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Evaluation of Sales Patterns of Poultry Antibiotics and Vitamins in The Veterinary Drug Industry: Implications for Farm Health and Sustainability

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ABSTRACT

The growing chicken population in Indonesia reflects the expanding poultry farming industry. To maintain chicken health and treat diseases, vitamins and antibiotics are commonly used, with guidelines for their use changing over time. To understand usage trends, data from PT Tekad Mandiri Citra (TMC) in Bandung is needed. This study evaluates the sales patterns of poultry antibiotics and vitamins in the veterinary drug industry between 2020 and 2022, with a focus on farm health and sustainability. Additionally, a SWOT analysis will be used to replace colistin antibiotics, based on changes to the Minister of Agriculture Regulation No. 14 of 2017. Data were processed using Microsoft Excel 2019 for descriptive analysis. The results show that 79% of broiler farms use antibiotics, and 81% use vitamins. In 2022, the most common antibiotics were from the fluoroquinolone group (34%), and the most used vitamins were from the miscellaneous group (35%). The SWOT analysis for 2021-2022 indicates that replacing colistin products has been successful.

Keywords: antibiotics, health, productivity, poultry, vitamin

ABSTRAK

Peningkatan populasi ayam di Indonesia mencerminkan berkembangnya industri peternakan ayam. Untuk menjaga kesehatan ayam dan mengobati penyakit, vitamin dan antibiotik sering digunakan, dengan pedoman penggunaannya yang berubah seiring waktu. Untuk memahami tren penggunaan, data dari PT Tekad Mandiri Citra (TMC) di Bandung diperlukan. Studi ini bertujuan untuk mengevaluasi pola penjualan antibiotik dan vitamin ternak unggas di industri obat hewan antara tahun 2020 hingga 2022, dengan fokus pada kesehatan peternakan dan keberlanjutannya. Selain itu, analisis SWOT akan digunakan untuk menggantikan produk antibiotik kolistin, berdasarkan perubahan pada Lampiran Peraturan Menteri Pertanian No. 14 Tahun 2017. Data diproses menggunakan Microsoft Excel 2019 untuk analisis deskriptif. Hasil identifikasi menunjukkan bahwa 79% peternakan broiler menggunakan antibiotik, dan 81% menggunakan vitamin. Pada tahun 2022, antibiotik yang paling umum digunakan berasal dari kelompok fluoroquinolon (34%), dan vitamin yang paling banyak digunakan berasal dari kelompok vitamin campuran (35%). Analisis SWOT untuk tahun 2021-2022 menunjukkan bahwa penggantian produk kolistin telah berhasil.

Kata kunci: antibiotik, kesehatan, produktivitas, unggas, vitamin

INTRODUCTION

Poultry is one of the world's major sources of animal protein and plays an important role in meeting human nutritional needs. The poultry industry is growing, as characterized by an increase in the number of poultry population in Indonesia. Based on the Central Statistics Agency (BPS) (2022), poultry livestock types experienced an increase in population including broiler chickens (broiler) 8.53%, layer chickens (layer) 10.88%, free range chickens 0.66% from 2020 to 2022. This increase in production occurred because in 2020 the Covid-19 pandemic affected public awareness of the importance of nutritional intake, especially food from poultry. One aspect of health is disease control and increasing poultry productivity. Antibiotics and vitamins are often used to manage the health of poultry.

Antibiotics have been utilized in animal farming for more than fifty years, both as therapeutic and metaphylactic/prophylactic treatments, as well as growth promoters. The effectiveness and cost-efficiency of most of these drugs led to their widespread and often indiscriminate use. As a result, the misuse and overuse of these antibiotics contributed to the creation of microbial reservoirs carrying antimicrobial resistance (AMR) genes in livestock, including poultry. Since some of the antibiotics used in animals are also used in humans, the spread of AMR poses a significant risk to the treatment of severe bacterial infections in people, resulting in higher medical costs, extended hospitalizations, and increased mortality (Abreu *et al.* 2023).

