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Bacterial Contamination on Meatballs Sold in Traditional Markets P.D. Surya Market in East Surabaya Region Causes a Decline in People's Income

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Abstract

Coliform, Escherichia coli and Salmonella sp. is a bacterial pathogen that causes foodborne disease which often contaminates food that is harmful to human health. The sale of meatballs without packaging accompanied by poor hygiene and environmental sanitation conditions has a high potential for contamination by Coliform, Escherichia coli and Salmonella sp. The purpose of this study was to identify the contamination of Coliform, Escherichia coli and Salmonella sp in bulk and packaged meatballs sold at PD Pasar Surya in the East Surabaya Region and to determine the relationship between the hygiene and sanitation of traders on the level of bacterial contamination, Coliform contamination, Escherichia coli and Salmonella sp in bulk and packaged meatballs. This research is a cross sectional study and the sample was taken by purposive sampling method. The relationship between hygiene and sanitation of traders with microbiological quality of bulk meatballs and packaged meatballs using Chi Square. The results showed that the level of total bacterial contamination was higher in bulk meatballs (66.6%) compared to packaged meatballs (40%), Total Coliform bulk meatballs were 60% higher than packaged meatballs (40%), Escherichia coli meatballs Bulk meat (40%) is higher than packaged meatballs (20%), Salmonella sp in bulk meatballs (33.3%) is higher than packaged meatballs (40%). There is a significant relationship between the hygiene and sanitation of traders and the level of bacterial contamination, Coliform, Escherichia coli and Salmonella sp.

Keywords
meat balls; coliform bacteria; escherichia coli; salmonella sp.

I. Introduction

Coliform bacteria are a group of bacteria from the Enterobacteriaceae family consisting of bacteria Klebsiella sp., Salmonella sp., Citrobacter sp., and Escherichia coli. The presence of Coliform bacteria in food is an indication of contamination by human feces spread by flies, the environment, water and human hands. One type of Coliform bacteria is Escherichia coli, which is commonly found in the gastrointestinal tract of humans and animals. The existence of these bacteria can cause health problems that will attack digestion, including nausea, vomiting, stomach heartburn to diarrhea. Based on research by Rokhmiyanti and Heryantoro (2017), there was an Extraordinary Event (KLB) of food poisoning due to Escherichia coli with the number of people exposed as many as 79 people in Kepek Village, Wonosari District, Gunungkidul Regency, Yogyakarta

The presence of Coliform, Escherichia coli and Salmonella sp bacteria in food or beverages is an indicator of poor sanitary hygiene of food service providers. These microbes can contaminate foodstuffs through raw materials and water used for the

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processing process can also contaminate food that has been cooked through food handlers, processing equipment, the surrounding environment or cross-contamination can occur during food preparation. According to Thaheer (2008), the main source of food contamination comes from food handlers, equipment, garbage, insects, rats and environmental factors such as air and water

Meatballs are a popular food for the Indonesian people, where the bruisers range from children to adults so it is not surprising that meatball traders can be found everywhere. Meatballs are processed ground beef products that are mixed with flour and spices and other mashed ingredients, then formed into rounds and then boiled until cooked. The term meatball is usually followed by the name of the type of meat, such as fish balls, shrimp meatballs, chicken meatballs, beef meatballs, rabbit meatballs, buffalo meatballs, and goat or lamb meatballs (Astawan, 2008).

Meatballs that are popularly loved as snacks in Indonesia, especially in Surabaya, are meatballs made from beef. According to SNI 01-3818-1995 Meat meatballs are round-shaped or other food products that are obtained additional food additions that are allowed. Meatballs sold in the Surabaya city market can be distinguished into factory-made meatballs and homemade meatballs. Factory-made meatballs consist of branded packaged meatballs, unbranded packaged meatballs and bulk meatballs.

According to Ariesthi (2019), pathogenic bacteria that often contaminate food are Salmonella sp and Escherichia coli which are bacteria that cause Foodborne disease. Contamination that occurs in meat is caused by several factors, including poor sanitary hygiene, unhealthy meat handling methods and equipment used in unclean processing. Escherichia coli is a species of bacteria found in the intestines of healthy humans and animals and is necessary to aid in the breakdown of cellulose and the absorption of vitamin K in blood clotting. However, this bacterium is often also the cause of diarrhea and is often used as a sanitary indicator microorganism, especially in water quality testing and to assess sanitation in the food processing industry.

