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Test *of Escherichia Coli* and Total Microbes on Burger Meat Sold in Kedinding and Pogot Villages, Surabaya, East Java

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Abstract

A burger is a type of fast food that consists of a bun in the middle that contains a patty (ground beef), vegetables, and some sauce. There are several parameters in determining food quality and safety, one of which is analyzing the content of microbiology such as bacteria, viruses, and protozoa in food. Biological hazards, especially in food, need special attention because they are often the causative agents of food poisoning cases. This study aims to determine Eschericia coli contamination and Total Plate Number (TPC) in burger meat samples sold in Kedinding and Pogot villages, Surabaya, East Java. This research is observational with a cross sectional approach. The inspection method used to determine Escherichia coli contamination and the Total Plate Count (TPC) is the Most Likely Number method to determine E. coli and the Total Plate Count (TPC). The results of this study showed that there was no E. coli in all burger meat samples and there were 6 burger meat samples contaminated with bacteria, namely in Samples A, B, C, G, H and I, which exceeded the contamination limit according to to SNI 8503 (2018).

Keywords: *Burgers, Escherichia coli, Total Plate Count (TPC)*

Abstrak

Burger adalah jenis makanan cepat saji yang terdiri dari roti di tengah yang berisi *patty* (daging giling), sayuran, dan beberapa saus. Terdapat beberapa parameter dalam menentukan mutu dan keamanan pangan, salah satunya menganalisis kandungan mikrobiologi seperti bakteri, virus, dan protozoa dalam pangan. Bahaya biologis, terutama pada makanan, perlu mendapat perhatian khusus karena sering menjadi agen penyebab kasus keracunan makanan. Penelitian ini bertujuan untuk mengetahui *cemaran Eschericia* dan Angka Lempeng Total (ALT) pada sampel daging burger yang dijual di desa Kedinding dan Pogot, Surabaya, Jawa Timur. Penelitian ini bersifat observasional dengan pendekatan cross sectional. Metode pemeriksaan yang digunakan *untuk menentukan kontaminasi Escherichia* dan Angka Lempeng Total (ALT) adalah metode *Most Likely Number* untuk menentukan E. dan Angka Lempeng Total (ALT). Hasil penelitian ini menunjukkan bahwa tidak terdapat *E.* pada seluruh sampel daging burger

dan terdapat 6 sampel daging burger yang terkontaminasi bakteri yaitu pada Sampel A, B, C, G, H dan I yang melebihi batas kontaminasi menurut SNI 8503 (2018).

Kata kunci: Burgers, Escherichia coli, Angka Lempeng Total (ALT)

Introduction

Diseases in humans caused by contaminated food are also called foodborne diseases (Nurmawati, S., Prodjosoewojo, S., Chairunnisa, NH., Djauhari, H., dan Alisjahbana, 2019). There are many types of foodborne diseases, but most foodborne diseases have toxic and infectious properties that occur when pathogens have settled on contaminated food and then ingested with food and settled in the human body (Bintsis, 2018). Some bacteria that very often cause foodborne illness are *Salmonella, Clostridium, Staphylococcus and Eschericia coli. Escherichia coli* can enter the human body when a certain food ingredient is ingested and the food is confirmed to have been contaminated by bacteria such as raw meat, undercooked meat, raw milk and fecal contamination in food water (BPOM, 2018). Improper meat processing and/or undercooked cooking processes can be the cause of poisoning due to the presence of *Eschericia coli* bacteria in meat that then settle, survive and multiply in the human body. If there are 10 *Eschericia coli* bacteria living in a burger patty and have multiplied it can cause poisoning in humans (Ademi & Rinanda, 2011).

Burger is a fast food that is very liked by various groups, especially children and teenagers because it is considered modern food and tastes delicious. A burger consists of a bun in the middle containing a *patty* (ground beef), vegetables, and some sauce. *Patty* burger is a ground beef dish, usually the main ingredient in making *a patty* is beef which contains a lot of fat so that it can be the main cause of cholesterol (Sultia & Dr. Endang Mulyatiningsih, 2021). The basic ingredients for making burger *patties* can use various kinds of meat such as beef, chicken, and fish (Puspitasari, 2015).

