Jurnal Riset Veteriner Indonesia
Journal of the Indonesian Veterinary Research
P-ISSN: 2614-0187, E-ISSN:2615-2835
Nationally Accredited Journal, Decree No. 36/E/KPT/2019.
Volume 10 No. 2 (July 2026), pp. 1-7
journal.unhas.ac.id/index.php/jrvi/

Detection of Antibiotic Residues in Commercial Layer Eggs Sold at Daya Traditional Market, Makassar, Indonesia

Putra Kurniawan[a], Baso Yusuf[a], Magfira Satya Apada[a], Elphan Augusta Kajang[a], Dian Fatmawati[a], Sitti Mughniati[a], Musdalifah[a], Andi Achmad Rifaldi[b], Rian Hari Suharto[a]*

[a]Veterinary Medicine Study Program, Faculty of Medicine, Hasanuddin University
[b]Faculty of Animal Science, Hasanuddin University
Jl. Perintis Kemerdekaan Km. 10, Makassar, 90245, Indonesia

*corresponding author: rianhs@unhas.ac.id

Abstract

Antibiotic residues in poultry products, such as eggs, pose a significant public health risk by contributing to antibiotic resistance. Despite being a major commodity, data regarding antibiotic residues in chicken eggs sold in Makassar City remains limited. This study aimed to detect the presence of antibiotic residues in fresh layer eggs sold at Daya Market, the largest traditional market in Makassar City. This study employed a descriptive survey method. Samples were collected using purposive sampling from 10 major egg distributors supplied by farms in Sidenreng Rappang (Sidrap) and Maros Regencies. A total of 80 eggs were collected and pooled into 10 composite samples. Screening was performed using the bioassay method based on the Indonesian National Standard (SNI 7424:2008) to detect four antibiotic classes: penicillin, tetracycline, aminoglycoside, and macrolide. The screening revealed that 100% (10/10) of the pooled samples tested positive for aminoglycoside residues. Residues from penicillin, tetracycline, and macrolide groups were not detected. The widespread presence of aminoglycoside residues indicates a high prevalence of antibiotic use, likely gentamicin, kanamycin, or streptomycin, in the supplying farms. This suggests a failure to adhere to appropriate withdrawal periods. Strict monitoring and farmer education regarding antibiotic usage are urgently needed to ensure food safety.

Keywords: Antibiotic residue; bioassay; Aminoglycoside; food safety.

Introduction

Chicken eggs are a vital and affordable source of animal protein globally. However, the intensification of poultry farming has led to the widespread use of antibiotics for therapy, disease prevention, and historically as growth promoters. While antibiotics are essential for animal health, their imprudent use—particularly the failure to adhere to withdrawal periods—poses a significant risk of residue accumulation in edible tissues and eggs (Hafiz et al., 2021; Anton et al., 2020).

Antibiotic residues in food products represent a severe chemical hazard. The presence of these residues can trigger allergic reactions in hypersensitive individuals and, more critically, contribute to the global crisis of antimicrobial resistance (AMR). The Food and Agriculture Organization (FAO, 2021) and the European Union have highlighted that without effective intervention, AMR could result in significant global economic losses and millions of fatalities

annually (Presiana et al., 2023).

In Indonesia, the government has strengthened regulations to ensure food safety, including prohibiting the use of antibiotic growth promoters (AGPs) through the Ministry of Agriculture Regulation Number 14 of 2017. Despite these regulations, field surveillance often reveals inconsistent compliance. Previous studies have shown varied results; for instance, Tumanduk et al. (2023) detected amoxicillin residues in poultry organs in Makassar, while Nurhidayah et al. (2015) reported negative results in fresh eggs across several provinces. These inconsistencies underscore the need for continuous local monitoring.

Makassar City, as a primary economic hub in Eastern Indonesia, relies heavily on traditional markets for food distribution. Daya Market is the largest traditional market in the city and serves as a key distribution hub for eggs supplied by major production centers in South Sulawesi, such as Sidenreng Rappang (Sidrap) and Maros Regencies. Consequently, the safety profile of eggs sold at Daya Market serves as a representative indicator of upstream farming practices in the region.