According to the results of Windayanti's research, K (2010), 40.8% of the 196 meatball samples in Tangerang Regency contained Coliform bacteria. The results of Pranada's research, R (2019) revealed that the number of bacteria that contaminated meatballs sold in Perwat village, Teluk Betung Timur district, found 10 bacteria from 39 meatball samples consisting of Salmonella sp bacteria. 28% and Escherichia coli bacteria 36%. The results of Rahmi's research, N (2015) revealed that of the 32 samples of beef meatballs sold in Banjarbaru City, there were 14 samples of beef meatballs (43.75%) did not contain Escherichia coli bacteria and 18 samples of beef meatballs (56.25%) contained Escherichia coli of 3.6 CFU / g -62 CFU / g.

Seeing the huge potential of beef meatball snacks and the high level of vulnerability of beef meatball snacks, researchers felt the need to conduct microbiological analysis of Coliform, Escherichia coli and Salmonella sp on meatball snacks and factors that affect the food safety of meatball snacks traded in traditional markets in the solar market in the East Surabaya region.

II. Research Method

This research was carried out at the Food Microbiology Laboratory of the Food Technology study program, Faculty of Engineering UPN "Veteran": East Java and the BSL-2 Laboratory of the Institute of Tropical Diseases, Universitas Airlangga from January to February 2022.

This research is an exploratory and descriptive survey using the Cross-Sectional Study approach, which is a research design using observation methods at the same time or at a certain time (Hidayat, 2007). Exploratory and descriptive survey research is research conducted by conducting observations and interviews about the circumstances and subjects to be studied. To determine the relationship between hygiene and sanitation of traders with the microbiological quality of bulk meat meatballs and packaging using Chi Square at $p<0.05$.

III. Result and Discussion

3.1 Results of Phase I Research

a. Trader Characteristics

In this study, 25 respondents were used to trade bulk beef meatballs and packaging sold in the PD Market. Solar Market East Surabaya Region. The results of interviews conducted on 25 respondents obtained the characteristics of traders (gender, age, last education and length of selling) can be seen in table 4.

Table 1. Trader Characteristics

gender		Age (years)			Education			Length of sale		
A. bulk meatball trader										
Man	11(73,3%)	19-28	2	13,3%	Not going to school	1	6,8%	<1	2	13,3%
Woman	4 (26,7%)	29-38	2	13,3%	Sd	2	13,3%	1-10	6	40%
		39-48	6	40%	Junior	4	26,7%	11-20	7	46,7%
		49-58	2	13,3%	Sma	8	53,2%	21-30	0	0%
		59-60	1	6,8%						
		>60	2	13,3%						
Total	15		15			15			15	
B. packaged meat ball vendors										
Man	6 (60%)	19-28	2	20%	Not going to school	1	10%	<1	0	0%
Woman	4 (40%)	29-38	1	10%	Sd	0	0%	1-10	3	30%
		39-48	4	40%	Junior	3	30%	11-20	5	50%
		49-58	1	10%	Sma	6	60%	21-30	2	20%
		59-60	2	20%						
		>60		8%						
Total	10		10			10			10	

The characteristics of bulk meatball traders showed that male traders were 11 (73.3%) more than women as many as 4 (26.7%). The age range of traders is 6 (40%) in the age range of 3 9-48 years, as many as 2 (13.3%) in the age range of 19-28, 29-30 and >60 years, and the lowest 1 (6.8%) at the age of 59-60 years. Traders with high school education had the highest percentage of 8 (53.2%) compared to junior high school 4(26.7%), elementary 2 (13.3%) and non-school 1 (6.8%). Traders with 11-20 years of selling experience have the highest percentage of 7 (46.7%) compared to 1-1 0 years 6 (40%), and less than 1 year 2 (13.3%) and not obtained (0%) traders with 21-30 years of selling experience year.