The large amount of public interest in burger food has an impact on the mushrooming of fast food vendors, both street vendors, medium and restaurant levels that specialize in selling burger menus. But the negative side of many burger sellers is the lack of cleanliness in the manufacturing process and the quality of burger meat, especially at street burger vendors or on the roadside and there are many flies that can be an intermediary medium for the spread of bacteria in food (Fukuda A, Usui M, Masui C, 2019).

There are several parameters in determining food quality and safety, one of which is to analyze the content of microbiology such as bacteria, viruses, and protozoa in food (Fadjar Kurnia, 2016). Especially food sold on the roadside at very cheap prices is often suspected of using raw materials that are not in accordance with the minimum production standards or even those that are not suitable for consumption, so that it can be the main cause of food poisoning or foodborne disease (Jamilatun, 2022).

Research Method

Material

The ingredients used in this study were meat burgers obtained from meat burger outlets in Kedinding Village and Pogot Village. Materials for microbiological analysis include: Brillian Green Lactose Bile (BGLB), 2% Broth (B.1), Lauryl Tryptose Broth (LTB) (B.2), EC Broth (B.3), Levine's Eosin Methylen Blue (L-EMB) Jilly (B.4), Tryptone (tryptophane) Broth (TB) (B.5), MR-VP broth (B.6), Simmon Citrate Jelly (B.7), Plate Count Jelly (B.8), bacto jelly, fluid thioglycolate medium, gas pack dan anaerobic indocator strips, solution butterfield's phosphate buffered, mineral oil, nutrient jelly, peptone water, plate count jelly, tryptic soy jelly.

Tools

The tools used in the process of making burgers are knives, cutting boards, copers, stoves, and pans. Tools used for microbiological analysis include a closed waterbath with a circulation of 45.5^{o}C ± 0.2^{o}C[a], incubator 35^{o}C ± 1^{o}C[b], blender and sterilizable jar or stomacher, diluent bottle, durham tube, petri dish size 15 mm x 90 mm, UV lamp with wavelength 365 nm, test tubes measuring 16 mm x 150 mm and 13 mm x 100 mm, scales with a capacity of ≥ 2kg and sensitivity of 0.1 g, microscope, pipette or pippetor 1 mL, 5 mL and 10 mL, ose needle, colony counting device, anaerobic jar, autoclave, blender along with sterilizable jar or stomacher, diluent bottle 20 mL, petri dish 15 mm x 90 mm, incubator 35^{o}C ± 1^{o}C, incubator 45^{o}C ± 1^{o}C, glass pipette or pipor 0.1 mL, 1 mL, 5 mL, and 10 mL, scales with an accuracy of 0.0001 g, waterbath temperature circulation 45^{o}C ± 1^{o}C.

Sample Testing

The sampling technique is *Simple Random Sampling*, where in this technique the process is carried out randomly in sampling and pupulation regardless of the class (Sugiyono, 2009). Sampling at 9 meat burger outlets sold in Kedinding and Pogot Villages, Surabaya, and testing samples for 2 times.

Data Analysis

The method of analyzing conditions and situations is carried out using qualitative descriptive methods, namely the results of interviews related to all conditions in the field are written and summarized in the form of written reports (Winartha, 2006).

Data analysis is carried out by explaining in writing related to the results of the data tested to describe both in general and generalization using descriptive data analysis.

Results and Discussion

Escherichia coli Test

1 Coliform Estimation Test

The results of the coliform estimation test on burger meat using Lactose broth media can be seen in Appendix 6, which shows gas in durham tubes in samples A, D and E.

Table 1. Coliform estimation test results with 3 series of dilution tubes 10^{-1}, 10^{-2}, 10^{-3}

Sampel Code	Positive Tube		
	10^{-1}	10^{-2}	10^{-3}
A	2	0	0
B	0	0	0
C	0	0	0
D	3	0	0
E	1	0	0
F	0	0	0
G	0	0	0
H	0	0	0
I	0	0	0

In Table 1 the numbers indicate the number of positive tubes. In this APM test using 9 tubes with 3 dilution series, namely 101, 10-2, 10-3. In sample A LSB media shows a value of 2-0-0 then there are 2 positive tubes at dilution 10-1, in samples B and C LSB media shows a value of 0-0-0 then there are no positive tubes, but in sample D shows a value of 3-0-0 then there are 3 tubes that are positive at dilution 10-1, in sample E LSB media shows 1-0-0 then there is 1 tube that is positive at dilution 10-1, while the samples F, G, H and I showed a value of 0-0-0 then there was no positive tube.

