

Cemaran Residu Antibiotik, *Salmonella*, Formalin, serta Nilai pH Daging Ayam Broiler di Pasar Tradisional dan Swalayan Kota Surakarta

Antibiotic Residue, *Salmonella*, Formalin Contamination and pH Value of Broiler Chicken Meat in Traditional Markets and Supermarkets in Surakarta City

Wari Pawestri ^{1*}, Ari Kusuma Wati ¹, Muhammad Cahyadi ¹, Yuli Yanti ¹, Joko Riyanto ¹, M. Risqi Novianto ²

¹Departement of Animal Science, Faculty of Animal Science, Universitas Sebelas Maret
Ir. Sutami St No.36, Ketingan. Jebres, Surakarta, Central Java

²Student Faculty of Animal Science, Universitas Sebelas Maret

* Corresponding Author: wari.pawestri@staff.uns.ac.id

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Abstrak: Penelitian bertujuan untuk mengetahui cemaran residu antibiotik, *Salmonella*, formalin, serta mengetahui nilai pH pada daging ayam broiler di pasar tradisional dan pasar swalayan Kota Surakarta. Sampel yang digunakan sebanyak 30 sampel daging ayam broiler bagian paha yang diperoleh dari pasar tradisional dan pasar swalayan di Kota Surakarta. Pengujian sampel dilakukan di Laboratorium Produksi Ternak, Fakultas Peternakan, Universitas Sebelas Maret dan di Balai Besar Veteriner (BBVet) Wates Yogyakarta. Hasil penelitian menunjukkan bahwa terdapat residu antibiotik golongan penisilin pada 13,33% sampel yang berasal dari swalayan. Selain itu, residu antibiotik golongan makrolida juga ditemukan pada 26,67% sampel dari pasar tradisional dan 66,67% sampel dari pasar swalayan. Cemaran *Salmonella* ditemukan pada 6,67% sampel dari pasar tradisional. Hasil uji formalin menunjukkan bahwa semua sampel daging negatif mengandung formalin. Nilai pH sampel daging pada penelitian ini adalah normal, yaitu $5,73 \pm 0,46$ untuk sampel dari pasar tradisional dan $5,73 \pm 0,59$ untuk sampel dari swalayan. Kesimpulan dari penelitian ini adalah terdapat residu antibiotik golongan penisilin pada daging ayam broiler dari pasar swalayan, dan golongan makrolida pada daging ayam broiler di kedua jenis pasar. Cemaran *Salmonella* ditemukan pada daging ayam broiler di pasar tradisional, namun tidak ditemukan adanya cemaran formalin. Nilai pH daging ayam broiler di pasar tradisional dan swalayan di Kota Surakarta tergolong normal.

Keywords: formalin, pasar, pH, residu antibiotik, *Salmonella*

Abstract: This research aimed to determine the contamination of antibiotic residues, *Salmonella*, formalin, and the pH value in broiler in traditional and supermarkets in Surakarta City. The samples used were 30 samples of broiler thigh parts obtained from traditional and supermarkets in Surakarta City. Sample testing was conducted at the Animal Production Laboratory, Universitas Sebelas Maret and at the Balai Besar Veteriner (BBVet) Wates Yogyakarta. The results showed that there were penicillin group antibiotic residues in 13.33% of samples from supermarkets. Macrolide antibiotic residues were also found in 26.67% of samples from traditional markets and 66.67% of samples from supermarkets. *Salmonella* contamination was found in 6.67% of samples from traditional markets. The formalin test results showed that all meat samples were negative from formalin. The pH value of meat samples in this study was normal, namely 5.73 ± 0.46 for traditional market samples and 5.73 ± 0.59 for samples from supermarkets. The conclusion of this study is that there are penicillin group antibiotic residues in broiler chicken meat in supermarkets, and macrolide group in broiler chicken meat in both types of markets. *Salmonella* contamination was found in broiler meat from traditional markets, but formalin contamination was not found. The pH value of broiler meat in traditional markets and supermarkets in Surakarta City was normal.

Keywords: antibiotic residue, formalin, markets, pH, *Salmonella*

1. Introduction

Broiler chickens are one of the sources of meat-producing animal food that has advantages. The advantage of broiler chickens is that they have very fast growth with a high increase in body weight in a relatively short time [1]. Broiler chicken meat has a protein content of 18.20% per 100 grams of chicken meat [2]. This high nutritional content is very good for consumption by the public. The average weekly consumption of chicken meat per capita in Indonesia in 2023 was 0.158 kg/capita/week. This number has increased from 2022 which amounted to 0.153 kg/capita/week and in 2021 amounted to 0.142 kg/capita/week [3].