The characteristics of packaged meat meatball traders showed that male traders were 6 (60%) higher than women by 4 (40%). The age range of traders is 4 (40%) at the age of 39-48 years, as many as 2 (20%) at the age of 19-2 8 and 59-60 years and as many as 1 (10%) at the age of 29-38 and >6 0 years. Traders with high school education have the highest percentage of 6 (60%) compared to junior high school 3(30%), not school 1 (10%) and get 1 (0%) trader with elementary education level. Traders with 11-20 years of selling experience have the highest percentage of 5 (5 0%), compared to 1-10 years 3 (30%), at the age of 21-30 years 2 (20%) and not obtained 0 (0%) traders with less than 1 year of experience.

Table 4 shows that the majority of respondents are male, this is because trading meatballs is the main livelihood of the head of the family (male). The highest percentage of traders' age is in the range of 39-48 years because in that age range it is the productive age. According to Tjiptoherijanto (2021), the age structure is divided into the young age group under 15 years old, the productive age group aged 15-64 years, and the old age group 65 years and over. Ukkas (2017) added that the age level greatly affects a person's productivity. The productive age tends to be stronger in terms of physique compared to the non-productive age. As you get older, productivity will decrease due to strength and physical energy that tends to decrease. According to Baskara (2021), humans who are more than 65 years old are elderly people who experience changes and decreases in health conditions so that at the age of more than 65 years they should no longer work (sell). According to Permatasari (2021), with age, the attitude aspect will be better, while respondents under the age of 20 years have a low knowledge aspect. The fact suggests that both knowledge and experience can increase with age.

b. Hygiene and sanitation of traders

Assessment of personal hygiene based on the observations of researchers in the field. The results of the hygiene and sanitation analysis of traders can be seen in Table 5.

Table 2. Analysis of the hygiene and sanitation of traders

Types of traders	**Personal hygiene**			**Sanitation Equipment**			**Serving Techniques**			**sales and environmental sanitation**		
Bulk meatballs	Good	10	66,67%	Good	10	66,67%	Good	4	26,67%	Good	3	20%
	Bad	5	33,33%	Bad	5	33,33%	Bad	11	73,33%	Bad	12	80%
Total		15			15			15			15	
Packaged meatballs	Good	7	70%	Good	5	50%	Good	2	20%	Good	5	50%
	Bad	3	30%	Bad	5	50%	Bad	8	80%	Bad	5	50%
Total		10			10			10			10	

Table 5 shows that the poor hygiene and sanitation conditions of packaged meat meatball traders are lower (30%) compared to the hygiene and sanitation of bulk meat meatball traders (33.33%). The poor sanitary condition of packaged meat meatball merchant equipment is higher (50%) than bulk meat balls (33.33%). The poor condition of serving packaged meat balls is higher (80%) than bulk meat meatballs (73.33%). The poor sanitation and environmental conditions of packaged meat meatballs are lower (50%) than bulk meat meatballs (80%).

His poor hygiene and sanitary conditions are indicated by no merchant using aids or gloves to touch the product at the time of sale. The sanitation of the equipment used by the vendors can be said to be bad because it uses plastic covers that are already dirty and there are some vendors who do not close the meat balls served at the table. Meat balls left open can also result in contamination with the outside environment. The sanitary hygiene of the point of sale and the surrounding environment can also affect bacterial contamination of meatball products. Pedagang uses a table that is not made of ceramics, the average merchant's table is made of wood which is difficult to clean. The condition of the floor of the place of sale is gross. All vendors also do not provide clean water for washing hands or equipment**.**

3.2 Results of Phase II Research

a. Total Bacteria

Total bacteria are generally used as indicators of product hygiene and sanitation processes, indicators of environmental microbial contamination of products, indicators of supervision, and are used as indicators of whether or not a person is acceptable

The results of the observation of total bacteria (Table 6), showed that 84% (21 of 25) samples had an average total of bacteria exceeding the maximum allowable limit of BSN (2014) where >1 x 10-5 colonies / gram) According to BSN (2014) about the quality requirements of Meat Balls is the maximum limit of total bacteria in meat meatballs is 1 x 10-5 colonies / gram. Somefactors that influence the high level of bacterial contamination include packaging conditions, the conditions used, the way of serving and the surrounding environment according to Hariyati (2018), stating that meat balls served open can increase the chances of contamination of meat balls Due to the wide-open surface of food and sources of contamination can be directly in contact with food

