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The Quality of Broiler Chicken Meat Sold in Traditional Market of Jember Regency: *Escherichia coli* Bacteria Contamination Rate, TPC Test, Water Content, and pH Value

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INFO ARTICLE

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ABSTRACT

Tujuan dari penelitian ini adalah untuk menilai kesesuaian dari daging ayam broiler yang dijual di pasar tradisional Kabupaten Jember dengan syarat tingkat Standar Nasional Indonesia (SNI) untuk Kontaminasi *Escherichia coli*. Sebanyak enam belas sampel daging ayam broiler yang dipilih secara acak (*random sampling*) dari delapan pasar tradisional yang berada di Kabupaten Jember. Bakteri *Escherichia coli* diperiksa dengan menginokulasi bakteri pada media L-EMBA dan kemudian dilakukan pemeriksaan secara mikroskopis. Parameter penelitian ini antara lain yaitu uji kandungan bakteri *Escherichia coli*, Uji *total plate count* (TPC), kadar air, dan nilai pH daging ayam broiler. Uji binomial dan analisis deskriptif digunakan dalam analisis data penelitian ini. Enam belas sampel daging ayam broiler dari pasar tradisional di Kabupaten Jember yang menjadi sasaran tes binomial, dan tidak ada temuan mengenai keberadaan bakteri *Escherichia coli*. Namun demikian, temuan nilai TPC dari enam belas sampel daging ayam broiler mengungkapkan bahwa semuanya di atas $1x10^6$ cfu/ml berdasarkan persyaratan SNI. Kandungan air daging ayam broiler rata-rata sebesar 75,07% dan rata-rata pH 6 yang menyebabkan daging menjadi lingkungan yang ideal untuk perkembangan mikroba. Berdasarkan penelitian yang telah dilakukan, maka dapat disimpulkan bahwa daging ayam broiler di Kabupaten Jember bebas dari kontaminasi bakteri *Escherichia coli*, namun jumlah nilai TPC masih di atas standar.

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ABSTRACT

The goal of this study was to assess whether the broiler chicken meat sold in Jember Regency's traditional markets complied with the Indonesian National Standard's (SNI) level for Escherichia coli contamination. Sixteen samples of broiler chicken meat were randomly selected (random sampling) from eight traditional markets that met the Jember Regency's requirements for traditional markets. Escherichia coli was examined by inoculating the bacteria on L-EMBA media and then performing a microscopic examination. The parameters of this study were the Escherichia coli bacteria content test, the TPC test, the water content, and the pH value of broiler chicken meat. The binomial test and descriptive analysis were utilized in this study's data analysis. Sixteen samples of broiler chicken meat from traditional markets in the Jember Regency were subjected to binomial tests, and none of the findings revealed the presence of the bacteria Escherichia coli. However, the TPC findings from 16 samples of broiler chicken meat revealed that every one of them above the $1x10^6$ cfu/ml according to SNI requirements. With an average water content of 75.07% and an average pH of 6, broiler chicken meat is an ideal environment for microbial development. Based on the research that has been carried out, it can be concluded that broiler chicken meat in Jember Regency is free from contamination of Escherichia coli bacteria, but the number of TPC is still above the standard.

INTRODUCTION

The increasing population growth is followed by an increase in the number of animal protein needs (Kusuma *et al*., 2021). In addition, awareness of the importance of animal protein and the increasing welfare of people's lives demands an increase in the quality of animal products. Broiler chicken meat is an animal product that is popular in public. People are more likely to buy broiler meat in traditional markets because the price of broiler chicken meat is relatively cheaper than the price of broiler meat sold in modern markets (Kusuma *et al*., 2021).

Broiler chicken meat sold in traditional markets is usually taken from the Chicken Slaughterhouse (RPA) or at each trader's home. The process of microbial contamination of broiler meat has occurred from the time broiler meat is at the slaughter site to distribution to the point of sale. Contamination that occurs in the cutting process comes from the blood that comes out of the process, or the tools used in the cutting process are not sterile, and the water used is polluted by bacteria (Soeparno, 2015).