Currently, data regarding antibiotic residues in eggs circulating in Makassar remains limited. This study aims to detect the presence of antibiotic residues, specifically aminoglycosides, penicillins, tetracyclines, and macrolides, in fresh commercial layer eggs sold at Daya Market, using the bioassay method to ensure compliance with food safety standards.

Materials and Methods

Study design and location. This study employed a descriptive cross-sectional design. Sample collection was conducted from December 2024 to January 2025 at Daya Market, the largest traditional poultry distribution center in Makassar City. The laboratory analysis for antibiotic residue detection was performed at the Veterinary Public Health Laboratory of the Maros Veterinary Center (Balai Besar Veteriner Maros).

Sampling strategy. Samples were collected using a purposive sampling technique, targeting the 10 largest egg distributors in the market. The minimum sample size was determined using the formula for disease detection in large populations as described by Sumiarto and Budiharta (2018). The calculation assumed a 95% confidence level and an estimated prevalence of 26.19%. This prevalence value was adopted from a previous study by Anton et al. (2020), which reported that 26.19% of egg samples collected from traditional markets tested positive for kanamycin residues. Based on these parameters, a minimum of 10 sampling units was required to ensure statistical validity. From each of the 10 distributors, eight (8) fresh chicken eggs were collected, resulting in a total of 80 eggs. For laboratory analysis, the pooling method was applied: four eggs from each stall were homogenized into one composite sample for screening, while the remaining four eggs were archived for confirmation testing if necessary.

Materials. The primary materials used included reference standards for four antibiotic classes: sodium penicillin (penicillin group), oxytetracycline HCl (tetracycline group), kanamycin sulphate (aminoglycoside group), and tylosin tartrate (macrolide group). Bacterial test organisms used were *Bacillus stearothermophilus* ATCC 7953 (for penicillin detection), *Bacillus cereus* ATCC 11778 (for tetracycline detection), *Bacillus subtilis* ATCC 6633 (for aminoglycoside detection), and *Kocuria rhizophila* (formerly *Micrococcus luteus*) ATCC 9341 (for *Macrolide detection*). Media used included nutrient agar (NA) and phosphate buffer solutions (pH 6.0, 7.2, and 8.0) prepared according to standard protocols.

Screening procedure. The screening test was conducted using the bioassay method in accordance with the Indonesian National Standard 7424:2008 (BSN, 2008), performed in triplicate (triplo). Nutrient agar inoculated with specific test bacteria was poured into petri

dishes and allowed to solidify. Sterile paper discs (8 mm diameter) were dipped into the homogenized egg samples for approximately 10 seconds and placed onto the surface of the agar. Positive controls (antibiotic standards) and negative controls were included in each batch. The plates were incubated at specific temperatures depending on the bacterial strain (e.g., 55°C for *B. stearothermophilus* and 30–37°C for others) for 18–24 hours. Results were determined by measuring the clear zone (zone of inhibition) formed around the disc. Positive results were determined based on the laboratory's established limit of detection (LOD), where an inhibition zone diameter of ≥12 mm (including the disc diameter) was considered positive.

Results

Interviews with the 10 egg distributors revealed the supply chain characteristics of eggs sold at Daya Market. As presented in Table 1, the majority of eggs (90%) originated from farms in Sidenreng Rappang (Sidrap) Regency, while one distributor (10%) sourced eggs from Maros Regency. Both regions are known as the central poultry production hubs in South Sulawesi. The turnover rate of eggs at the market was relatively fast, with storage durations ranging from 2 to 5 days before being sold to consumers.

The screening test using the bioassay method yielded striking results. As presented in Table 1 and illustrated in Figure 1, all pooled samples (100%) tested positive for aminoglycoside residues, exhibiting average inhibition zone diameters ranging from 11.7 mm to 13.7 mm. Conversely, no inhibition zones were observed for penicillin, tetracycline, or macrolide groups in any of the samples, indicating that the antibiotic residues detected were specific to the aminoglycoside class.

Table 1. Screening results of antibiotic residues in pooled egg samples (n=10).

