

Survey of Oxytetracycline Residue Content in Broiler Chicken Meat in Semarang City, Central Java Province, Indonesia

Dwi Sutningsih^{1,2,*}, Eka Faizah¹, Nur Azizah Azzahra²

¹Department of Epidemiology and Tropical Disease, Faculty of Public Health, Diponegoro University, Jl. Prof. Soedarto, S.H., Tembalang, Semarang, Central Java, Indonesia

²Postgraduate School, Diponegoro University, Jl. Imam Bardjo S.H., No.5 Semarang, Central Java, Indonesia

Received December 28, 2022; Revised March 17, 2023; Accepted April 7, 2023

Cite This Paper in the Following Citation Styles

(a): [1] Dwi Sutningsih, Eka Faizah, Nur Azizah Azzahra, "Survey of Oxytetracycline Residue Content in Broiler Chicken Meat in Semarang City, Central Java Province, Indonesia," *Universal Journal of Agricultural Research*, Vol. 11, No. 2, pp. 434 - 439, 2023. DOI: 10.13189/ujar.2023.110220.

(b): Dwi Sutningsih, Eka Faizah, Nur Azizah Azzahra (2023). Survey of Oxytetracycline Residue Content in Broiler Chicken Meat in Semarang City, Central Java Province, Indonesia. *Universal Journal of Agricultural Research*, 11(2), 434 - 439. DOI: 10.13189/ujar.2023.110220.

Copyright©2023 by authors, all rights reserved. Authors agree that this article remains permanently open access under the terms of the Creative Commons Attribution License 4.0 International License

Abstract To increase chicken meat production, farmers add antibiotics oxytetracycline to prevent secondary infectious diseases due to viruses and feed additives and prevent bacterial diseases. This study aims to find an overview of the oxytetracycline antibiotic residues in broiler chicken meat sold in traditional markets and modern markets in Semarang City, Indonesia. The study is descriptive research, a survey method with a cross-sectional approach. The samples were broiler chicken meat with a total of 47 samples, consisting of 33 from traditional and 14 from modern markets. Sample examination was carried out by the Bioassay method to determine the oxytetracycline residue in the sample and with the HPLC method to determine its content. The results showed as many as three samples of broiler chicken meat containing oxytetracycline which is 0.1 ppm residue out of 47 samples. The three samples were from traditional markets in Semarang City, with the content of each residue namely 0.869 (Johar Market), 0.271 (Sampangan Market), and 0.366 (Damar Market). Meanwhile, the samples from the modern market did not contain oxytetracycline residue. Therefore, relevant agencies should regularly monitor antibiotic residues in Animal Source Foods, especially broiler chicken meat, both in traditional and modern markets.

Keywords Oxytetracycline Residue, Broiler Chicken

Meat, Traditional Market, Modern Market

1. Introduction

Animal source food is needed by humans as a source of protein. Animal protein can be sourced from milk, meat, and eggs. Animal protein is essential as it contains essential amino acids that are needed by humans. However, food of animal origin will become useless and endanger human health if it is not safe. Therefore, food safety of animal origin is an absolute requirement [1].

To face challenges in the future, Indonesia must be able to produce food from animals that are Safe, Healthy, Whole, and Halal (ASUH). Safe means that materials of animal origin do not contain biological, chemical, or physical hazards that can endanger public health [2,3]. Healthy means that food contains nutritional components that are useful for health and growth. Whole means the meat is not mixed with other parts of the animal or other animals. Halal means that animals are slaughtered according to Islamic law [4,5].

Food safety is a major requirement that is becoming increasingly important for the health of the people who consume it [6]. The importance of food safety is in line with

the better public awareness of quality animal-origin food, meaning that in addition to its high nutritional value, the product is safe and free from microbial contamination, chemicals, or contamination that can interfere with health. Therefore, the safety of food of livestock origin is an absolute requirement [1].

Based on research conducted by Umaroh [7], the consumption of animal protein of livestock origin increased from 4.8% in 2015 to 5.1% in 2016. The higher consumption of proteins derived from meat was accelerated by an increase in the meat production of broiler chickens on farms. Society tends to choose meat products, in this case meat breeds of chickens (broilers). This phenomenon is caused by the increasing public knowledge of nutrition and protein quality. In addition, the easier access to get broiler meat is one reason for the increasing consumption of broiler chickens [7].