One of the safety parameters of animal products is reviewed from the contamination of *Escherichia coli* bacteria. These bacteria can cause thypoid. The maximum limit of microbial contamination (BMCM) in food according to SNI 01-3924-2009, states that the maximum limit of contamination of *Escherichia coli* bacteria in fresh chicken meat is less than 1×10^1cfu/ml (BSN, 2009). Pathogenic *E. coli* contamination can cause foodborne disease. Common symptoms of *E. coli* infection include bloody diarrhea, vomiting, abdominal pain, and stomach cramps. (Septiani *et al*., 2020). While broiler meat from traditional markets has a TPC value that is higher than the maximum requirement set by SNI, meat from modern markets has a TPC value that is following SNI (3924: 2009) (Subagja *et al*., 2022). Based on the description above, monitoring microbial contamination in foodstuffs of animal origin such as chicken meat is very important, because

it is closely related to guaranteeing health protection and consumer safety. Research related to the contamination of *Escherichia coli* bacteria in broiler chicken meat in traditional markets in Jember Regency is still very limited. Therefore, it is necessary to conduct research to identify the level of contamination of *Escherichia coli* bacteria in broiler meat in traditional markets in Jember Regency.

METHOD

This research was non-experimental research (descriptive research) with a survey method. A total of 16 broiler chicken meat samples (two samples from market) were taken randomly (Random Sampling) from 8 traditional markets (Bangsal Sari, Rambi Puji, Tanjung, Gebang, Balung Jenggawah, Sempolan, and Kreongan) that are included in the predetermined traditional market criteria (*Purposive Sampling*) in Jember Regency. Each broiler meat sample that has been taken is then tested on the amount of *Escherichia coli* with the saucer count *method* using the media *Levine Eosin Methylen Blue Agar* (*L-EMBA)* and compared with the Maximum Limit of Microbial Contamination (BMCM) which has been set in SNI Number 3924 of 2009. (Normaliska *et al*., 2019). Identification *Escherichia coli* test conducted at the Laboratory of the Faculty of Microbiology and Natural Sciences, Universitas Jember. Additionally, tests for the physical and microscopic quality of broiler chicken meat, such as pH tests, water content, and Total Plate Count (TPC), were conducted (Subagja *et al*., 2022). Data on the test results in the laboratory related to the *Escherichia coli* contamination test on broiler meat samples in the traditional market of Jember Regency, then tabulated and analyzed using a binomial test (Edwin *et al*., 2016).

RESULTS AND DISCUSSION

Test of *Escherichia coli* on Broiler Chicken Meat

The results of the study obtained from testing the contamination of *Escherichia coli* bacteria on chicken meat in the traditional market of Jember Regency conducted at the Laboratory of the Faculty of Microbiology and Natural Sciences, Universitas Jember. There was no *Escherichia coli* colony appearance on sample from P1 to P16.

The results obtained from macroscopic observations on L-EMBA media that have been tested for *Escherichia coli* showed negative results, because in L-EMBA media there were no metallic green colonies. The color on the L-EMBA media after testing *Escherichia coli* did not change color or was still purplish red.

Based on the test of 16 broiler chicken meat samples, it shows that broiler meat sold in the traditional market of Jember Regency is entirely without bacterial contamination or negative *Escherichia coli* bacteria.

Table 1. Percentage of *Escherichia coli* Bacteria Identification Results in Broiler Chicken Meat Sold in Traditional Markets in Jember Regency

Sample code	Market	Identification Results
P1	Bangsal Sari	Negative
P2	Bangsal Sari	Negative
P3	Rambi Puji	Negative
P4	Rambi Puji	Negative
P5	Tanjung	Negative
P6	Tanjung	Negative
P7	Gebang	Negative
P8	Gebang	Negative
P9	Balung	Negative
P10	Balung	Negative
P11	Jenggawah	Negative
P12	Jenggawah	Negative
P13	Sempolan	Negative
P14	Sempolan	Negative
P15	Kreongan	Negative
P16	Kreongan	Negative

Escherichia coli bacteria that can contaminate chicken meat generally come from the chicken slaughterhouse (RPA), equipment that is in direct contact with the meat, the chicken slaughter table, and the water used for washing carcasses at the time after slaughter can cause bacterial contamination of the meat (Bahri *et al*., 2019). Furthermore, broiler chicken meat in the mostly traditional market in Jember Regency is from the chicken slaughterhouse (RPA).