Surakarta City is one of the cities where there are many broiler meat sellers that are able to provide meat needs for the public. The average broiler meat consumption in Surakarta City was recorded at 0.155 kg/capita/week [4]. People generally get broiler meat from traditional markets and supermarkets in Surakarta City. Public consumption of this meat must be balanced with improvements in the quality of broiler chicken meat, both in terms of food safety and health.

Meat quality can be determined physically, microbiologically, and chemically. One of the parameters included in the physical properties of meat is the pH value. [5] stated that the normal pH of broiler meat is in the range of 5.70-5.90. A pH value that is higher or lower than normal will cause a decrease in meat quality. In addition, high nutritional content is the cause of meat easily contaminated with microbes which is also a factor in reducing meat quality. Microbes or bacteria that are often found in meat are *Salmonella* spp. and *Escherichia coli*. In addition, the decline in meat quality can also be caused by physical contact and chemicals [6]. The chemical that is often used by unscrupulous people on meat is formalin. Formalin is a compound that is harmful to the human body and can cause cancer [7]. Another chemical found in chicken meat is antibiotic residue. Cases of antibiotic residues have been reported in several regions in Indonesia. [8] reported that residues of penicillin, tetracycline, aminoglycoside, and macrolide antibiotics were found in Bali, Nusa Tenggara Barat (NTB), and Nusa Tenggara Timur (NTT) at 0.3% - 9.15%.

Until now, there is still little information about the quality of meat in traditional markets and supermarkets in Surakarta City. Therefore, many people do not know the quality of the meat they consume. This is the background of this research. This study aims to determine the contamination of antibiotic residues, *Salmonella*, formalin, and pH values in broiler chicken meat in traditional markets and supermarkets in Surakarta City.

2. Materials and Method

2.1. Materials

The tools used in sampling were knife, cutting board, camera, cool box, and pH meter (MQuant, pH 0-14). The materials used in this research were 30 broiler chicken thighs (15 from traditional markets and 15 from supermarkets). The samples we taken from 9 traditional markets and 11 supermarkets across five districts in Surakarta City. The number of samples taken in each sub-district was proportional.

2.2. Method

2.2.1. Pre-survey

The pre-survey stage was conducted to find out traditional markets and supermarkets in Surakarta City that sell broiler meat. This is done to determine whether there are broiler meat sellers in each market. At this stage, the number of traders in each market is also calculated which will be used as the basis for determining the number of samples.

2.2.2. Sampling of broiler chicken meat

The method used for determining and collecting samples is stratified sampling. Sampling activities began with an interview with the seller to fill in the identity. Each chicken thigh meat sample was labeled with the seller's name and market origin. Meat samples were stored in a cool box with ice packs to maintain the meat temperature between 0-4°C. Samples were transported to the laboratory. Samples arrived at the Animal Production Laboratory, Faculty of Animal Science within a maximum of one hour, while samples sent to Balai Besar Veteriner (BBVet) Wates, Yogyakarta arrived within a maximum of four hours after sampling. Next, the chicken meat samples were examined in the laboratory.

2.2.3. Laboratory examination

The pH value examination was conducted at the Animal Production Laboratory, Faculty of Animal Husbandry, Universitas Sebelas Maret, Surakarta. The PH test was conducted by weighing 10g meat sample. The meat sample was mashed and 10 ml of distilled water was added, then homogenized. The pH meter was then inserted into the mashed meat mixture. The measurement was repeated three times and then averaged. Antibiotic residue, *Salmonella*, and formalin tests were conducted at the BBVet Wates Yogyakarta. The examination of antibiotic residue refers to Standar Nasional Indonesia (SNI) 7424-2008. Microbial contamination testing methods are based on SNI 2897-2008 and examination of microbial contamination refers to the SNI 3924-2009.

2.3. Data analysis

The data obtained was analyzed descriptively. Descriptive analysis aims to measure and describe/explain the data obtained through the collection of facts thoroughly and thoroughly in accordance with the problem to be solved. Descriptive analysis relates to providing data information or describing data or circumstances [9].