Broiler breed chickens are a breed of young roosters or females aged about 6-8 weeks, which are intensively treated, to obtain optimal meat production [8]. To produce optimal meat production, the livestock of these broilers must have good growth and avoid various diseases. Antibiotics have become one of the parts that support chicken productivity and growth. ⁹ In the pre-production (maintenance) stage, the use of antibiotics has become necessary so that chicken productivity can be maintained or improved in maintaining or restoring the health of chickens [9]. Antibiotics have been widely used in the field of animal husbandry including chicken farming, both with therapeutic doses for the PTO treatment and with sub-therapeutic doses to spur the growth and efficiency of feed use, which can ultimately increase livestock productivity [10].

Recently antibiotics have been widely used with sub-therapeutic doses to prevent disease and spur the growth of chickens both through feed and drinking water continuously over a long period, oxytetracycline can harm consumers because it has the potential to cause resistance to disease-causing organisms, so now the use of antibiotics including oxytetracycline with sub-therapeutic doses is prohibited in many countries, including Indonesia [11] and oxy, tetracycline is classified into hard drugs [12]. This study aims to determine whether there is oxytetracycline residue in broiler meat sold in traditional and modern markets in Semarang City, Central Java, Indonesia.

2. Materials and Methods

This type of research is descriptive research, a survey method with a cross-sectional approach. The samples were broiler chicken meat with a total of 47 samples, consisting of 33 samples from traditional markets and 14 from modern markets. The tools used in this study were Centrifuge 3,000 rpm, water bath disc paper, sterile cabinet (*clean bench*), *Homogenizer I ultrasonic homogenizer*, autoclave,

refrigerator, analytical scales, three (3) incubator types (30 °C ± 1 °C, 36 °C ± 1 °C and 55 °C ± 1 °C), sample plastic. Meanwhile, the materials used in this study were broiler chicken meat, dapar phosphate solution, vegetative test germ culture or spores of *Bacillus cereus* ATCC 11778, *Bacillus cereus* agar media, standard solution comparing Oxytetracycline hydrochloride, and standard antibiotics. Sample examination is carried out by the Bioassay method to determine the residue of oxytetracycline in the sample and with the HPLC method to determine its content.

3. Results

3.1. Test Results of Oxytetracycline Residue on Purebred Chicken Meat Samples at the Semarang City Traditional Market

After all samples of purebred chicken meat from each traditional market were collected, then the samples were taken and weighed as much as 10g and tested with the Bioassay method to see the presence of oxytetracycline residues. A positive sample test result means that the meat sample of purebred chickens contains oxytetracycline residues. The results of testing samples of purebred chicken meat from traditional markets are presented in the following table.

Table 1. Distribution of oxytetracycline residue testing results on purebred chicken meat samples at the Semarang city traditional market

Residual test results	Frequency	%
Positive	3	9,10
Negative	30	90,90
Total	33	100

Table 1 shows that most samples of purebred chicken meat in the traditional market did not contain oxytetracycline residues, namely as many as 30 samples with a percentage of 90.90% and as many as 3 samples contained oxytetracycline residues with a percentage of 9.10%.

3.2. Test Results of Oxytetracycline Residue on Purebred Chicken Meat Samples in Semarang City Modern Market

Samples of purebred chicken meat that have been collected from the modern market were then also tested using the Bioassay method to see the presence of oxytetracycline residues in purebred chicken meat. The sample tested was as much as 10 grams. The results of testing oxytetracycline residues on the meat of purebred chickens derived from the modern market are presented in the following table:

Table 2. Distribution of oxytetracycline residue testing results in chicken meat samples in Semarang city modern market

Residual test results	Frequency	%
Positive	0	0
Negative	14	100
Total	14	100

Table 2 shows that all samples of purebred chicken meat sold in all modern markets do not contain oxytetracycline residues, that is, as many as 14 samples with a percentage of 100 %.