2 *E.coli* Estimation Test

The *E. coli* estimation test aims to transfer the culture with an inoculation needle from each positive Brillian Green Lactose Bile (BGLB) tube into a tube containing EC Broth media that has been filled in the durham tube. EC broth tubes are incubated for 24-48 hours with a temperature of 45.5ºC. After 48 hours, you will see a tube that is positive for E. *coli* bacteria will become cloudy and produce bubbles in the durham tube (Widyaningsih et al., 2016).

Figure 1. *E. coli* Estimation Test

Ket : *E.coli* estimation test on BGLB media (BGLB negative : left, BGLB positive : right)

3 *E. coli* Affirmation Test

In this test, the tube containing a positive EC Broth was scratched on Levine's Eosin Methylen Blue (L-EMB) media diameter of 3 mm and then incubated for 18-24 hours at a temperature of 35ºC. The result will grow *E. coli* colonies with black or dark characteristics at the center of the colony with or without greenish metallic (Nurmawati, S., Prodjosoewojo, S., Chairunnisa, NH., Djauhari, H., dan Alisjahbana, 2019).

Based on the picture above, *E. coli* was found in Sample D, but the number of colonies still meets the requirements of SNI 8503: 2018, namely contamination is still below the maximum limit of <3 APM / g. *Escherichia coli* test results on burger meat in Kedinding and Pogot villages, Surabaya can be seen in Table 2.

Table 2. Test Results of *Escherichia coli* on burger meat in Kedinding and Pogot villages Surabaya

Sampel	*E.coli* Value (MPN/g)	Maximum Limit (MPN/g)	Information
A	<3	<3	MS
B	<3	<3	MS
C	<3	<3	MS
D	<3	<3	MS
E	<3	<3	MS
F	<3	<3	MS
G	<3	<3	MS
H	<3	<3	MS
I	<3	<3	MS

Information:

TMS : Not Eligible

MS : Qualified

Total Plate Number (TPC) Test

Based on the observations, it showed that samples containing bacteria exceeded the contamination limit carried out at dilutions 1 to 5, positive samples were in samples A, B and C. The results of Total Plate Number (TPC) testing on burger meat in Kedinding and Pogot villages Surabaya can be seen in Table 3.

Table 3. Total Plate Number (TPC) results on burger meat in Kedinding and Pogot villages Surabaya

Sampel	ALT Sampel (koloni/g)	Maximum Limit Microbe	Information
A	4.5×10^4	$1x10^4$	TMS
B	3.4×10^4	$1x10^4$	TMS
C	2.9×10^5	$1x10^4$	TMS
D	3.5×10^3	$1x10^4$	MS
E	4.3×10^3	$1x10^4$	MS
F	3.3×10^3	$1x10^4$	MS
G	2.3×10^4	$1x10^4$	TMS
H	1.1×10^6	$1x10^4$	TMS
I	2.4×10^4	$1x10^4$	TMS

Information:

TMS : Not Eligible

MS : Qualified

Table 3 above shows that from all samples tested, there were 6 samples contaminated with bacteria, and among the 9 samples there were 3 samples whose contamination numbers were below the maximum limit. 6 samples contaminated with bacteria were obtained because all outlets did not meet hygiene and sanitation requirements in accordance with the Ministry of Health of the Republic of Indonesia Number 942 / MENKES / SK / VII / 2003.