Amino acids, vitamins, and minerals as nutritional additives and nutraceuticals are important in poultry production and health. Vitamins exert catalytic functions that facilitate nutrient synthesis, thus controlling metabolism and affecting the performance and health of poultry. Amino acids play a key role in improving overall physiological health (Bouyeh and Gevorgyan 2016), boosting immunity against infections (Faluyi *et al.* 2015), and maintaining stability under non-infectious or management-related conditions (Saleh *et al.* 2018), all of which contribute to enhanced production performance in birds (Ghoreyshi *et al.* 2019). Previous research has shown that broilers facing infections typically experience poor performance due to structural and functional changes in the intestinal mucosa caused by the infection (Su *et al.* 2015; Gottardo *et al.* 2016).

The poultry industry is closely related to the veterinary industry. The veterinary medicine industry is growing as the number of veterinary medicine producers and distributors is increasing. Based on data from the Indonesian Veterinary Medicine Association (ASOHI) (2023), there were 113 veterinary medicine producers, 272 veterinary medicine importers, and 44 veterinary medicine exporters in 2022.

In light of this phenomenon, PT Tekad Mandiri Citra (TMC), a manufacturer, importer, and distributor of veterinary drugs since 1999 with responsibilities related to the use of antibiotics and vitamins, recognizes the necessity to identify the use of antibiotics and vitamins in poultry among the customers of the PT TMC Bandung branch in 2020-2022. This identification is imperative to provide a comprehensive overview of the class of antibiotics and vitamins utilized in poultry, facilitating the analysis of their sales potential. Subsequent to the identification phase, a SWOT strategy analysis is requisite to substitute products with colistin content in the polypeptide group. Colistin, an antibiotic used in poultry farming, has raised concerns due to its potential to contribute to Antimicrobial Resistance (AMR), which can affect both animal and human health. Moreover, this identification process is instrumental in acquiring information regarding the specific poultry sector that utilizes the most antibiotics and vitamins.

The objective of this study is to identify the utilization of antibiotics and vitamins in poultry at PT TMC Bandung branch. The specific objectives of this study are threefold: first, to analyze the highest percentage of antibiotic and vitamin use in poultry at PT TMC Bandung branch in 2020-2022; second, to analyze the percentage of antibiotic and vitamin group use in poultry at PT TMC Bandung branch in 2020-2022; and third, to evaluate the results of the application of colistin antibiotic product substitution through SWOT analysis at PT TMC Bandung branch.

The findings of this study are pertinent to the realm of pharmaceutical marketing, offering insights into the distribution patterns of antibiotic and vitamin products within the Bandung branch. This information can inform strategic decisions regarding product utilization and the assessment of market prospects.

Maintaining optimal poultry health is contingent upon effective disease control, which in turn enhances productivity. Antibiotics and vitamins are frequently employed in the management of poultry health. The utilization of antibiotics in poultry farming has been a subject of considerable controversy, as it has the capacity to engender antibiotic resistance (Dibner & Richards 2005). The emergence of antibiotic resistance represents a grave threat to human health, as it can diminish the efficacy of antibiotics in the treatment of human diseases. Consequently, it is imperative to comprehensively examine the utilization of antibiotics in poultry farming. In addition to antibiotics, vitamins play a pivotal role in ensuring poultry health and productivity. Sufficient and suitable vitamins can enhance various aspects of poultry growth, development, and reproduction (Cho & Kim 2010).

The state of practice of medicine use in poultry is subject to change over time, thus necessitating the collection of actual data to facilitate comprehension of prevailing trends and shifts in utilization. The identification of antibiotic and vitamin use in poultry over a defined period can yield a more profound understanding of contemporary poultry farming practices. These data can be instrumental in the development of enhanced guidelines for medication use, the mitigation of the risk of antibiotic resistance, and the assurance of optimal poultry health and productivity (Leeson & Summers 2005). The present study, which focuses on the identification of antibiotic and vitamin use in poultry at PT TMC Bandung branch, is expected to assist the poultry farming industry in selecting antibiotics and vitamins for disease management and control in the field.