Sample code	Inhibition zone screening result by antibiotic group			
	Penicillin	Tetracycline	Macrolide	Aminoglycoside
Loc 1	Negative	Negative	Negative	Positive (13.7 mm)
Loc 2	Negative	Negative	Negative	Positive (13.0 mm)
Loc 3	Negative	Negative	Negative	Positive (13.3 mm)
Loc 4	Negative	Negative	Negative	Positive (12.0 mm)
Loc 5	Negative	Negative	Negative	Positive (11.7 mm)*
Loc 6	Negative	Negative	Negative	Positive (12.7 mm)
Loc 7	Negative	Negative	Negative	Positive (12.7 mm)
Loc 8	Negative	Negative	Negative	Positive (13.3 mm)
Loc 9	Negative	Negative	Negative	Positive (13.7 mm)
Loc 10	Negative	Negative	Negative	Positive (12.3 mm)
Controls	Valid (+)	Valid (+)	Valid (+)	Valid (+)

Notes: Values in the aminoglycoside column represent the mean diameter of inhibition zones from three replicates (triplo). Negative indicates no inhibition zone was formed (0 mm). *Although the average is slightly below 12 mm, individual replicates showed clear inhibition zones consistent with positive detection based on laboratory qualitative standards.

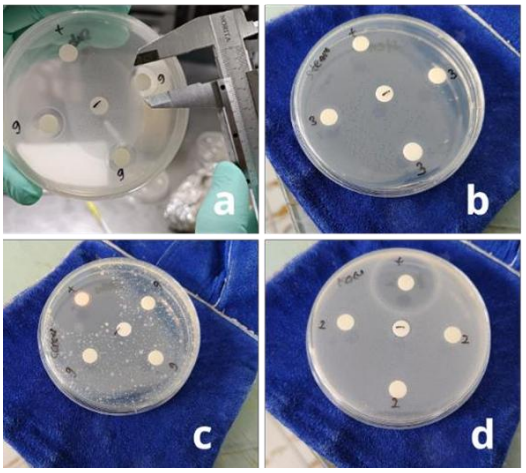

Figure 1. Results of antibiotic residue testing using the bioassay method: (a) positive result for aminoglycoside group indicated by clear inhibition zones; (b) negative result for penicillin group; (c) negative result for tetracycline group; and (d) negative result for macrolide group.

Discussion

This study revealed a critical food safety issue in Makassar City: 100% of the commercial layer egg samples (n=10) collected from Daya Market tested positive for aminoglycoside antibiotic residues. This prevalence is alarmingly higher than findings from previous studies conducted in other regions of Indonesia, indicating a systemic failure in antibiotic stewardship within the supply chain originating from Sidenreng Rappang (Sidrap) and Maros Regencies.

In comparison, a study by Anton et al. (2020) in traditional markets of East Jakarta reported a 26.19% prevalence of kanamycin (an aminoglycoside) residues. Supporting this pattern, Witoko et al. (2019) found that in Denpasar, Bali, aminoglycosides were also the predominant residue, detected in 66.7% of samples collected from farmers. Furthermore, national surveillance data cited by Directorate of Animal Health (2021) involving 6,945 animal product samples identified that residues most frequently detected belonged to the aminoglycoside, macrolide, and tetracycline groups, with an overall prevalence of 6.7%. Similarly, Nurhidayah et al. (2015) confirmed the recurring presence of aminoglycoside residues in eggs across several provinces in Indonesiaa. The fact that the current study found a 100% positive rate suggests that the use of aminoglycosides in the specific farms supplying Daya Market is not sporadic, but rather an intensive and uniform practice.

The specific detection of aminoglycosides (such as gentamicin, kanamycin, streptomycin, and neomycin), in the absence of other antibiotic classes, likely correlates with the disease challenges prevalent in the region. According to Xu et al. (2019), aminoglycosides are often the antibiotics of choice for poultry farmers due to their high efficacy against Gram-negative bacteria, high polarity, and water solubility. These properties make them highly effective for controlling common bacterial infections in intensive farming, such as colibacillosis (caused by *Escherichia coli*) and Salmonellosis (*Salmonella* spp.).