3.3. Test Results of Oxytetracycline Residue Content in Boiler Chicken Meat

After the chicken meat sample was tested using the Bioassay method to see the presence of residues and positive results were obtained, then another test was carried out using the High-Performance Liquid Chromatography (HPLC) method to see the residual content. As for its residual content, it is presented in the following table.

Table 3. Test Results of Oxytetracycline Residue content in Positive Purebred Chicken Meat Samples Containing Residues

Sample Number	Market Name	Residual Content (ppm)	Information
1	Johar	0,869	Exceeds BMR
8	Sampang	0,271	Exceeds BMR
24	Damar	0,366	Exceeds BMR

Table 3 shows that the residual content of oxytetracycline in purebred chicken meat sold in johar, Sampangan, and Damar markets exceeded the Maximum Residue Limit (BMR).

4. Discussion

Broiler chicken meat is one source of animal protein needed by the human body, animal protein is essential because it contains amino acids that are close to the amino acid composition needed by humans so that they will be easier to digest and more efficient in their utilization. Food from livestock will become useless and endanger human health if it is not safe [13]. Consuming livestock product that contains the residue, especially if higher than the standard will interfere with health [1]. One of the residues commonly found in broiler chicken meat is antibiotic residue.

The recent study showed that fewer samples of purebred chicken meat in the traditional market contained oxytetracycline residues. Similarly, research was conducted by Dewi et al. [14] from the Denpasar Regional VI Veterinary Investigation and Testing Center in 2003-2004, as many as 55 (18.9%) chicken meat samples from the traditional market containing residues of antibiotics of

the tetracycline group, penicillin, macrolides, and aminoglycosides.

In research conducted by Murdiati et al. [15] in West Java, from 93 samples of chicken meat examined, 70% of the samples showed positive results containing oxytetracycline residues. The study done by Marline et al. [16] stated that 27.08% of the samples taken from the poultry farm at Pamijahan-Bogor contained residues and detected antibiotic groups, namely macrolides and tetracyclines. About 4.17% of liver samples and 4.17% of thigh meat samples were detected as positive for tetracycline [16].

The presence of oxytetracycline residues in broiler chicken meat sold in traditional markets is thought to be caused by several factors including the addition of antibiotics in the ration with an amount exceeding the dose, the administration of antibiotics over a long period so that it can cause residues in the meat, and the cutting is carried out before the stoppage period of drug administration ("withdrawal time") is exceeded [17].

Discontinuing the administration of antibiotics before slaughtering an animal will eliminate the accumulation of antibiotics in the tissue. Residues existence in meat and other tissues are usually negligible after five days of the last administration [18].

In the livestock business, antibiotic residues can be found in materials derived from livestock as a result of the use of drugs, including antibiotics. Residues of antibiotics are compounds of origin and/or their metabolites contained in animal product tissues and include residues resulting from other descriptions of the said antibiotics. The more intensive a livestock business is, the greater the possibility for the residue to be buried or even unavoidable. Often farmers do not pay attention to the rules for using antibiotics, so the antibiotics given are often under-dose so that it does not produce healing in livestock. Then the disease will return with a more severe attack and is no longer sensitive to the same antibiotic with the same dose. This situation makes farmers increase the dose of antibiotic use. In addition, antibiotics also have a negative impact on livestock, including growth inhibition and decreased hatchability. Antibiotics cannot be completely excreted from the body tissues of livestock, some are still retained in body tissues as a form of residue. Residues of antibiotics will be carried in products of animal origin such as meat, eggs, and milk, which will be dangerous for consumers who consume them [19].

In general, antibiotics, especially the tetracycline group, are quite widely used in animal husbandry, because these antibiotics have a broad spectrum that can kill gram-positive, negative bacteria, and pathogens that are not effective with other antibiotics. Therefore, the antibiotics often offer an option in the treatment of diseases, besides the price is also more affordable [20]. In addition to treatment, oxytetracycline is an antibiotic that is often added to feed and is effective in stimulating growth rate, weight, and carcass composition as well as feed conversion

efficiency in young cattle [21].