MATERIAL AND METHODS

The research was conducted at the PT TMC Bandung branch in November 2023. Data were obtained from the company's sales system covering the years 2020 to 2022. The data obtained were processed using Microsoft Excel 2019 and analyzed descriptively to describe the results of identifying the use of antibiotics and vitamins at PT TMC Bandung branch in 2020-2022.

RESULTS AND DISCUSSION

Antibiotic Utilization Trends (2020–2022)

As illustrated in Table 1, the percentage of antibiotic utilization in poultry on broiler farms exhibited an increase from 2020 to 2021 (83%), followed by a decline in 2022 (76%). In contrast, antibiotic usage in layer farms remained consistent in 2020 and 2021 (14%), with a subsequent increase observed in 2022 (16%). Notably, antibiotic use in breeding farms reached its peak in 2020 (9%), followed by a decline in 2021 (3%) and a resurgence in 2022 (8%).

Table 1. Presents an overview of antibiotic use in poultry at PT TMC Bandung branch

Poultry Business Types	2020	2021	2022	Total
Broiler Farm	78%	83%	76%	79%
Layer Farm	14%	14%	16%	15%
Breeding Farm	9%	3%	8%	6%

The increased antibiotic use in 2021 was likely due to an upsurge in bacterial infections manifesting in the field. Data amassed by the Bandung branch of PT TMC reveal that colibacillosis, a bacterial infection caused by the Gram-negative bacterium *Escherichia coli* (Santoso *et al.* 2020), emerged as the predominant bacterial infection in the field during 2021. According to Wahyuwardan *et al.* (2014), the prevalence of *Escherichia coli* infection in dead chickens was found to range from 75% to 100% in carcass examinations. Peighambari *et al.* (2000) further noted that colibacillosis is particularly prevalent in young chickens aged 2 to 4 weeks. The primary source of *Escherichia coli* bacterial infection in chickens has been identified as contaminated water sources, including both natural and man-made water reservoirs (Nuraini *et al.* 2020). Additional risk factors for infection include litter, chicken manure, and cage dust (Tabbu 2018). The treatment of colibacillosis cases involves the administration of antibiotics (Tabbu 2018).

A comparability between the increase in antibiotic use in layer and breeding farms in 2022 and that of broiler farms is indicated by the presence of a common factor: the increase in CRD (Chronic Respiratory Disease) bacterial infections. The Bandung branch of PT TMC has collected data indicating that CRD is an infectious disease caused by *Mycoplasma gallisepticum*. The occurrence of this disease is associated with seasonal changes, high rainfall, and dust in cages. The treatment of CRD bacterial infections involves the administration of antibiotics, as previously outlined by Tabbu in 2018.

The highest utilization of antibiotics in poultry at PT TMC Bandung branch was observed in broiler farms, accounting for 79% of the total consumption. This elevated utilization is attributable to the substantial growth in the broiler population, which surpasses that of layer chickens. According to data from Indonesia's Central Bureau of Statistics (BPS) (2022), the broiler population was 2,919,516,243 birds in 2020, 2,889,207,954 birds in 2021, and 3,168,3 The layer population was 345,181,214 birds (2020), 386,125,709 birds (2021), and 378,590,549 birds (2022). In addition, three cage systems are employed by broiler farmers: closed house, semi-closed house, and open house. Cages in broiler rearing play an important role in the success of farming (Umam *et al.* 2014). The incidence of bacterial infection disease in open houses is higher, resulting in greater economic losses due to disease infection. Closed houses that are filled beyond capacity result in high densities that impact health and growth risks.