Escherichia coli bacteria are classified as mesophile bacteria that have an optimal growth temperature of 15 to 45℃, with a minimum growth temperature of 10 to 20℃, and a maximum temperature of 40 to 45℃, and these bacteria can live at a pH of 5.5 to 8 (Lubis *et al*., 2012). One of the meat cutting processes in RPA is the *process of scalding* using hot water with a temperature of about 59 to 60℃ for approximately 30 seconds. *Escherichia coli* bacteria are likely to die after *scalding* in RPA. This statement is supported by (Lubis *et al*., 2012) those who state that *Escherichia coli* bacteria have a maximum growth temperature of 50℃, if the temperature is above 50℃ then *Escherichia coli* bacteria die (inactivate). Heating at 70 degrees C for 3.5 seconds is effective for *E. coli* decontamination (Saimah *et al*., 2016).

Test of Total Number of Microbes (TPC) on Broiler Chicken Meat

Based on the test results of 16 broiler meat samples that have been carried out related to testing total bacteria using the *Total Plate Count* (TPC) method on broiler meat sold in the traditional market of Jember Regency, the results listed in Table 2 were obtained.

Table 2. The Amount of Microbial Contamination (TPC) In Broiler Chicken Meat Sold in Traditional Markets in Jember Regency

Sample Code	Traditional Market	TPC (cfu/ml)
P1	Bangsal Sari	7.50×10^6
P2	Bangsal Sari	3.00×10^6
P3	Rambi Puji	4.50×10^7
P4	Rambi Puji	1.50×10^7
P5	Tanjung	1.55×10^6
P6	Tanjung	2.13×10^7
P7	Gebang	9.50×10^6
P8	Gebang	1.36×10^6
P9	Balung	1.30×10^6
P10	Balung	1.02×10^6
P11	Jenggawah	6.65×10^6
P12	Jenggawah	1.30×10^7
P13	Sempolan	4.50×10^6
P14	Sempolan	1.37×10^8
P15	Kreongan	5.70×10^7
P16	Kreongan	1.28×10^8

Based on the data above, the total number of bacteria (TPC) in broiler meat sold in the traditional market of Jember Regency does not match or exceed SNI (2009) regarding the limit of microbody contamination of fresh broiler meat. The maximum limit of microbial contamination in broiler meat is $1x10^6$ cfu / g. Broiler meat sample data that has been taken from several markets for TPC testing can be seen that broiler meat taken from the sempolan market with sample code (P16) has the highest TPC value, while broiler meat taken from the balung market with sample code (P12) has the lowest TPC value when compared to several other markets (BSN, 2009).

The high value of TPC in the sample (P16) is due to dirty, muddy, dusty market conditions, the base was not clean and open without packaging and was not equipped with a cooling device. The condition of the stalls on the P13 sample in Sempolan Market, Jember Regency is adjacent to vegetable sellers, household appliance sellers and fish sellers. It can also lead to cross-contamination of broiler meat. In addition, the high value of TPC is also influenced by the time of the cutting process, transportation to sales in the market which is more than 4 hours. According to fresh carcass, it is carcass that is obtained no more than 4 hours after the cutting process and does not undergo further treatment (BSN, 2009).

The place of sale of meat prepared by traders that is not closed and not stored in cold temperatures can result in faster breeding of bacteria. The source of bacterial contamination occurs during marketing, in general chicken meat sold in traditional markets is still lacking in terms of cleanliness and does not have proper storage facilities, for example meat is exposed on a dirty base without a lid and stored only at room temperature which is 25 to 40℃ so that bacteria will develop faster (Bahri *et al*., 2019).

