Microbiological analysis of raw chicken meat sold at Maros traditional markets: Total Plate Count and *Escherichia coli*

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A Nurmasytha, F N Yuliati, Hajrawati and K I Prahesti

Faculty of Animal Science, Universitas Hasanuddin, Perintis Kemerdekaan km. 10, Makassar 90245

E-mail: faridanuryuliati@gmail.com

Abstract. This study aimed to determine the total bacteria number, total *Escherichia coli* bacteria, and the hygiene of chicken meat sold in traditional markets in Maros Regency. This research was conducted using a survey method. The questionnaire was used to determine hygiene. A total of 24 samples of chicken meat obtained from four traditional markets in Maros were examined using the pour plate method to enumerate *E. coli* and total plate count and then descriptively analyzed. The total bacteria in chicken meat in market A, B, C, and D was 3.6×10^5, 1.9×10^6, 2.5×10^5, 1.7×10^6 CFU/g, respectively. The enumeration of *E. coli* ranged between 1.6×10^3 and 3.0×10^4 CFU/g. The overall result indicated that all chicken meat samples did not meet the SNI-7388-2009 requirements for the maximum threshold for microbial contamination in food. Based on the questionnaire surveillance, the four markets were in poor sanitation and hygiene. This research revealed that the chicken sellers in traditional markets did not have sufficient knowledge about the importance of sanitation and hygiene concerning the food safety of the products.

1. Introduction

People generally buy raw chicken meat in traditional markets. The meat was sold on the open display table without a cover, nor cooling box. The sellers were poorly concerned about the hygiene aspects of the product. Several studies have shown that there was an increase in the number of bacteria in raw chicken meat from the slaughtering process to selling. The total bacteria number of chicken meat sold in Semarang was 1.2×10^8 CFU/g and the total bacteria number of chicken meat sold in Bogor traditional market was 8.1×10^6 CFU/g [1]. The high total number of microbes in traditional markets was caused by poor sanitation in handling chicken meat [2].

One common contaminant bacteria in raw chicken meat is *Escherichia coli*. This Gram-negative bacteria, in excessive numbers, may cause diarrhea, as well as infection when they spread to other systems or organs in the body. Common symptoms include stomach pain, vomiting, nausea, fever, loss of appetite, and dizziness. Hajrawati et al. [1] stated that the total *E. coli* in chicken meat sold in Bogor traditional markets was 2.9×10^2 CFU/g and exceeded the threshold required by the Indonesian National Standard, SNI-7388-2009, i.e., 1×10^1 CFU/g, so it can be concluded that it is not safe for consumption. This study was aimed to

determine the total bacteria, *E. coli,* and hygiene sales of chicken meat in the traditional markets of Maros Regency.

2. Methods

2.1. Sampling method

This study used a random sampling method with the formula according to Federer [3] to determine the experimental test sample, as follow:

$$(t-1)\,(n-1) \geq 15$$

t: number of experimental groups, n: number of samples per group

Raw chicken meat samples were taken from four different markets with six samples from each market. Using the formula above, a total sample size of 24 was obtained. The sample used in this study was raw broiler chicken breast meat taken from four traditional markets in Maros regency. Each sample was put into a sterile plastic bag, labeled, and transported in a cooling box to the laboratory for testing. The assessment for total bacteria, *E. coli* number, and pH values were carried out at the Veterinary Public Health Laboratory, Disease Investigation Center, Maros.

2.2. Total plate count and Escherichia coli enumeration

Total plate count (TPC) was used as a procedure for the enumeration of microorganisms that grow in an agar medium under particular conditions (time and temperature) [4]. The TPC and *E. coli* were enumerated by serial dilution and pour plate method. The plate count agar (PCA) media was used to enumerate the total bacteria number of the raw chicken meat samples while *Brilliance E. coli* (BEC) media was used for *E. coli* enumeration. The incubation was carried out at 37^{o}C for 24 hours.

For *E. coli* enumeration, the positive control was made by growing *E. coli* culture on BEC media, while negative control was made by pouring BEC media on Petri dishes without any bacteria culture. The *E. coli* was marked as a purple colony on BEC media. The formula used for enumeration of TPC and *E. coli* was as follow [5]:

$$\text{Bacteria number} = \text{colony number} \times \frac{1}{\text{dilution factor}}$$

3. Results and discussion

The results of the microbiological analysis were presented in table 1. The results showed that 50% of the chicken breast samples taken from 4 traditional markets met the SNI-7388-2009 standards. The rest, as much as 50% exceeded the required limit.