Hygiene Sanitizing Burger Meat

Table 4. Results of hygiene and sanitation observations based on food handler variables in 2003

Variabel	A		B		C		D		E		F		G		H		I	
	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T
Food Handlers																		
a. Does not suffer from easily transmitted diseases :																		
• Cough																		
• Flu	√		√		√		√		√		√		√		√		√	
• *Influesnza*																		
• Diarrhea																		
Similar stomach diseases																		
b. Close wounds (open wounds/ulcers or other wounds)	√		√		√		√		√		√		√		√		√	
c. Mantain hand hygiene	√		√		√		√		√		√		√		√		√	
d. Mantain hair hygiene	√		√		√		√		√		√		√		√		√	
e. Mantain nail hygiene	√		√		√		√		√		√		√		√		√	
f. Mantain clothes hygiene	√		√		√		√		√		√		√		√		√	
g. Wearing an apron	√			√		√	√		√		√			√		√		√
h. Wearing a head cover	√			√	√		√		√		√			√	√			√
i. Wash hand every time handle food		√		√		√	√		√		√			√		√		√
j. Using gloves	√			√	√		√		√		√			√		√		√
k. Not smoking	√		√		√		√		√		√		√		√		√	
l. Not scratching limbs (ears, nose, mouth or other parts)	√		√		√		√		√		√		√		√		√	
m. No cough or sneeze in the presence of food to be served without covering the mouth and nose	√		√		√		√		√		√		√		√		√	
	TMS	TMS	TMS	MS	MS	MS	TMS	TMS	TMS		TMS	TMS	TMS	MS	MS	MS	TMS	TMS

In Table 4, the results of observations of food handler variables from 9 outlets there are *6* burger outlets that do not meet the requirements according to the Ministry of Health of the Republic of Indonesia Number 942 / MENKES / SK / VII / 2003. The criteria that most burger outlets do not meet are vendors not washing their hands when they want to handle food, not wearing aprons, not wearing head coverings, and not wearing gloves. The spread of bacteria can be through human hands, such as during the packaging process that is less aseptic. Microbiology can move through human hands to food caused by unhygienic hands, such as not using gloves and having touched other body parts (Riyanto, 2012). Burger outlet traders do not attach much importance to washing hands before handling food because in the process of handling food the traders use food tongs so that they do not directly contact with their burgers, therefore contaminated 6 out of 9 samples tested Total Plate Number (TPC).

Table 5. Results of hygiene and sanitation observations based on equipment variables in 2003

Variabel	A		B		C		D		E		F		G		H		I	
	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T
Equipment																		
a. Equipment used to process and serve snacks must be appropriate for its intended purpose and meet hygiene and sanitation requirements	√		√		√		√		√		√		√		√		√	
b. Equipment that has been washed with clean water and soap		√		√		√	√		√		√			√		√		√
c. Then dry with a clean cloth		√		√		√	√		√		√			√		√		√
d. The equipment is stored in a place that is free from contamination		√		√		√	√		√		√			√		√		√
e. Do not reuse equipment that is only for single use	√		√		√		√		√		√		√		√		√	
	TMS		TMS		TMS		MS		MS		MS		TMS		TMS		TMS	

Table 5 shows that the results of variable equipment observations from 9 outlets there are 6 burger outlets that do not meet the requirements according to the Ministry of Health of the Republic of Indonesia Number 942 / MENKES / SK / VII / 2003. The criteria that are most not met by burger outlets are that the equipment that has been used is washed with clean water and soap such as Teflon used to grill burger meat is not immediately washed when it is finished grilling but teflon will be washed when the merchant has finished selling, then the washed equipment is not dried with a dryer or clean cloth (when it has been cleaned the equipment is not wiped using a dryer, only left until the water dries by itself), then the cleaned equipment is not stored in a place that is free of contamination (equipment is only placed in a place that is not covered so it is not free from pollution) for reasons of limited space to store equipment so that the equipment is simply placed.

Table 6. Hygiene and sanitation observation results based on vending facility variables in 2003

Variabel	A		B		C		D		E		F		G		H		I	
	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T
Vendor Facilities																		
a. The construction of the vending facility is easy to clean	√		√		√		√		√		√		√		√		√	
b. There is a place for clean water	√			√	√		√		√		√			√		√		√
c. There is a place for storing food	√		√		√		√		√		√		√		√		√	
d. There is a place to store food that is ready to be served		√		√		√	√		√		√			√		√		√
e. Equipment storage space is available	√		√		√		√		√		√		√		√		√	
f. There is a place to wash your hands	√			√	√		√		√		√			√		√		√
g. There is a place for groceries	√		√		√		√		√		√		√		√		√	
h. There is space for equipment	√		√		√		√		√		√		√		√		√	
i. Trash cans are available	√		√		√		√		√		√		√		√		√	
	TMS		TMS		TMS		MS		MS		MS		TMS		TMS		TMS	