This research revealed that all samples of purebred chicken meat sold in all modern markets did not contain oxytetracycline residues. The absence of residues from broiler chicken meat samples sold on the modern market is likely because broiler breed chicken meat sold in modern markets (self-service and hypermart) comes from large types of farms that have already implemented Good Agriculture Practices (GAP) so the resulting chicken meat is free of residues. Good Agriculture Practices or Good Cultivation Methods is a guideline explaining how to cultivate good livestock to produce quality food that is safe and suitable for consumption [22]. A good cultivation method pays attention to aspects of food safety, one of which is by suppressing the minimum possible chemical residues contained in foodstuffs as a result of the use of fertilizers, disease control drugs, growth-promoting agents, and inappropriate veterinary drugs [23].

By paying attention to the GAP, it is possible that broiler chicken meat sold in the modern market of Semarang city does not contain residues of the antibiotic oxytetracycline. This is by a study by Rusiana in 2004 conducted in Jakarta by collecting meat from several types of large farms. The results of the study showed that meat sold in modern markets such as supermarkets is free of residues [24].

The result showed that the residual content of oxytetracycline in purebred chicken meat sold in several traditional markets exceeded the Maximum Residue Limit (BMR). The BMR for oxytetracycline residues in purebred chicken meat according to SNI No. 01-6366-2000 is 0.01 ppm [25]. Another study was also conducted by Panggabean et al. [19] who conducted study to determine the presence of Neomycin residue in chicken meat circulating in DKI Jakarta. From the research results of Panggabean et al. [19], it is known that from 136 chicken meat samples, 47 samples (35%) contained Neomycin residues that exceeded the BMR set by SNI, namely 0.05 ppm.

The antibiotics used on farms do not only provide benefits for animals and breeders, but can also pose a risk to public health if they are not used according to regulations. The risk is in the form of antibiotic residues in meat that can cause hypersensitivity reactions ranging from mild to severe, poisoning, and most importantly, increased resistance to some pathogenic microorganisms which will cause major problems in the field of human health [26].

The content of drug residues that pass the set BMR will cause the meat to be unsafe for consumption because it can cause allergic reactions, poisoning, certain microbial resistance or cause physiological disorders in humans. The results of a survey in America show that around 77% of respondents are worried about the problem of drug residues (especially antibiotics) in livestock meat [1].

Almost all feed mills add veterinary drugs in the form of antibiotics to commercial feed, so most of the commercial feed circulating in Indonesia contains antibiotics [27]. Thus, if the farmer who uses the ration does not pay attention to

the rules of its use, it is strongly suspected that livestock products such as chicken meat contain antibiotic residues that can interfere with human health, including resistance to certain antibiotics [28]. The use of feed additives to improve feed efficiency and livestock productivity has become widespread, especially in laying hens and broilers because it economically benefits farmers. This situation causes livestock to be constantly exposed to veterinary drugs for most of their lives, so the resulting livestock products are most likely still containing drug residues, especially when the drug dose and downtime are not adhered to [27].

Antibiotics cannot be found in the meat of farm animals if they are given enough substances to spur their growth. However, these antibiotics can be found in meat if they are given 10 times more [18]. Research with antibiotic residue testing on broiler chicken meat and native chicken meat stated that of the 6 broiler chicken meat samples that tested positive, 2 samples contained antibiotic residues and none of the native chicken meat samples contained antibiotic residues. From the results of the research, it can be seen that antibiotic residues are commonly found in broiler chicken meat and are not found in non-purebred chickens. This is likely because the maintenance of broiler chickens is carried out intensively, meaning that farmers fully intervene in the life of broiler chickens so that broiler chickens grow quickly, for example by feeding in which there are already antibiotics to trigger the growth of broiler chickens [18].

5. Conclusion

Of the 47 samples of purebred chicken meat taken from traditional markets and modern markets, there were 3 samples containing oxytetracycline residues. Samples of purebred chicken meat containing oxytetracycline residues came from the traditional market of Semarang city, namely samples from Johar market, Sampangan market, and Damar market. While the meat samples of purebred chickens that come from the modern market do not contain oxytetracycline residues. Therefore, relevant agencies must periodically monitor antibiotic residues in Animal Food, especially broiler chicken meat, both in traditional and modern markets.

