Evaluation of Coliform Bacterial Contamination in a Meat Grinding Machine at the Traditional Market Polewali Mandar

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ABSTRACT
Meat is one of the livestock commodities that has complete nutritional content, especially protein, where meat protein contains complete amino acids so it is needed by the body. Meat has enormous benefits but meat is also an excellent medium for bacterial growth if handled incorrectly. A meat grinder machine that is not clean can allow cross-contamination during the process of making ground meat. The purpose of this study was to detect coliform bacteria in a meat grinder machine at the Traditional Market of Polewali Mandar Regency. The study of coliform bacteria detection was carried out by planting a suspension of the test material on MacConkey selective media and then continued with identification tests using the sugar test, urea test, citrate test, indole test, and TSIA. The results of the study on 20 samples of leftover meat from a meat grinder machine obtained from the traditional markets of Pekkabata (Machines A and B) and Wonomulyo (Machines C and D), after planting on MacConkey differential media, all samples contained bacterial colony growth. From the results of the biochemical test, it was found that the bacteria were contaminated with *Proteus vulgaris*, *Proteus mirabilis*, and *Enterobacter agglomerans*. The results of the study concluded that there was coliform bacterial contamination in the meat grinding machine at the Traditional Market, Polewali Mandar Regency.

Keywords: *Coliform, meat, grinder machine*

1. INTRODUCTION

Meat is one of the livestock products that have complete nutritional content, especially protein, meat protein contains complete amino acids so it is needed by the body. Meat has enormous benefits but meat is also an excellent medium for bacterial growth if handled incorrectly.

Handling ground beef during cutting, thawing, mixing with leftover meat, grinding, and serving without packaging can result in microorganism contamination. The development of aerobic bacteria such as *Pseudomonas*, *Bacillus sp*, *Shigella*, and *Salmonella* bacteria will increase during the thawing and grinding process, this is because the meat will be in direct contact with the meat air.

The process of making ground beef in traditional markets that do not pay attention to the sanitation of the meat milling machine is very possible for cross-contamination of ground meat. Workers at meat milling service providers in traditional markets do not use special clothes when working, workers do not use gloves, there are no stages of machine cleaning after every meat milling process is complete and the area where the grinding process is not separated from the mixed traders in the market.

The application of sanitation in food processing is very important, the presence of bacterial contamination in foodstuffs such as coliform bacteria is an indicator in sanitation. Bacteria of the Enterobacteriaceae family are Coliform bacteria commonly found contaminating food and beverages, both cooked, frozen or uncooked, and

unfrozen. Several bacteria of the *Enterobacteriaceae* family are pathogenic, including of the genus *Enterobacter*, *Escherichia*, *Proteus*, *Salmonella*, *Shigella,* and *Klebsiella* [1], these bacteria can produce toxins that are harmful to the health of people who consume them. The traditional market is one of the places where meat is marketed which has a high risk of being contaminated with pathogenic bacteria due to poor environmental sanitation [2].

2. MATERIALS AND METHODS

2.1. Materials

The main ingredients used in this research are the remaining ground beef attached to the meat grinding machine at the traditional markets in Polewali Mandar, namely the Pekkabata market (machines A and B) and the Wonomulyo market (machines C and D).

2.2. Methods

Research is descriptive laboratory research. Detection of Coliform bacteria begins with taking a sample from a positive tube that forms gas from the MPN (Most Probable Number) test that has been done previously. The samples were then grown on Mac Conkey Agar media using the spread plate technique which was incubated at 37^{o}C for 24 hours. After obtaining several different types of colonies, then proceed with the purification of the isolates using the scratch plate technique. The sample plates were then incubated at 37^{o}C for 24 hours, after which biochemical tests were performed, namely motility test, indole, Methyl Red (MR), Voges-Proskauer (VP), Citrate, Triple Sugar Iron Agar (TSIA), and urease.

3. RESULTS AND DISCUSSIONS

The results of the study of Coliform detection on ground beef machines in the traditional market of Polewali Mandar Regency with samples of leftover meat from meat grinding machines obtained from Pekkabata traditional markets (A and B machines) and Wonomulyo traditional markets (C and D machines), respectively. each as many as 5 samples in each machine, after planting on MacConkey differential media, it was found that 20 samples contained bacterial colony growth. Bacterial colonies growing on differential media were red, rod-shaped, and medium-sized.

Colonies grown on MacConkey media were then subjected to biochemical tests to identify any Coliform bacteria that contaminated the samples. Biochemical tests were carried out for identification, among others, using the TSI, SIM, MRVP, Citrate, Urea, and sugar tests, with the results as shown in the following table.

Proteus sp belongs to the Enterobacteriaceae family, gram negative, has a straight rod-like shape that is chained and in pairs, not encapsulated does not have spores, lives facultatively anaerobically, and has peritrich flagella to be able to move actively. These bacteria have a size of 0.4 – 0.8 x 1.0 – 3.0 µm. *Proteus sp* is a bacterial pathogen that can cause urinary tract infections, gastrointestinal tract infections, and abscesses [3].