Table 3. Results of the observation of total bulk meatball bacteria

No	Sample Code	Total Bacteria (Colonies/gram)	Status
1	C1	4.5x10-5	Does not meet
2	C2	2.9x10-3	Does not meet
3	C3	2x10-6	Meet
4	C4	4.5x10-6	Meet
5	C5	9.1x10-6	Meet
6	C6	3.2x10-6	Meet
7	C7	6.4x10-5	Does not meet
8	C8	4.6x10-6	Meet
9	C9	3.2x10-5	Does not meet
10	C10	3.3x10-5	Does not meet
11	C11	2.4x10-3	Does not meet
12	C12	9.4x10-4	Does not meet
13	C13	3.11x9-4	Does not meet
14	C14	7.7x9-5	Does not meet
15	C15	2.7x10-4	Does not meet

Description: Qualified < 1 x 10-5 colonies/gram
Ineligible > 1 x $^{10-5}$ colony/gram

The results of the observations in Table 6 show that 66.6% (10 out of 15 bulk meatball samples) have an average total of bacteria exceeding the maximum allowable limit of BSN (2014) where >1 x 10-5 colonies / gram) According to BSN (2014) about the quality requirements of Meat Balls is the maximum limit of total bacteria in meat meatballs is 1 x $^{10-5}$ colonies/gram.

The results of observations in Table 7 show that 40% (4 out of 10 samples of packaged meatballs) have an average total of bacteria exceeding the maximum allowable limit of BSN (2014) where >1 x 10-5 colonies / gram) According to BSN (2014) about the quality requirements of Meat Balls is the maximum limit of total bacteria in meat meatballs is 1 x $^{10-5}$ colonies / gram.

From the results of the study in Tables 6 and 7, it shows that 25 samples of bulk meat balls and packaged meat meatballs that have been obtained in bulk meatballs that are 66.6% (10 out of 15 samples of bulk meatballs) are higher than packaged meatballs by 40% (4 out of 10 samples of packaged meatballs). The high number of bacteria in meat meatballs is not only influenced by the hygiene and sanitation conditions of traders and the surrounding environment.

Table 4. Results of total bacterial observation of packaged meat meatballs

No	Sample Code	Total Bacteria (Colonies/gram)	Status
1	K1	1.53x10-6	Meet
2	K2	2.9x10-5	Does not meet
3	K3	1.1x10-6	Meet
4	K4	7.7x9-7	Meet
5	K5	1.7x10-4	Does not meet
6	K6	4.4x10-7	Meet
7	K7	2.1x10-6	Meet
8	K8	2.3x10-4	Does not meet
9	K9	8.2x10-7	Meet
10	K1O	6.3x10-5	Does not meet

Description: Qualified < 1 x 10-5 colonies/gram
Ineligible > 1 x $^{10-5}$ colony/gram

The total bacteria in the sample codes K2, K5, K8 and K10, exceeded the maximum limit of BSN (2014). This is because the condition of the packaging on the meat ball product is not in a vacuum state, the packaging is damaged and the meat balls are not sold for too long. Incompatibility of packaging conditions can result in contamination of meat balls. Bulk meat meatballs sold in open conditions have a higher bacterial total. The total difference in bacteria in bulk meat balls and packaged meat balls is influenced by several factors.

Somefactors that influence the high level of bacterial contamination include packaging conditions, the conditions used, the way of serving and the surrounding environment according to Hariyati (2018), stating that meat balls served open can increase the chances of contamination of meat balls Due to the extent of the exposed surface of food and the source of contamination can be directly in contact with the food.

Based on Table 8, the highest bacterial contamination (2.9x10-3) is bulk packaged meat balls sold by C2 handlers, while the lowest contamination (2x10-6) is C3 traders. This high contamination is influenced by the hygiene and sanitary conditions of traders. Where sanitary hygiene pedagagng C2 obtained poor sanitary hygiene for 4 categories, while in C2 traders obtained good sanitary hygiene for 4 categories.