Acknowledgements

We thank all who had supported this research and this publication. We thank to livestock department who has responsibility to supervise the Broiler Chicken farm.

Funding

This publication was funded by SEAHOON Small

Grants 2022 No Agreement 222-GR060-2206-2211.

REFERENCES

- [1] Bahri S., Masbulan E., Kusumaningsih A., "Preproduction Process as an important factor in producing livestock products that are safe for humans," *Jurnal Litbang Pertanian*, Vol. 24, No. 1, pp. 27-35, 2005.
- [2] Thaha A.H., Suarda A., Mulia A., Arsyad M.A., "Regeneration of ASUH Sacrificial Meat Providers (Safe, Healthy, Whole, Halal) and Appropriate," *Aksiologiya Jurnal Pengabdian Kepada Masyarakat*, Vol. 5, No.3, pp. 319-339, 2021, DOI: <http://dx.doi.org/10.30651/aks.v5i3.4433>
- [3] Anggaeni T.T.K., Indraswari N., & Sujatmiko B., "Socialization of ASUH Food (SAFE, HEALTHY, WHOLE, AND HALAL) and Healthy Snacks in an Effort to Increase Public Awareness of the Quality of a Healthy Life," *Media Kontak Tani Ternak*, Vol. 4, No. 1, 2022, DOI: <https://doi.org/10.24198/mktt.v4i1.38627>
- [4] Mail D.A.A., Fahmi N.F., Putri, D.A. Hakiki, M.S., "Cattle Slaughter Policy in RPH (Slaughterhouse) in Relation to Halal Management Principles and HACCP (Hazard Analysis Critical Control Point)," *Halal Research Journal*, Vol.1, No.1, pp. 20–38, 2021, DOI: <https://doi.org/10.12962/j22759970.v1i1.33>.
- [5] Tolistiawaty I., Widjaja J., Isnawati R., Lobo L.T., "Description of Slaughterhouses/Abattoirs in Sigi Regency, Central Sulawesi," *Jurnal Vektor Penyakit*, Vol. 9, No. 2, pp. 45–52, 2015, DOI: 10.22435/vektor.v9i2.5793.45-52
- [6] Anditiarin D., Wahyuningsih S., Afian F., Mulyawan W., "Prevention of Liability Diseases During Flight With the Application of the Principles of Food Safety (Food Safety) by the Cabin Crew on the Aircraft," *Jurnal Kedokteran*, Vol.6, No.1, 2020, pp. 68–76, DOI: <http://dx.doi.org/10.36679/ke.dokteran.v6i1.265>
- [7] Umaroh R., Vinantia A., "Analysis of Consumption of Animal Protein in Indonesian Households," *Jurnal Ekonomi dan Pembangunan Indonesia*, Vol. 18, No.3, pp. 22-32, 2018, DOI: 10.21002/jepi.2018.13
- [8] Livestock and Animal Health Service of Lampung, "Chicken Meat Quality," Livestock and Animal Health Service of Lampung, 2010.
- [9] Murwani R., "Feed Additives, Natural Additives Substitute for Antibiotics." Unnes Press, 2008.
- [10] Hintono A., Astuti M., Wuryastuti H., Rahayu ES., "Oxytetracycline Residue and Its Antibacterial Activity in Eggs of Chickens Administered Therapeutic Doses of Oxytetracycline Through Drinking Water," *Journal of the Indonesian Tropical Animal Agriculture*, Vol. 32, No.1, pp. 64-70, 2007, [http://eprints.undip.ac.id/26258/1/32\(4\)2007p245-250.pdf](http://eprints.undip.ac.id/26258/1/32(4)2007p245-250.pdf)
- [11] Directorate General of Indonesian Livestock, "Summary of Feed Additives for Animals," Directorate General of Indonesian Livestock, 1991.
- [12] Minister of Agriculture of the Republic of Indonesia, "Decree of the Minister of Agriculture Number: 806/Kpts/TN/206/12/94 concerning Classification of Veterinary Drugs," Minister of Agriculture of the Republic of Indonesia, 1994.
- [13] Ministry of Health and Ministry of Agriculture. "Chicken Meat, a Nutritious Food Source," Ministry of Health and Ministry of Agriculture, 2010.