2.4. Ethical Approval

This research was approved by the Experimental Animal Research Ethics Committee of Universitas Sebelas Maret with Number 175/UN27.14.1/PT/2023.

3. Result and Discussions

3.1. Presence of antibiotic residues

The results in Table 1 show that antibiotic residues were found in broiler meat samples from both traditional markets and supermarkets. The antibiotic was penicillin group which was present in 13.33% of broiler meat samples from supermarkets. In addition, macrolide antibiotic residues were also found in 26.67% of samples from traditional markets and 66.67% of samples from supermarkets. Samples that are positive for antibiotic residues are characterized by the presence of an inhibition zone in the sample. SNI 01-6366-2000 sets the limit that the inhibition zone of antibiotic residues is <13 mm, so if it exceeds this limit then the meat is positive for antibiotic residues. No aminoglycoside and tetracycline antibiotic residues were found in the samples used in this research. Research conducted [10] also found that no tetracycline antibiotic residues were found in broiler meat because farmers already understood the use of antibiotics at the right dose and in accordance with the withdrawal time.

Table 1. The presence of antibiotic residues of broiler chicken meat in traditional markets and supermarkets in Surakarta City

Antibiotics	Traditional markets (%) n=15	Supermarkets (%) n=15
Penicilin	0	13.33
Aminoglycosides	0	0
Macrolides	26.67	66.67
Tetracycline	0	0

n shows the number of samples

The use of antibiotics by farmers generally aimed to prevent disease and maintain poultry health. The use of antibiotics must be at an appropriate dose for poultry because according to Peraturan Menteri Pertanian Republik Indonesia No. 14 Tahun 2017 classifies that some antibiotics such as penicillins, aminoglycosides, macrolides, and tetracyclines are included in the category of hard drugs. However, there are still few farmers who pay attention to the dosage of antibiotics so that many

antibiotic residues are found in poultry meat after slaughter [11]. In addition, antibiotic residues can also be caused by inappropriate application of antibiotic withdrawal time. [12] stated that inappropriate antibiotic withdrawal time, especially for chickens that are ready to be harvested and slaughtered, can allow the chicken meat to contain antibiotic residues. This is supported by the statement of [13] that the application of antibiotic downtime aims to eliminate drugs and their residues from the animal's body according to the type of drug used based on the required period, and if it is not appropriate it will cause losses.

The type of antibiotic most commonly found in the samples of this research is the markolide group. Research conducted by [14] also found that there were antibiotic residues in broiler meat in the traditional market of Kendari City. Macrolide antibiotics are generally used to inhibit gram-positive bacteria such as *Staphylococcus* bacteria and gram-negative bacteria such as *Escherichia coli* with a withdrawal time of about 4 days. Macrolide antibiotics are given to chickens for the treatment of respiratory diseases which are generally added to drinking water [14].

Penicillin is an antibiotic used to treat gram-positive and gram-negative bacterial infections, this type of antibiotic kills the bacteria that cause infection or stops bacterial growth, the withdrawal time of penicillin is 5-7 days after it was given [15]. Just like other antibiotics, tetracycline is an antibiotic that is useful for inhibiting bacteria, both gram negative and grampositive bacteria. Tetracycline antibiotics have a withdrawal time of about 5 days [16]. Aminoglycoside antibiotics are generally used to kill bacteria with an inhibitory mechanism in the protein synthesis process [17].

3.2. Salmonella contamination

Salmonella is a type of gram-negative bacteria, rod-shaped, non-spore, non-capsular, active with peritrichic flagella, and is facultatively anaerobic [18]. *Salmonella* bacterial infection is still a big problem in the field of food safety [19], because there are still few people who pay attention to the cleanliness and hygiene of the food they consume. *Salmonella* infection in animals and humans can cause typhoid, paratyphoid and salmonellosis. Salmonellosis can disrupt the gastrointestinal tract and many of them can cause death [20].

The research that has been done found that there is *Salmonella* bacterial contamination (6.67%) in broiler meat samples from one of the traditional markets in Surakarta City. Research conducted by [21] also found *Salmonella* (12.5%) contamination in broiler chicken meat sold in several traditional markets in Makassar City. The presence of bacterial

contamination in these samples is not in accordance with SNI 3924:2009 that fresh cut meat must be negative or must not contain *Salmonella* bacteria. *Salmonella* was not found in broiler meat samples from supermarkets. Data on *Salmonella* contamination in broiler meat samples from both types of markets are presented in Table 2.