Table 6 shows the results of variable observations of hawker facilities from 9 outlets there are 6 burger outlets that do not meet the requirements according to the Ministry of Health of the Republic of Indonesia Number 942 / MENKES / SK / VII / 2003. The main variables in the standard are related to the availability of clean water and the process of cleaning production equipment that is poorly maintained sterility (Djaja, 2008). The most criteria not met by burger outlets is that there is no place for clean water because traders store water in tubs that are not closed so that it is easily contaminated, then the second criterion is that there is no place for food that is ready to be served or distributed because food is directly served to consumers once it is cooked. The third criterion is that there is no place to wash hands because according to the merchant, this handwashing place is not too important because consumers do not need to wash their hands before eating the burger, consumers can eat the burger directly without touching the burger because the burger is covered with burger wrapping paper.

Table 7. Hygiene and sanitation observation results based on trader center variables in 2003

Variabel	A		B		C		D		E		F		G		H		I	
	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T	Y	T
Vendor Facilities																		
a. The location of traders must be far enough from sources of pollution such as open rubbish dumps		√		√		√		√		√	√			√		√		√
b. The location must be far from the waste processing site	√		√		√		√		√		√		√		√		√	
c. The location must be far from the slaughterhouse	√		√		√		√		√		√		√		√		√	
d. The location must be far from busy roads with high speed traffic		√		√		√		√		√		√		√		√		√
e. The location must have clean water available	√			√	√			√		√	√			√		√		√
f. Garbage storage is available	√		√		√		√		√		√		√		√		√	
g. There is a place for waste water disposal		√		√		√		√		√	√			√		√		√
h. Toilets available		√		√		√		√		√	√			√		√		√
i. The location is free from insects and disturbing animals	√		√		√		√		√		√		√		√		√	
j. Fixed location	√			√		√		√		√	√			√		√		√
k. Selling 1 product		√		√		√		√		√		√		√		√		√
	TMS		TMS		TMS		TMS		TMS		TMS		TMS		TMS		TMS	

Table 7 shows that the results of variable observations of merchant centers from 9 outlets of all outlets do not meet the requirements according to the Ministry of Health of the Republic of Indonesia Number 942 / MENKES / SK / VII / 2003. All outlets do not meet the criteria in the merchant center variable. The most things that are not met by outlets are outlets located close to sources of pollution such as open trash cans, trash cans are only placed in plastic containers and coated with plastic but not closed and very close to the burger processing

site, the second criterion that is not met is the outlet Close to the highway which is a source of pollution so that burgers are likely to be polluted, the third criterion is that there is no clean water available because water is only placed in an uncovered tub, then the next criterion is that the outlet does not have a waste disposal site because the outlet feels there is no waste generated from the burger processing process, then the outlet There is no toilet available so that traders do not have a place to urinate or defecate and if you want to go to the toilet you have to go to a public toilet which is very risky for disease transmission, the next criterion is that the outlet has a place that is not fixed and sells other exposures such as kebabs, maryams and hotdogs, if the outlet sells other snacks the risk of food contaminants is greater.

Conclusion

All samples of burger meat sold in Kedinding and Pogot villages Surabaya, East Java did not contain *E-coli*, but for Sample A (Platok Street No. 145), Sample B (Kedinding Lor Street No. 80), Sample C (Randu Street No. 16), Sample G (Kedinding Lor Street No. 8), Sample H (Kedinding Lor Street Sedap Malam Lane) and Sample I (Kedinding Lor Street Flamboyan Lane) contaminated with bacteria from the results of the Total Plate Number (TPC) examination.

The content of *E. coli* in all burger meat samples has met the Indonesian National Standard No. 8503 of 2018, which is < 3MPN / g, but the bacteria contained in burger meat are only 3 samples of burger meat that meet the Indonesian National Standard No. 8503 of 2018, namely Sample D (Kedinding Lor Street No. 8), Sample E (Pogot Street No. 17), and Sample F (Pogot No. 55).

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