- [14] Handayani N.M.S., Dewi A.A.S., Riti N., Ardana I.G.P.S., "Microbial contamination and antibiotic residues in products of animal origin in the Provinces of Bali, NTB and NTT 2003-2004," Indonesian Regional VI Veterinary Investigation and Testing Center, 2004.
- [15] Murdiati T.B., Indraningsih, Bahri S., "Contamination of animal products by pesticides and antibiotics," *ACIAR Proceedings*, No. 85. pp. 115–121, 1998.
- [16] Marlina A.N., Zubaidah E., Sutrisno A., "Effect of giving antibiotics during cultivation on the presence of residues in broiler meat and liver from smallholder farms," *Jurnal Ilmu-Ilmu Peternak*. Vol. 25, No.2, pp. 10–19, 2015, DOI: <https://doi.org/10.21776/ub.jiip.2015.025.02.02>
- [17] Ngangguk C., Detha A., Wuri D., "Study of Tetracycline Residues in Broiler, Free-range Chicken and Spent Laying Chickens Sold in Kupang City," *Jurnal Kajian Veteriner*, Vol. 2, No. 2, pp. 175-181, 2019, DOI: <https://doi.org/10.35508/jkv.v2i2.1002>
- [18] Fitriyaningsih, "Penicillin Residues in Broiler and Free-range Chicken Meat Tissue (Case in Johar, Peterongan and Banyumanik Markets, Semarang City)," Diponegoro University Faculty of Animal Husbandry, 2005.
- [19] Panggabean T.A., Inanusantri, Mardiaty E., "Identification of Neomycin Residues in Chicken Meat in DKI Jakarta," *Kesmavet DKI Jakarta*, 2009.
- [20] Kondo F., Morikawa S., Tateyama S., "Simultaneous Determination of Six Tetracyclines in Bovine Tissue, Plasma and Urine by Reverse-Phase High-Performance Liquid Chromatography," *Journal of food protection*, Vol. 52, No.1, pp. 41–44, 1989, DOI: 10.4315/0362-028X-52.1.41
- [21] Maynard L., Loosli J. K., "Animal Nutrition," Mc Graw-Hill Book Co., Inc., 1996.
- [22] Indonesian Directorate General of Processing and Marketing of Agricultural Products, "Technical Guidelines for Food Quality and Safety Development." Indonesian Directorate General of Processing and Marketing of Agricultural Products, 2010.
- [23] Sumaryanto H., "Good Manufacturing Practices (GMP)," Institute for Research and Community Empowerment, University of IPB, 2010.
- [24] Rusiana, Iswarawanti, "85% of broiler chicken meat contains antibiotics," *Senior Edisi* 236 Januari, 2004, pp. 23-29.
- [25] The Indonesian National Standardization Agency, "Filter Test Method (Screening Test) for Antibiotic Residues in Meat, Eggs and Milk by Bioassay," The Indonesian National Standardization Agency, 2008.
- [26] Phillips I., Casewell M., Cox T., De Groot B., Friis C., Jones R., Nightingale C., Preston R., Waddell J., "Does the use of

antibiotics in food animals pose a risk to human health? A critical review of published data,” *The Journal of antimicrobial chemotherapy*, Vol. 53, No. 1, pp. 28–52, 2004, DOI: 10.1093/jac/dkg483

- [27] Bahri S., Kusumaningsih A., Murdiati, T.B., Nurhadi A., Masbulan E., “Policy Analysis on Food Safety of Livestock Origin (Especially Layer Chicken and Broiler),” in *Research Report, Indonesian Livestock Research and*

Development Center, 2000.

- [28] Hurd H.S., Doores S., Hayes D., Mathew A., Maurer J., Silley P., Singer R.S., & Jones R.N, “Public health consequences of macrolide use in food animals: a deterministic risk assessment,” *Journal of food protection*, Vol. 67, No. 5, pp. 980–992. DOI: 10.4315/0362-028x-67.5.980