Vitamin Utilization Trends (2020–2022)

The identification results demonstrated that the utilization of vitamins in broiler farms increased from 79% in 2020 to 85% in 2021, and then decreased to 79% in 2022 (Table 2). The increase in vitamin use in 2021 can be attributed to a decline in meat demand (Widagdo 2022), which resulted in an increase in the maintenance time in broiler cages, exceeding 35 days. This prolonged maintenance period, when density is high, has a significant impact on temperature elevation. The utilization of vitamins in broiler farms is aimed at enhancing poultry productivity. Appropriate and sufficient vitamins can aid in enhancing growth, development, and reproduction in poultry (Cho & Kim 2010). Umam *et al.* (2014) have asserted that fluctuations in temperature can adversely impact broiler performance, potentially leading to weight loss.

Table 2. Vitamin use in poultry at PT TMC Bandung branch

Poultry Business Types	2020	2021	2022	Total
Broiler Farm	79%	85%	79%	81%
Layer Farm	13%	13%	13%	13%
Breeding Farm	7%	2%	8%	6%

The genetics of broiler chickens have undergone significant development in recent years, as evidenced by the rapid advancements in their growth rate. According to Cobb-Vantress (2018), it required 42 days in 1990 for broilers to reach a body weight of 1.6 kilograms. In contrast, by 2018, the same body weight was attained in just 42 days. To ensure the efficacy of genetic enhancements, a conducive environment is imperative (Umam *et al.* 2014). Prolonged broiler rearing periods, particularly those associated with fluctuating temperatures, increase the likelihood of diminished productivity. Consequently, the supplementation of vitamins becomes essential to optimize performance.

From 2020 to 2022, the utilization of vitamin supplements on layer farms remained consistent at 13%, indicating no significant increase or decrease in their application. According to Hy-Line (2019), layer chickens exhibit greater resilience to fluctuations in environmental

temperature due to genetic enhancements and reduced intrinsic stress compared to broilers. Additionally, these chickens require a longer rearing period of 100 weeks. The prolonged rearing period, spanning 100 weeks, has been shown to increase operational costs, as the economic turnover of layer farms does not match the rapid pace seen in broiler farms. Layer chickens reach commercial egg production at 18 weeks of age, indicating that during the initial 5-month period, from 0 to 18 weeks, the layer farm business remains unprofitable.

Vitamin use in breeding farms decreases in 2020 (7%), decreases in 2021 (2%), and increases in 2022 (8%). The decrease in vitamin use in breeding farms is related to the Covid-19 pandemic. The Covid-19 pandemic has reduced the public's purchasing power for poultry protein, causing commercial farmers to reduce their production capacity. This has led to a decline in income for the poultry industry in general, resulting in a reduction in the population or number of birds kept (Widagdo *et al.* 2022). In addition, there is a reduction in breeding or early culling, resulting in a global decline in the number of chickens in breeding farms.

The Following Report Details The Highest-Class Antibiotics and Vitamins Utilized in Poultry at PT TMC Bandung Branch from 2020 to 2022

As illustrated in Figure 1, fluoroquinolone antibiotics represent the most prevalent class of antibiotics utilized in poultry (34%). These fluoroquinolones are a broad-spectrum antibiotic class employed in the treatment of diseases caused by Gram-positive and Gram-negative bacterial infections affecting the respiratory, digestive, and urinary tracts (Raini 2016). Notably, the most prevalent respiratory diseases afflicting poultry are those caused by CRD (Chronic Respiratory Disease) (Widianingrum *et al.* 2022), while the most prevalent digestive diseases are those caused by *Escherichia coli* bacteria (Nuraini *et al.* 2020).