Table 5. The results of observations of the sanitary hygiene of traders and the total bacteria in bulk meat balls

No	Sample Code	Personal hygiene	Sanitation Equipment	Serving Techniques	sales and environmental sanitation	Total Bacteria (Colonies/gram)
1	C1	Good	Good	Good	Good	4.5x10-5
2	C2	Bad	Bad	Bad	Bad	2.9x10-3
3	C3	Good	Good	Good	Good	2x10-6
4	C4	Good	Bad	Bad	Bad	4.5x10-6
5	C5	Good	Good	Bad	Bad	9.1x10-6
6	C6	Good	Good	Bad	Bad	3.2x10-6
7	C7	Good	Good	Bad	Bad	6.4x10-5
8	C8	Good	Good	Good	Bad	4.6x10-6
9	C9	Good	Good	Good	Good	3.2x10-5
10	C10	Bad	Good	Bad	Bad	3.3x10-5
11	C11	Bad	Bad	Bad	Bad	2.4x10-3
12	C12	Bad	Bad	Bad	Bad	9.4x10-4
13	C13	Good	Bad	Bad	Bad	3.11x9-4
14	C14	Good	Good	Bad	Bad	7.7x9-5
15	C15	Bad	Good	Bad	Bad	2.7x10-4

The high total bacteria in bulk meat meatballs are caused by poor sanitary hygiene conditions, poor storage processes and packaging conditions that are not considered. The state of sanitary hygiene can affect the quality of food products. As a result, it can cause health problems such as *foodborne disease* and food poisoning cases (Trigunarso, 2020). The causative factors of poor sanitary hygiene are other than those affected by the hygiene of traders and food sanitation. Indicators of hand and nail hygiene are one of the causes of poor personal hygiene of traders (Trigunarso, 2020). In addition, poor environmental conditions such as the presence of open trash cans and flies around the sales area.

Table 6. Results of observations of sanitary hygiene of traders and total bacteria on bulk sausages

No	Sample Code	Personal sanitation	Sanitation Equipment	Serving Techniques	sales and environmental sanitation	Total Bacteria (Colonies/gram)
1	K1	Good	Good	Good	Bad	1.53x10-6
2	K2	Bad	Bad	Bad	Good	2.9x10-5
3	K3	Good	Bad	Good	Bad	1.1x10-6
4	K4	Bad	Good	Bad	Good	7.7x9-7
5	K5	Good	Good	Bad	Good	1.7x10-4
6	K6	Bad	Bad	Bad	Bad	4.4x10-7
7	K7	Good	Bad	Bad	Bad	2.1x10-6
8	K8	Good	Bad	Bad	Good	2.3x10-4
9	K9	Good	Good	Bad	Bad	8.2x10-7
10	K10	Good	Good	Bad	Good	6.3x10-5

Table 7. Chi Square Test of the relationship of hygiene and sanitation conditions to total bacteria

Sanitary Hygiene Practices	Total bacteria				Total		A	*p Value*
	<1x10-5		>1x10-5					
	Sum	%	Sum	%	N	%		
Good	9	20%	3	24%	11	44%	0,05	0,008
Bad	3	12%	11	44%	14	56%		
Total	11	32%	14	68	25	100%		

Based on the results of the study in Table 10, it is known that there is a real relationship between sanitary hygiene conditions and total bacteria. Chi-Square test results, obtained *a p-value* **of** 0.008 ($p < 0.05$). Thus, there is a real relationship between sanitary hygiene of traders and bacterial contamination in meat balls. The total bacterial parameter in food products is very important to pay attention to because this parameter is closely related to the safety of these food products for consumption and the degree of damage to food products. The total bacterial content in meatballs is a maximum of 10^5 cfu / g (BSN, 2014).

b. Total Coliform

Based on Table 11 shows that as much as 60% (9 out of 15 samples of bulk meat balls) of meat meatball samples sold in the traditional market P.D. Pasar Surya East Surabaya Region, contamination of Coliform bacteria exceeds the maximum limit set by BSN 2014 About the quality requirements of meat balls Stipulating for meat meatballs has a limit of APM *Coliform* >10/g. Highest contamination (total *Coliform* >1100 MPN/gram). The highest contamination (total *Coliform* >1100 MPN/gram) at traders on samples of meat balls C5 and C8.

