal hygiene.

This is line with research results which show that 100% of food handlers who have poor personal hygiene have proven that the handlers' hands are identified as having *Escherichia coli*. The use of personal accessories such as rings and lack of washing hands without using soap or not using hand sanitizer can cause the presence of *Escherichia coli* and *Salmonella aureus* bacteria on hands (López et al., 2023).

The habit of hand washing without soap and running water and hands drying with an apron/shirt worn is one of the causes of *Escherichia coli* on the hands of food handlers. If this behavior continues, food contamination cannot be avoided. Hands that contain *Escherichia coli* become a transmission medium for the transfer of bacteria to food. Food handlers can be a source of food contamination through hands, hairs, or sweat.

Cleanliness of food handlers, especially hand hygiene must be considered in catering service (Diyannah et al., 2021). Although most of the handlers in catering service have good personal hygiene, but there are still many handlers who do not apply all the principles of personal hygiene such as the use of accessories rings, the behavior of washing hands without soap and running water and drying hands with clothes/aprons worn. So that from this unconscious behavior can cause the hands to be contaminated by *Escherichia coli* and if used to handle cooked food then the food can also be contaminated.

Food hygiene relationship with *Escherichia coli* on hands in catering service groups A1 and A2

Maintaining food hygiene can avoid *Escherichia coli* contamination. Food hygiene start from selecting food ingredients to serving food. Unclean food ingredients and food handlers who handle these food ingredients can be contaminated by *Escherichia coli*. In this study, food hygiene was good but 88,9% of handlers' hands were still contaminated by *Escherichia coli*, this could be caused by other factors such as handlers not paying attention to personal hygiene.

The results showed that there was no relationship between food hygiene with *Escherichia coli* on the hands of catering service in the Banyudono region. Food hygiene catering service in the Banyudono region has been good of 88.9% but food handlers hand there is still

Escherichia coli. Although the food hygiene is good, handlers in catering service still have poor hygiene behavior so that the presence of *Escherichia coli* on the hands of the handlers is possible because of personal hygiene practices that are not good, such as washing hands not using soap and there are still handlers who use rings.

Based on food hygiene research data in the Banyudono region has been good as much as 72%, food handling from the selection of food ingredients to storage of cooked food has applied the principles of food hygiene. So that in the application of food hygiene is not a factor in the contamination of *Escherichia coli* on the hands of handlers. This study is in line with Rahmayani & Simatupang (2019) which states that there is no relationship between the selection of food and beverage raw materials with *Escherichia coli* contamination. The food handlers in catering service always buy groceries when there is an order, the processed food is always fresh and not stored for long.

The relationship of sanitary facilities with *Escherichia coli* on hands in catering service groups A1 and A2

The availability of sanitation facilities, including clean water and hand washing soap, can support hand hygiene for food handlers. Food handlers who maintain hand hygiene can avoid contamination of food. This is in accordance with the results of research in the field, food services that have inadequate sanitation facilities show the presence of *Escherichia coli* on the hands of handlers.

The results showed that there was no relationship between sanitation facilities with *Escherichia coli* on the hands of catering service in the Banyudono region. Research data shows that sanitation facilities are still less qualified in catering service by 92.3% whose food handlers have *Escherichia coli*. Based on the results of the study, each catering service has provided enough clean water to support food handling activities. Hand washing place is also provided with soap, the presence of clean water can be used by the touchers to support personal hygiene practices.

Washing hands with soap after food handling activities and after from the toilet can avoid *Escherichia coli* contamination of food that comes from the hands of handler (Hutasoit, 2020). However, from the observations made by research, there are still food handlers who wash their hands do not use soap and running water after the bathroom or other activities. This statement is in line with research Anditiarina et al. (2020) which states there is a relationship between the practice of washing hands after using the toilet with the presence of bacteria.

Washing hands with soap and water by handlers while working can reduce contamination with *Escherichia coli* and *Salmonella spp.* Lack of soap availability contributes to contamination with *Escherichia coli* and *Salmonella spp.* (Lazaro et al., 2019). In addition, the waste collected into one between organic and inorganic waste is not directly thrown into the trash, but is collected near the food handling area, making it a gathering place for flies.

CONCLUSIONS

Personal hygiene and food hygiene in catering service Class A1 and A2 is quite good. The utilization of sanitation facilities in catering service is still lacking, and the presence of *Escherichia coli* in food and hands of many handlers is still not qualified. There is a relationship between sanitation facilities (p value = 0,000) with *Escherichia coli* in food in catering service groups A1 and A2 in the Banyudono district. There was no relationship between personal hygiene (p value = 0,302) and food hygiene (p value = 0,177) with *Escherichia coli* in food in catering service groups A1 and A2 in the Banyudono district.

There was no relationship between personal hygiene (p value = 0,096), food hygiene (p value = 0,548) and sanitation facilities (p value = 0,322) with *Escherichia coli* on hands in catering service groups A1 and A2 in the Banyudono district. Although personal hygiene and food hygiene are good, there are still handlers who do not pay attention to personal hygiene and take advantage of the availability of sanitation facilities in catering service, so food service need to implement rules to always maintain cleanliness for handlers, pay attention to food hygiene and provide good facilities.

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