Fluoroquinolone, a member of the quinolone class of antibiotics, has found widespread application in the field of poultry farming, particularly in the context of broiler chickens. This class of antibiotics boasts a wide range of therapeutic benefits, including effectiveness against gram-positive, gram-negative bacteria, and mycoplasma. Notably, fluoroquinolone demonstrates rapid absorption within the body and exerts bactericidal action. A notable example is the active substance enrofloxacin, which is employed in this class of antibiotics to treat cases of Chronic Respiratory Disease (CRD) caused by *Mycoplasma gallisepticum*. Enrofloxacin has also been utilized in cases of CRD that have become complicated due to secondary infections caused by *Escherichia coli* bacteria (Sumano *et al.* 1998)

Furthermore, there has been an anticipated increase in the utilization of beta-lactams from 2020 to 2022, a development that can be attributed to the prohibition of colistin-class antibiotic combinations, as outlined in the amendment to the attachment in the Regulation of the Minister of Agriculture of the Republic of Indonesia No. 4 of 2017 concerning the Classification of Veterinary Drugs. Colistin, classified as a polypeptide antibiotic, exerts its antimicrobial action by impeding the permeability of bacterial cell membranes. Concerns have been raised regarding the potential consequences of excessive reliance on colistin in poultry farms, specifically the emergence of resistance mutations that could potentially impact human health (Fransesco 2023).

As illustrated in Figure 2, the miscellaneous category constitutes the predominant vitamin class utilized in poultry, accounting for 35% of all applications. This group encompasses a range of vitamin products, including multivitamins comprising vitamins A, B-complex, C, D, and E. These vitamins are designed to enhance growth and productivity in poultry.

As antioxidants, vitamins A, E, and C have been demonstrated to facilitate wound healing and regeneration of epithelial cells in the digestive, respiratory, and reproductive tracts of poultry (Setiawan *et al.* 2013). This contributes to the optimization of the body condition of poultry following infection. Triana (2006) posits that vitamin D plays a pivotal role in calcium and phosphate metabolism and is essential for skeletal development. B-Complex vitamins play a significant role in carbohydrate, protein, and fat metabolism, thereby contributing to optimal poultry growth. The use of multivitamins in poultry has been demonstrated to enhance

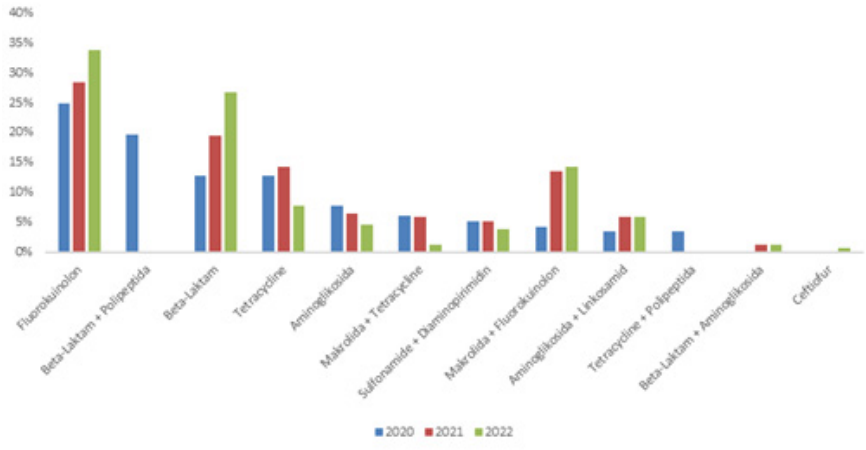

Figure 1. Graph of antibiotic classes in poultry at PT TMC Bandung branch in 2020-2022

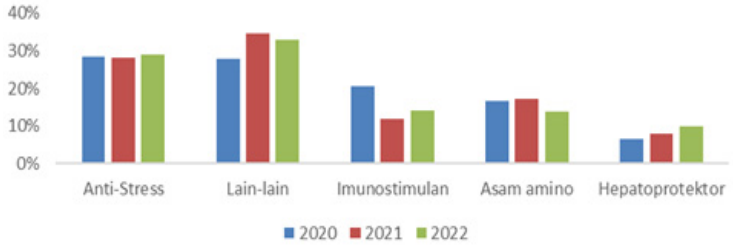

Figure 2. The graph presents a comprehensive overview of the vitamin groups present in poultry at the PT TMC Bandung branch from 2020 to 2022

fitness, growth, productivity, and survival (Anggorodi 1995). The high use of vitamins in poultry has been observed to be triggered by extreme temperature changes, rapid chicken growth, easy chicken stress, high density, the healing period after vaccination, moving cages, and chaff replacement. These conditions necessitate an increase in vitamin intake to support the stability and health of poultry, thereby ensuring maximum production of both eggs and meat.