Table 8. Total Coliform on Bulk Meatballs

No	Sample Code	Total *Coliform* (MPN/gram)	Status
1	C1	6,1	Meet
2	C2	3,6	Meet
3	C3	3,0	Meet
4	C4	9,4	Meet
5	C5	>1100	Does not meet
6	C6	20	Does not meet
7	C7	35	Does not meet
8	C8	1100	Does not meet
9	C9	11	Does not meet
10	C10	29	Does not meet
11	C11	3	Meet
12	C12	14	Does not meet
13	C13	7,4	Meet
14	C14	11	Does not meet
15	C15	11	Does not meet

Description: Qualified < 10 MPN/gram
Ineligible > 10 MPN/gram

Table 9. Total Coliform on Packaged Meat Balls

No	Sample Code	Total *Coliform* (MPN/gram)	Status
1	K1	15	Does not meet
2	K2	0	Meet
3	K3	3,6	Meet
4	K4	7,4	Meet
5	K5	3	Meet
6	K6	3	Meet
7	K7	15	Does not meet
8	K8	15	Does not meet
9	K9	11	Does not meet
10	K10	0	Meet

Description: Qualified < 10 MPN/gram
Ineligible > 10 MPN/gram

Based on Table 12 shows that 40% (4 out of 10 samples of packaged meat balls) of Coliform bacterial contamination exceeds the maximum limit set by BSN 2014 About the quality requirements of meat balls Stipulating for meat meatballs has a limit of APM Coliform >10/g . lowest contamination in C10 and k10 meat ball samples (total *Coliform* <10 MPN/gram).

From the results of the study Table 11 and 12 showed that 25 samples of bulk meat meatballs and packaging that had been obtained in bulk meatballs that were 60% (9 out of 15 samples of bulk meatballs) were higher than packaged meatballs by 40% (4 out of 10 samples of packaged meatballs). The high number of bacteria in meat meatballs is not only influenced by the hygiene and sanitation conditions of traders and the surrounding environment.

According to Bambang (2014), *total Coliform* in meat balls is an indicator of pathogens in animals and humans, because the number of colonies is positively correlated with the presence of pathogenic bacteria. Transmission of *Coliform* bacteria can be through oral, nasal, air and direct contact. The results of Coliform's observations on BGLB media can be seen in Figure 4.

Figure 1. *MPN observations on BGLB media*

According to Falamy et al. (2013), *Coliform* bacteria or often called bacteria of the *Enterobacteriaceae* group, among others, consist of bacteria *Klebsiella sp., Salmonella sp., Citrobacter sp., and Escherichia coli.* The presence of bacteria of the *Enterobacteriaceae* group in the food sold indicates pollution by human feces. It is well known that *Coliform* bacteria such as *Escherichia coli* can withstand months on the soil and in water, but can die by heating at 60ºC or more for 15 minutes.

Table 10. Relationship of a trader's sanitary hygiene to the total number of *Coliforms*

Sanitary Hygiene Practices	*Coliform*				Total		A	*p Value*
	<10		>10					
	Sum	%	Sum	%	N	%		
Good	10	0	5	60	16	60	0,05	0,034
Bad	2	8	8	32	9	40		
Total	12	48	13	52	25	100		

Based on the results of the study in Table 13, it is known that there is a real relationship between sanitary hygiene and total *Coliform* in meat balls sold in the traditional market pd solar market in East Surabaya. Chi-Square test results, obtained *a p-value* of 0.034 ($p < 0.05$). Thus, there is a real relationship between sanitary hygiene of traders and total Coliform in meat balls.

Food raw materials must be secured to avoid damage such as rupture, rot and pollution from the origin of the material or from the environment and good foodstuffs must be old enough/mature as needed, pollution-free, not physically damaged, or due to chemicals, free from disease seeds (Cahyadi, 2008).