Proteus vulgaris and *Proteus mirabilis* are two common Proteus species associated with infection in humans and animals. These bacteria have fimbriae, which are certain chemicals found at the tip of the pili, the function of these fimbriae allows these bacteria to move from one place to another so that this becomes one of the virulence factors of the bacteria *Proteus vulgaris* and *Proteus mirabilis*. *Proteus mirabilis* and *Proteus vulgaris* bacteria live freely in rotting food, water, feces, and soil [4].

Enterobacter agglomerans is a gram-negative bacterium, does not have spores, and belongs to the Enterobacteriaceae family. These bacteria are often found in vegetable waste, foodstuffs, and water. These bacteria are pathogenic in animals and humans which can cause infectious diseases of bone or joint tissue and urinary tract infections [4]

Meat grinding machines in traditional markets look less clean. Where the beef to be ground is placed in an open space so that flies can easily land and transmit various bacteria. Many factors that support ground meat can be contaminated with bacteria, including through an unhygienic cutting process, the hands of mill workers, water used to clean meat or cutting tools that may have been contaminated, meat grinding machines that are not regularly cleaned and from the meat itself because of the habitat of these coliform bacteria is the intestines of animals. However, this ground meat can still be consumed safely, with proper handling, namely by maintaining hygiene when handling ground meat, such as always washing hands before and after touching the meat, and cooking it until it is thoroughly cooked evenly because bacteria can die by heating above temperature. 60 ^{o}C.

4. CONCLUSION

From the results of biochemical tests on ground beef samples taken from grinding machines in the two traditional markets, 20 samples were found to have bacterial contamination, namely samples A (1,3 and 4) contained *Proteus vulgaris* bacteria while samples A (2 and 5) contained *Enterobacter agglomeration* bacteria. In samples B (1,2,3 and 5) there were *Proteus vulgaris*

Table 1 Biochemical test results of meat samples from meat grinding machines in traditional markets

code	TSIA							SIM		MRVP		CIT	UR	Interpretation
	slant	butt	H_2S	gas	G	L	S	IND	MOT	MR	VP			
A1	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
A2	acid	acid	-	+	+	+	+	+	+	+	+	+	-	*Enterobacter agglomerans*
A3	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
A4	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
A5	acid	acid	-	+	+	+	+	+	+	+	+	+	-	*Enterobacter agglomerans*
B1	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
B2	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
B3	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
B4	acid	acid	-	+	+	+	+	+	+	+	+	+	-	*Enterobacter agglomerans*
B5	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
C1	acid	acid	-	+	+	+	+	+	+	+	+	+	-	*Enterobacter agglomerans*
C2	acid	acid	-	+	+	+	+	+	+	+	+	+	-	*Enterobacter agglomerans*
C3	acid	acid	-	+	+	+	+	+	+	+	+	+	-	*Enterobacter agglomerans*
C4	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
C5	acid	acid	+	-	+	+	+	-	+	+	+	+	+	*P. mirabilis*
D1	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
D2	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
D3	acid	acid	+	-	+	+	+	+	+	+	+	+	+	*P. vulgaris*
D4	acid	acid	+	-	+	+	+	-	+	+	+	+	+	*P. mirabilis*
D5	acid	acid	+	-	+	+	+	-	+	+	+	+	+	*P. mirabilis*

TSIA: Triple Sugar Iron Agar, SIM: Sulfur Indol Motilitas, MR : Methyl Red, VP : Voges Proskauer, CIT : Citrat, UR: Urea, G: Glukosa, L: Laktosa, M: Mannitol, S: Sukrosa, IND : Indol, MOT : Motility

bacteria while in samples B4 there were *Enterobacter agglomerans* bacteria, In samples C (1,2 and 3) there were *Enterobacter agglomerans* bacteria while in sample C4 there were *Proteus vulgaris* bacteria and C5 there were *Proteus mirabilis* bacteria. Sample D (1,2 and 3) contained *Proteus vulgaris* bacteria while samples D (4 and 5) contained *Proteus mirabilis* bacteria. The results of the study can be concluded that there is coliform bacterial contamination in the meat grinding machine at the Traditional Market of Polewali Mandar. Machine at the Traditional Market of Polewali Mandar Regency.

AUTHORS' CONTRIBUTIONS

N.S. conceived of the presented idea. N.S., D.U., S.P, and S.M. designed the method. N.S. and S.M. collecting data. S.P. verified the analytical methods. N.S. and S.M. investigate the laboratory test and D.U. supervised the findings of this work. N.S. and D.U. reviewed, revised the manuscript, edited the manuscripts and publications. All authors agreed on the final draft of the manuscript before submitted for publication.

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