Water Content of Broiler Chicken Meat

Factors that can affect the growth of microorganisms in chicken meat, including temperature, water availability, and humidity during storage as well as during the distribution, handling, pH, and length of time after cutting (Saimah *et al*., 2016). The water content and pH value of broiler meat are shown in Table 3.

Table 3. Water Content and pH Value of Broiler Chicken Meat in Traditional Markets in Jember

Sample Code	Water Content (%) M	pH value
P1	74,75	6
P2	75,86	6
P3	73,89	6
P4	75,97	6
P5	74,67	6
P6	74,9	6
P7	76,57	6
P8	75,81	6
P9	74,53	6
P10	75,03	6
P11	77,34	6
P12	75,17	6
P13	73,81	6
P14	74,39	6
P15	72,49	6
P16	75,95	6
Average	75,07	6

The increased water content is influenced by the amount of free water formed as a by-product of microbial activity. When microbes reach a constant growth phase, small molecular compounds containing water will be produced. The longer the chicken meat is stored, the food substances contained in the meat will decompose, especially bound water released out, causing an increase in free water. The meat that is stored for too long will cause the release of bound water into free water. Thus, the longer chicken meat is stored, the higher the water content (Wala *et al*., 2016).

The pH Value of Broiler Chicken Meat

Another factor that supports the high content of TPC in broiler meat sold in the traditional market of Jember Regency is the pH value of meat. The pH value obtained from 16 broiler meat samples sold in the traditional market of Jember Regency resulted in an average pH value of 6. Because litmus paper is used to conduct the pH test, the findings of the pH value are comparable. A pH value that is still in the range between 6 to 6.5 can result in faster growth and breeding of pathogenic microorganisms in broiler meat. The bacterial population is rapidly doubling every 30 minutes at a temperature of 25℃ and the pH value ranges from 6.0 to 6.5. A supporting factor apart from the content of water content and pH value that can affect the high contamination of microbes in broiler meat is the length of time sold. The length of time sold is the time span between after the cutting process and the time the meat is sold. The longer the time for the sale

of meat, the higher the possibility of microbial contamination in the meat (Bahri *et al*., 2019).

It is likely that the largest (dominant) bacterial content is suspected to be *Salmonella sp* bacteria from total microbial contamination (TPC) in broiler meat sold in the traditional market of Jember Regency. Other bacteria such as *Salmonella sp*. contamination in meat can come from livestock, transportation, RPA and markets or marketplaces, this is because *Salmonella sp* bacteria often settle in environments such as soil, water, and insects. The traditional market conditions that have been observed mostly have dirty, muddy, and smelly places that result in the large number of flies or other insects in the market environment, making it easier for cross-contamination to occur. Cross-contamination can also lead to an increase in the number of microbes in broiler meat sold in traditional markets. The places of sale of meat that are not closed and not stored in cold temperatures can result in the rapid proliferation of bacteria (Bahri *et al*., 2019).

Bacterial pollution in meat generally occurs in the cutting process, especially during the production of offal (*evisceration*). Bacterial contamination is suspected that it occurs during the offal removal process (*evisceration*), after the hot water dyeing process (*scalding*). In general, bacteria will die during the *scalding* process, because they use hot water with a temperature of 59 ^{o}C to 60^{o}C for approximately 30 seconds. In contrast to *Salmonella* bacteria which may not die during the *scalding* process because these bacteria are in the intestinal tract (inner organs), so that during the *evisceration* process it is suspected that it can contaminate the meat.

CONCLUSIONS AND SUGGESTIONS

Based on the research that has been carried out, it can be concluded that broiler chicken meat in Jember Regency is free from contamination of *Escherichia coli* bacteria, but the number of TPC is still above the standard. The suggestion from this research is that regular supervision and guidance are needed to improve the quality of broiler chicken meat in traditional markets in Jember Regency by relevant agencies.

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CONTRIBUTION STATEMENT

In this article, Dharwin Siswantoro acts as the main contributor, while Imam Busthomi, Ujang Suryadi, and Agus Hadi Prayitno acts as a member contributor, Satria Budi Kusuma act as a member and correspondence contributor.

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