The presence of these residues in market-ready eggs is a strong indicator of non-compliance with withdrawal periods. From a pharmacokinetic perspective, Goetting et al. (2011) explain that aminoglycosides are not significantly metabolized in the poultry body and are excreted in their active form. Empirical evidence supports this persistence. Alm and Elhearon (2010) specifically found that gentamicin residues could persist in eggs for 12–15 days following injection. This duration underscores the necessity of strict adherence to regulatory standards. According to the Indonesian Animal Drug Association (2014), specific withdrawal times are mandated to avoid residues: gentamicin requires approximately 10 days after the last parenteral administration, kanamycin requires 7 days, neomycin (oral) requires 5 days, and

streptomycin requires 5 to 8 days depending on the dosage. The detection of residues in this study implies that eggs were harvested and distributed within these prohibited windows, disregarding both biological persistence and regulatory guidelines.

This non-compliance is often driven by economic factors and a lack of knowledge regarding proper antibiotic usage. Hadi et al. (2009) reported that approximately 40–62% of antibiotic usage in the field does not align with proper therapeutic indications. Farmers often face economic pressure to maintain cash flow, making them reluctant to discard eggs produced during the withdrawal period. Prajwal et al. (2017) further highlight that the easy accessibility of antibiotics without veterinary prescriptions exacerbates uncontrolled self-medication practices among farmers. Although the Indonesian government has prohibited the use of antibiotic growth promoters (AGP) through Ministry of Agriculture Regulation No. 14 of 2017, the high residue levels suggest that antibiotics are still being used extensively, either therapeutically or as hidden prophylaxis in feed or water.The presence of aminoglycoside residues poses direct risks to public health, including potential nephrotoxicity and ototoxicity associated with long-term exposure, as well as allergic reactions in hypersensitive individuals. More broadly, it contributes to the selection pressure for antimicrobial resistance (AMR), which threatens the efficacy of these critical drugs in human medicine.

This study employed a qualitative bioassay screening method based on SNI 7424:2008. While this method is sensitive for initial detection, it possesses a limitation: it cannot distinguish between specific aminoglycoside compounds or quantify their exact concentrations. This distinction is critical because the regulatory standards have evolved. Under the latest Indonesian National Standard, the maximum residue limit (MRL) for neomycin in eggs is set at 0.5 mg/kg, whereas gentamicin and streptomycin are not explicitly regulated (TD) for this matrix (BSN, 2023). Consequently, a positive bioassay result does not automatically indicate a regulatory violation for neomycin, as the concentration could be within the permissible limit. Therefore, future research must employ quantitative methods, such as high-performance liquid chromatography (HPLC), to definitively identify the compound and determine compliance with the specific MRLs established in SNI 9923:2023.

Conclusion

Based on the research findings, it is concluded that 100% of commercial layer eggs sold at Daya Market, Makassar, are contaminated with antibiotic residues specifically from the aminoglycoside group. This widespread prevalence indicates a systemic failure in adhering to antibiotic withdrawal periods at the upstream farming level, particularly in the supply regions of Sidenreng Rappang (Sidrap) and Maros. The absence of penicillin, tetracycline, and macrolide residues suggests a specific reliance on aminoglycosides for disease control in these areas. Consequently, strict monitoring of veterinary drug usage and intensified education regarding withdrawal periods for farmers are urgently required. Furthermore, to support regulatory enforcement, future surveillance should employ quantitative methods to determine definitive compliance with the specific maximum residue limits stipulated in SNI 9923:2023.

Conflict of Interest

We certify that there is no conflict of interest with any financial, personal, or other relationships with other people or organization related to the material discussed in the manuscript.

Acknowledgment

The authors wish to express their gratitude to the Balai Besar Veteriner Maros (Maros Veterinary Center) for providing the laboratory facilities necessary for this study. Appreciation is also extended to the laboratory personnel for their technical assistance during the screening process.

Reference

Alm El Dein, A., dan Elhearon, E., 2010. Antibiotic Residue in Eggs of Laying Hens Following Injection with Gentamicin. *New York Science Journal*, 3(11), 135–140.

Anton, Taufik E., dan Wulandari Z. 2020. Studi Residu Antibiotika dan Kualitas Mikrobiologi Telur Ayam Konsumsi yang Beredar di Kota Administrasi Jakarta Timur. *Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan* 8(3), 151–159.