Table 11. Contamination of *Escherichia coli* in Bulk Meat Balls

No	Sample Code	*Escherichia coli*	Status
1	C1	Negative	Meet
2	C2	Positive	Does not meet
3	C3	Negative	Meet
4	C4	Negative	Meet
5	C5	Positive	Does not meet
6	C6	Positive	Does not meet
7	C7	Positive	Does not meet
8	C8	Negative	Meet
9	C9	Negative	Meet
10	C10	Negative	Meet
11	C11	Negative	Meet
12	C12	Positive	Does not meet
13	C13	Negative	Meet
14	C14	Positive	Does not meet
15	C15	Negative	Meet

Based on the observations in Table 14, there were 40% (6 out of 15) samples of bulk meat balls that were positive for containing *Escherichia coli*, exceeding the limit according to the Regulation of the Minister of Health of the Republic of Indonesia Number 1096 / MENKES / PER / VI / 2011.

Table 12. *Contamination of Escherichia coli* on Packaged Meat Balls

No	Sample Code	*Escherichia coli*	Status
1	K1	Negative	Meet
2	K2	Negative	Meet
3	K3	Negative	Meet
4	K4	Negative	Meet

5	K5	Negative	Meet
6	K6	Negative	Meet
7	K7	Negative	Meet
8	K8	Negative	Meet
9	K9	Positive	Does not meet
10	K1O	Positive	Does not meet

Based on the observations in Table 15, there were 20% (2 out of 10) samples of packaged meat balls that were positive for containing *Escherichia coli*, exceeding the limit according to the Regulation of the Minister of Health of the Republic of Indonesia Number 1096 / MENKES / PER / VI / 2011.

From the results of the study Tables 14 and 15 showed that 25 samples of bulk meat meatballs and packaging that had been obtained in bulk meatballs that were 40% (6 out of 15 samples of bulk meatballs) were higher than packaged meatballs by 20% (2 out of 10 samples of packaged meatballs). The high number of bacteria in meat meatballs is not only influenced by the hygiene and sanitation conditions of traders and the surrounding environment.

Bas *et al*, (2006) state that contamination by *Escherichia coli* in food is mostly by hand as a result of poor handler hygiene as well as cross-contamination. This happens if food handlers do not wash their hands with soap before touching foodstuffs. *Escherichia coli* colonies on EMBA media can be seen in Figure 2**.**

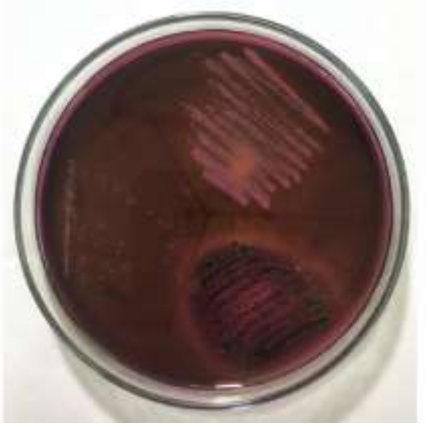

Figure 2. *Colony of Escherichia coli on EMBA media*

Table 13. Chi Square test of the relationship of hygiene and sanitation conditions to *Escherichia coli* contamination

Sanitary Hygiene Practices	***Escherichia coli***				**Total**		**A**	***p Value***
	Negative		**Positive**					
	Sum	%	Sum	%	N	%		
Good	10	40%	4	16%	14	56%	0.05	0.046
Bad	7	28%	4	16%	10	44%		
Total	17	68%	8	32%	25	100%		

Based on the Chi-Square test (Table 16) there is a real relationship between the sanitary hygiene of traders and the contamination of *Escherichia coli* in meat balls sold at the traditional market pd solar market in East Surabaya, Chi-Square test results, obtained *a p-value* of 0.046 ($p < 0.05$). This is because meatballs stored in containers or open places are easily contaminated with microbes from dust, air, or other materials.

According to Prabu (2009), storage locations that do not meet health requirements will facilitate contamination by microorganisms such as bacterium, fungi, viruses and parasites as well as chemicals that can pose a risk to health

It is likely that the increase in microbial contamination comes from microbial contamination during the meatball making process. The source of contaminants is likely from tools or ingredients added (tapioca, mangosteen peel flour, spices or other ingredients) in the processing process which can also come from less hygienic processing methods. Contamination can occur if the finished food produced is directly related to the surface of the table or food processing device during the preparation process that has previously been contaminated by pathogenic microbes (Indraningsih et al., 2010).