As a comparison, the results of the TPC study of chicken meat samples in Palopo City were 4.6×10^{6} [4]. The results of the research by Hajrawati et al. [1] revealed that the chicken meat from traditional markets in Bogor has a total plate count of 8.1×10^{6} CFU/g. In general, it is known that the high TPC is caused by not implementing good sanitation and hygiene.

Table 1. The TPC of raw chicken meat breast samples in Maros traditional market

Market	TPC (CFU/g)	SNI* (CFU/g)
A	3.6×10^5	1×10^6
B	1.9×10^6	
C	2.5×10^5	
D	1.7×10^6	

*SNI 7388:2009 the maximum threshold for microbial contamination in food.

Poor sanitation and hygiene provided opportunities for microbial contamination [6]. In Maros traditional market, raw chicken meat was sold in open display and flies swarmed around the meat. The chicken did not store in cold temperatures, thus increased bacterial contamination. Ulfah et al. [7] suggested that bacterial contamination could also occur during serving through flies when the meat was sold on an open table.

Table 2. The total *E. coli* of raw chicken breast meat samples in Maros traditional market

Market	Total *E. coli* (CFU/g)	SNI* (CFU/g)
A	1.7×10^4	1×10^1
B	1.8×10^3	
C	1.6×10^3	
D	3.0×10^4	

*SNI 7388:2009 the maximum threshold for microbial contamination in food

Table 2 presented the total *E. coli* number of raw chicken breast meat samples in Maros traditional market. The enumeration result showed that the *E. coli* number of samples from four markets exceeded the SNI standard. As a comparison, a study of the TPC value of raw chicken meat in Banda Aceh showed a result of 5.2×10^2 CFU/g [2]. Another study by Hajrawati et al. [1] stated that chicken meat samples obtained from traditional markets in Bogor had a total *E. coli* number of 2.9×10^2 CFU/g. These results indicated that the sanitation and hygiene of the raw chicken meat selling process in traditional markets were still poor.

The high level of *E. coli* contamination of raw chicken breast meat samples in Maros traditional markets was strongly affected by the street vendors condition and the opened sale displays, thus facilitated contamination from the air and dust. Selfiana et al. [2] suggested that the factors causing *E. coli* contamination in chicken meat on the market are through the media of dust, water, and air. In this study, we conducted simple questionnaire surveillance and the result showed that the raw chicken meat sellers did not have sufficient knowledge about the importance of sanitation and hygiene concerning the food safety of the products. It is crucial for the parties concerned to take part in improving the knowledge of sellers in traditional markets about good selling practices for raw meat products.

4. Conclusion

The TPC of raw chicken breast meat samples in four traditional markets in Maros ranged from 2.5×10^5 to 1.9×10^6 CFU/g. The enumeration of *E. coli* ranged between 1.6×10^3 and 3.0×10^4 CFU/g. The overall result indicated that all chicken meat samples did not meet the SNI-7388-2009 requirements for the maximum

threshold for microbial contamination in food. Poor sanitation and hygiene were the main causes of the chicken meat products.

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References
[1] Hajrawati M, Fadliah, Wahyuni I I and Arief 2016 Kualitas fisik, mikrobiologis, dan organoleptik daging ayam broiler pada pasar tradisional di Bogor *J. Ilmu Produksi dan Teknol. Has. Peternak.* **4** 386–9
[2] Selfiana D R, Rastina, Ismail C N, Thasmi, Darniati and Muttaqien 2017 Jumlah cemaran Escherichia coli pada daging ayam broiler di pasar Rukoh Banda Aceh *JIMVET* **1** 148–54
[3] Federer W 1963 *Experimental Design Theory and Application* (New York: Mac Millan)
[4] Haruni S, Malaka R and Ali H M 2019 Prevalence of microbial contamination and antibiotic residue in chicken meat, beef, and offal in South Sulawesi Hasanuddin *J. Anim. Sci.* **1** 1–11
[5] Fardiaz 2004 *Analisa Mikrobiologi Pangan* (Jakarta: PT. Raja Grafindo Persada)
[6] Sari A I, Mulyadi A and Afandi D 2015 Hubungan higiene dan sanitasi pedagang dengan kontaminasi salmonella pada daging ayam potong di pasar tradisional Pekanbaru *J. Ilmu Lingkung.* **9** 173–82
[7] Ulfah N F, Erina and Darniati 2017 Isolasi dan identifikasi escherichia coli pada ayam panggang di beberapa rumah makan di kecamatan syiah kuala kota banda aceh *JIMVET* **1** 383–90