A SWOT Analysis Strategy is Proposed for The Substitution of Polypeptide Colistin Antibiotics at PT TMC Bandung Branch

One of the polypeptide antibiotics is colistin, which is prohibited from oral, parenteral, and topical use in accordance with the alterations to Attachment No. 14 of 2017 to the Ministry of Health's Regulation No. 14 of 2017. PT TMC Bandung branch must develop a strategy to substitute these products.

As illustrated in Table 3, there was no utilization of polypeptide antibiotics in 2021 and 2022. These antibiotics are classified as veterinary medicinal products that are employed in conjunction with other antibiotic groups. This observation is consistent with the SWOT (Strength, Weaknesses, Opportunities, Threats) analysis strategy, which aims to substitute colistin group products with alternative products, such as single beta lactam products. The data indicates an increase in the percentage of use of a single beta lactam group.

Table 3. The utilization of polypeptide antibiotics in conjunction with single beta lactam in the Bandung branch for poultry during the 2021-2022 period is examined

Factions	2021	2021	2022
Beta lactam + Polipeptide	19.70%	0%	0%
Tetracycline + Polipeptide	3.40%	0%	0%
Beta lactam	13%	19%	27%

A SWOT matrix was developed to determine suitable strategies for substituting colistin-based products, with a focus on combinations of beta lactam + polypeptide and tetracycline + polypeptide. As illustrated in Table 4, the S-O strategy involves leveraging existing strengths to capitalize on opportunities. The S-T strategy entails identifying strengths to mitigate threats. The W-O strategy aims to minimize threats by leveraging existing opportunities. The W-T strategy is a strategy to reduce weaknesses and avoid threats (Haerawan & Intern 2019).

The SWOT matrix strategy prioritized capitalizing on opportunities related to colibacillosis and necrotic enteritis cases in poultry, which are two digestive diseases that can be effectively addressed with amoxicillin products belonging to the single beta lactam antibiotic class. This strategy enables single beta lactams to manage these cases without the necessity of colistin. Amoxicillin's antibiotic spectrum also boasts the advantage of a broad spectrum that is effective against Gram-positive and Gram-negative bacteria.

Table 4. The single beta lactam SWOT analysis demonstrates a set of strategies that are conducive to the substitution of polypeptide groups

External Factors **Internal Factors**	**Opportunities** Digestive cases such as colibacillosis and necrotic enteritis still exist in broiler and layer farms.	**Threats** There are many similar competing products, farmers are still hesitant if they do not use colistin for digestive treatment.
Strength The single beta lactam antibiotic amoxicillin can be used for the treatment of gastrointestinal cases such as colibacillosis and necrotic enteritis.	**S-O Strategy** Provide farmers with a medication program according to the indication.	**S-T Strategy** Analyzed the comparative products and explained the spectrum of effectiveness of beta lactams that there is no effect without colistin.
Weaknesses The antibiotic amoxicillin cannot be used for respiratory cases.	**W-O Strategy** Mentoring farmers in the field to conduct early detection of digestive cases.	**W-T Strategy** Provide additional product recommendations to accompany single beta lactam products in improving poultry performance and add to the selling point of the product.

CONCLUSION

Broiler farms showed the highest antibiotic (79%) and vitamin (81%) usage, with fluoroquinolones and miscellaneous vitamins being most common. A SWOT analysis supports substituting colistin with single beta-lactam antibiotics to align with regulatory changes and improve sustainability

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