According to the Ministry of Health of the Republic of Indonesia No.942 / Menkes / SK / VII / 2003 concerning the requirements for Sanitary Hygiene of Snack Food where the raw materials used must be good quality raw materials, fresh and not spoiled. Meanwhile, all meat ball sellers sold at the PD traditional market in East Surabaya use fresh and non-rotten raw materials, so in this case meat ball sellers sold at the PD traditional market in the East Surabaya region meet health requirements.

This is in accordance with Setyorini (2013), that there is a relationship between the hygiene practices of traders and the existence of *Escherichia coli* in rojak sold around the Semarang State University campus. This result is based on the Fisher test, obtained a p-value of 0.021 ($p < 0.05$).

c. Isolation and Identification of Salmonella sp

The first stage for isolation and identification of *Salmonella* sp. is to carry out a search using *Buffered Pepton Water* (BPW) media then as much as 25gr of samples are smoothed and homogenized at 225ml BPW. After that it is incubated for 24 hours at a temperature of 37^{o}C. This stage is carried out to grow and multiply the growing bacteria. The ability of BPW media in enrichment that occurs during the incubation period at pH 7.2 provides an environment for *Salmonella* sp. to be able to grow well. The presence of bacterial growth in BPW is characterized by a cloudy BPW condition. Growth yield *Salmonella* sp.

Selenite Cystine Broth (SCB) media is a medium used at the *Selective Enrichment* stage. Each sample that has been homogenized and incubated as much as 500 µl of samples from BPW is put into *Selenite Cystine Broth* media and then incubated for 24 hours. This stage is used to multiply the growth of *Salmonella* and inhibit other bacteria from growing. The change in SCB to red due to the presence of acids formed due to the growth of bacteria. In accordance with Warsiki's statement (2016). the discoloration from yellow to oran ge showed positive results on SCB media. This change occurs because the SCB media contains sodium selenite inhibitors which are reduced to selenium and a reaction occurs with sulfur-containing amino acids so as to prevent the growth of other bacteria. Growth yield *Salmonella* sp.

Xylose Lysine Deoxycholate (XLD) media is a medium used for the growth of *Salmonella* sp. XLD media will show color changes that are easy to see visually. The color change that occurs in XLD media is from a transparent clear color (colorless) to a pink color (*fuschia*) at the observation time of the 24-72hour clock in this media *Salmonella sp.* will grow with red characteristics and the presence or absence of black spots in the middle. According to Samiea ea, al. (2019) this is because *Salmonella* sp. can ferment *xylose*, decarboxylate lysin and produce hydrogen sulfide from sodium thiosulfate. The fermentation results can change the pH of XLD media into bases so that it can change the color of the media to pink (pink) and red colonies with or the absence of a black dot in the middle (black *center)* produced from hydrogen sulfide.

IV. Conclusion

1. The total bacterial contamination rate in bulk meat balls is higher by 66.6% (10 out of 15) compared to packaged meatballs by 40% (4 out of 10) exceeding the maximum limit of BSN (2014) about the requirements for the Quality of Meat Balls is the maximum limit of total bacteria in meat meatballs is 1 x 10-5 colonies / gram, total Coliform in bulk meatballs that is 60% (9 of 15) higher than packaged meatballs by 40% (4 out of 10 samples), The contamination rate of Escherichia coli bulk meatballs by 40% (6 out of 15) is higher than that of packaged meatballs by 20% (2 out of 10) and the contamination rate of Salmonella sp. by 33% (5 out of 15) lower compared to packaged meatballs by 40% (4 out of 10).
2. There is a marked relationship between the sanitary hygiene conditions of traders and the level of bacterial contamination, contamination of Coliform, Escherichia coli and Salmonella sp. on bulk meatballs and packaged meat balls. The worse the trader's hygiene and sanitation, the higher the bacterial contamination, Coliform contamination, Escherichia coli and Salmonella sp

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