BSN (Badan Standardisasi Nasional). 2008. *SNI No. 7424:2008 tentang Metode Uji Tapis (Screening Test) Residu Antibiotika pada Daging, Telur, dan Susu secara Bioassay*. Badan Standardisasi Nasional, Jakarta.

BSN (Badan Standardisasi Nasional). 2023. *SNI 9923:2023 Batas maksimum residu obat hewan dalam pangan asal hewan*. Badan Standardisasi Nasional, Jakarta.

Directorate of Animal Health (Direktorat Kesehatan Hewan). 2021. *Pedoman Umum Penggunaan Antibiotik di Bidang Peternakan dan Kesehatan Hewan*. Direktorat Jenderal Peternakan dan Kesehatan Hewan, Kementerian Pertanian Republik Indonesia, Jakarta.

FAO. (2021). *The FAO Action Plan on Antimicrobial Resistance 2021–2025*. Food and Agriculture Organization of the United Nations, Rome.

Goetting, V., Lee, K. A., & Tell, L. A., 2011. Pharmacokinetics of Veterinary Drugs in Laying Hens and Residues in Eggs: A Review of the Literature. *Journal of Veterinary Pharmacology and Therapeutics*, 34(6), 521–556.

Hadi U, Duerink DO, Lestari ES, Nagelkerke NJ, Kauter M, Veld DH., 2009. Antibiotic Usage and Antimicrobial Resistance in Indonesia. PhD desertation. Leiden.

Hafiz, A., Agustin, A. L. D., & Atma, C. D., 2021. *Deteksi Residu Antibiotik pada Telur Ayam Layer di Peternakan Ayam Layer di Sesaot Lombok Barat*. Jurnal Vitek Bidang Kedokteran Hewan, 11(1), 48–52.

Indonesian Animal Drug Association (Asosiasi Obat Hewan Indonesia). 2014. *Indeks Obat Hewan INDONESIA* (IOHI) (Edisi IX). Subdirektorat Pengawasan Obat Hewan, Direktorat Kesehatan Hewan, Direktorat Jenderal Peternakan dan Kesehatan Hewan, Kementerian Pertanian, Jakarta.

Nurhidayah, Yulianti, N. T., Palupi, M. F., Ariyani, N., Patriana, U., Werdiningsih, S., Nugraha, E., Sari, R. A., Ambarwati, Widyarimbi, D., & Rusmiati, E. (2015). Pengkajian Residu Beberapa Golongan Antibiotika pada Telur di Beberapa Provinsi di Indonesia. *Buletin Pengujian Mutu Obat Hewan*, 23.

Prajwal, S., Vasudevan, V. N., Sathu, T., Irshad, A., Nayankumar, S. R., & Pame, K. (2017). Antibiotic Residues in Food Animals: Causes and Health Effects. *The Pharma Innovation Journal*, 6(12), 1–4.

Presiana. D, Erline. Y, Nugroho I, Shofura S, Nurwanti. D, Lili D, Desi R.W, Chasfila S, Sekar I.M, Nindya S.C, Tiara R.Y, Merin I.P, Retno. H, dan Abdul H., 2023. *Pedoman Mitigasi Risiko Keberadaan Residu Antibiotik dan Mikrob Resisten Antibiotik Pada Pangan Olahan*. Badan Pengawas Obat dan Makanan, Jakarta.

Tumanduk R., Massi M.N., Agus R., dan Hamid, F., 2023. Analisis Residu Amoksisilin pada Hepar dan Ventrikulus Ayam Petelur di Pasar Tradisional Makassar. *Jurnal Ilmu Alam dan Lingkungan*, 14 (2), 20–28.

Sumiarto, B. and Budiharta, S. 2018. *Epidemiologi Veteriner Analitik*. Gadjah Mada University Press, Yogyakarta. Pp. 54–56.

Witoko, M. C., Suardana, I. W., & Rudyanto, M.D., 2019. Detection of Antibiotic Residues in Chicken Eggs at the Chicken Egg Farmers and Egg Distributors on Trading Business in Denpasar Municipality*. Journal of Veterinary and Animal Sciences*, 2(2), 72–78.

Xu, C., Kuang, H., & Xu, L. (2019). Introduction of Immunoassays. In *Food Immunoassay* (pp. 1–14). Springer, Singapore.