Table 2. *Salmonella* contamination of broiler chicken meat in traditional markets and supermarkets in Surakarta City

Markets	Number of samples	<i>Salmonella</i> test results	
		Negative (%)	Positive (%)
Traditional markets	15	93.33	6.67
Supermarkets	15	100	0

Salmonella contamination in broiler meat in traditional markets can occur because traders pay less attention to hygiene during the slaughtering process. [22] stated that *Salmonella* contamination in chicken slaughterhouses is higher in incidence followed by bacterial contamination of slaughter equipment such as knives and other equipment. In addition, the open and unclean condition of the market is also a contributing factor to bacterial contamination. Meat sales in supermarkets are better than traditional markets. Meat served in supermarkets is generally in a closed state using packaging or showcases and is served by paying attention to the temperature of the carcass display rack (temperature 0-5°C) [23].

3.3. Formalin contamination

Formalin (CH₂O) is a chemical compound consisting of hydrogen, oxygen, and carbon [24]. Formalin is also known as formaldehyde, methanal, methylene oxide, oxymethylene, methyl aldehyde, oxomethane, and formic aldehyde. Formalin is generally used as a preservative for corpses and organs of living things, pest killers, disinfectants in the plastic and foam industries, and for room sterilization [25]. In addition, [26] added that formalin is generally used as a pest repellent to kill viruses, bacteria, fungi, and parasites that are effective at high concentrations.

Table 3. Formalin test results of broiler chicken meat in traditional markets and supermarkets Surakarta in City

Markets	Number of samples	Formalin test results	
		Negative (%)	Positive (%)
Traditional markets	15	100	0
Supermarkets	15	100	0

The results in Table 3 show that no formaldehyde contamination was found in broiler

chicken meat in traditional markets or supermarkets in Surakarta City. Research conducted by [27] also found that no formaldehyde contamination was found in chicken meat in Makassar City. Formalin is usually used as a meat preservative by irresponsible people. [28] stated that the characteristics of chicken meat containing formalin are that it has a striking odor and is not inhabited by flies. If the formalin level is high, the texture of the chicken is slightly tense or stiff. Furthermore, when chicken meat is put into a reagent or laboratory test, gas bubbles will appear.

The use of formalin in food has an impact on the onset of poisoning in the human body, the effects of which are acute abdominal pain and vomiting, depression of the nervous system or circulatory failure and can cause cancer in humans [29] Misuse of formaldehyde may be subject to administrative sanctions and punitive sanctions in accordance with the Undang-Undang No. 8 Tahun 1999 about Consumer Protection.

3.4. The pH value

The research that has been conducted found that the average pH level of broiler meat in traditional markets in Surakarta City is 5.73 ± 0.46 . This value is not much different from the average pH level of broiler chicken in Surakarta City supermarkets which amounted to 5.73 ± 0.59 . Both results of pH levels are in the normal range in line with the statement of [5] that the normal pH of broiler meat is 5.70-5.90. [30] also added that the ultimate/maximal pH of broiler meat is 5.70-6.00. These results indicate that broiler meat in traditional markets and supermarkets in Surakarta City is classified as good in terms of pH values.

The pH value or degree of acidity can determine the quality of a food product (including meat). This is because pH is a benchmark for inhibiting the presence of biological contaminants such as bacteria, fungi, and other microorganisms that can cause damage to the physical or nutritional properties contained in food products. A pH value that is higher or lower than the normal range will reduce the physical quality of the meat. [31] stated that meat with a final pH that is too high will produce meat with Dark Firm and Dry (DFD) quality, while meat with a final pH that is too low will produce meat with Pale Soft and Exudative (PSE) quality because protein denaturation will occur. [6] states that factors that can affect the rate and magnitude of meat pH reduction are divided into two, namely intrinsic factors consisting of species, muscle type, muscle glycogen, and variability among livestock. While the second factor is extrinsic factors including environmental temperature, cutting treatment, cutting process and stress before cutting.

4. Conclusion

The conclusion of this study is that there are penicillin group antibiotic residues in broiler chicken meat in supermarkets, and macrolide group in broiler chicken meat in both types of markets. *Salmonella* contamination was found in broiler meat from traditional markets, but formalin contamination was not found in both types of markets. The pH value of broiler meat in traditional markets and supermarkets in Surakarta City was normal.

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