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Growth Performance, Feed Utilization Efficiency, and Physiological Responses of Broiler Chickens Supplemented with Ethanolic Turmeric *(Curcuma Longa L.)* Extract in Drinking Water

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Abstract

This study evaluated the effects of varying levels of ethanolic turmeric (*Curcuma longa*) extract administered through drinking water on the growth performance, feed utilization, and water consumption of broiler chickens and assessed its potential as a natural growth-promoting additive. Anchored on the concept that the bioactive compounds of turmeric enhance digestion, nutrient utilization, antioxidant activity, and immune function, the study employed an experimental research design using a Completely Randomized Design (CRD). A total of 150 one-day-old Cobb 500 broiler chicks were randomly assigned to five treatment groups with three replications. Ethanolic turmeric extract was prepared through maceration and administered at concentrations of 0, 5, 10, 15, and 20 g/L in drinking water. Data on body weight, weight gain, percentage rate of growth, feed consumption, feed conversion ratio, feed conversion efficiency, and water consumption were analyzed using Analysis of Variance (ANOVA), with treatment means compared through the Honestly Significant Difference (HSD) test. The results showed no significant differences in most growth performance, feed utilization, and water consumption parameters. However, broilers supplemented with 15 g/L turmeric extract attained the highest final body weight, while the 5 g/L treatment achieved the best feed conversion ratio and greatest economic return. The findings indicate that moderate levels of turmeric extract, particularly 5–15 g/L, can improve selected production traits and may serve as a natural growth-promoting additive in broiler production. The study supports Sustainable Development Goal (SDG) 2: Zero Hunger by promoting sustainable livestock production and SDG 8: Decent Work and Economic Growth by identifying a natural feed additive that may improve production efficiency and economic returns. Its findings contribute to agricultural and economic sustainability by encouraging safer and more efficient poultry production practices.

Keywords: Broiler Chickens, Completely Randomized Design, Curcuma Longa, Ethanolic Turmeric Extract, Feed Utilization, Growth Performance, Water Consumption

1. Introduction

Broiler production is an important source of affordable animal protein and income but faces challenges such as high feed costs, disease, oxidative stress, and restrictions on antibiotic growth promoters (Aviagen, 2022; Havenstein, Ferket, & Qureshi, 2003; Castanon, 2007). These concerns have increased interest in natural feed additives like turmeric (*Curcuma longa*), which contains curcumin and other bioactive compounds with antioxidant, antimicrobial, anti-inflammatory, and immunomodulatory properties that may improve broiler performance (Abbas et al., 2010; Alagawany et al., 2021). This study evaluates the effects of ethanolic turmeric extract administered through drinking water on the growth performance, feed utilization, and water consumption of broiler chickens.

1.1 Background of the Study

Modern broilers are bred for rapid growth and efficient meat production, reaching market weight within 30–45 days (Aviagen, 2022). However, intensive production is challenged by disease, metabolic disorders, and increasing production costs (Havenstein, Ferket, & Qureshi, 2003). The restriction of antibiotic growth promoters has encouraged the use of natural alternatives, with turmeric emerging as a promising phytogenic additive because of its beneficial bioactive compounds (Castanon, 2007; Abbas et al., 2010; Alagawany et al., 2021). Previous studies have shown that turmeric

improves broiler performance, although the optimum preparation and dosage vary. Positive results have been reported using fresh extract (Aglipay et al., 2024), aqueous extract (Baqer et al., 2023), turmeric powder (Chala Kinati et al., 2022; Nguyen, 2022; Enyenihi et al., 2021), turmeric leaf meal (Akpan et al., 2025), cooked turmeric (Anyanwu et al., 2021), and encapsulated extract (Rido, 2025). However, Kumar et al. (2020) and Durrani et al. (2022) reported inconsistent findings regarding the most effective supplementation level. Moreover, limited studies have evaluated ethanolic turmeric extract administered through drinking water, highlighting the need for further investigation.

1.2 Themes and Insights from Related Literature

The literature consistently identifies turmeric as a natural alternative to antibiotic growth promoters because of its antioxidant, antimicrobial, digestive, and immunomodulatory properties. Studies have shown that turmeric enhances antioxidant status, gut health, immune response, nutrient utilization, and growth performance (Khanghahi et al., 2024; Hussein et al., 2020; Rahmani et al., 2021). Several studies likewise reported improvements in body weight gain, feed conversion ratio, and feed efficiency following turmeric supplementation (Baqer et al., 2023; Nguyen, 2022; Enyenihi et al., 2021; Akpan et al., 2025; Rido, 2025). Meanwhile, Aglipay et al. (2024) and Anyanwu et al. (2021) found that turmeric supplementation reduced feed consumption while maintaining or improving productive performance. Despite these positive findings, variations in extraction methods, dosage, and routes of administration indicate that the optimum level of ethanolic turmeric extract in drinking water remains to be established.

1.3 Local, National, and Global Context

Broiler production is a major contributor to food security and agricultural economies worldwide because of its efficient production and ability to provide affordable animal protein (FAO, 2023). In the Philippines, the poultry industry continues to expand to meet increasing consumer demand, but producers face challenges including disease outbreaks, oxidative stress, high feed costs, and restrictions on antibiotic growth promoters (Aviagen, 2022; Castanon, 2007). These challenges have encouraged the adoption of natural phytogenic feed additives such as turmeric (*Curcuma longa*), which has shown potential to improve broiler health, feed efficiency, and productivity (Abbas et al., 2010; Alagawany et al., 2021). However, information on the use of ethanolic turmeric extract through drinking water under local production conditions remains limited.

1.4 Theoretical or Conceptual Basis

This study is anchored on the concept that the bioactive compounds in turmeric, particularly curcumin, enhance broiler performance through antioxidant, antimicrobial, anti-inflammatory, and immunomodulatory activities. These compounds improve digestive enzyme activity, intestinal health, nutrient absorption, and immune function, leading to better growth performance and feed efficiency (Prasad & Aggarwal, 2018; Khanghahi et al., 2024; Hussein et al., 2020; Rahmani et al., 2021). Consequently, ethanolic turmeric extract is expected to improve body weight, weight gain, feed utilization, and water consumption when administered through drinking water.

1.5 Research Gaps and Rationale

Previous studies have demonstrated the benefits of turmeric supplementation using different preparations, including powder, aqueous extract, cooked turmeric, leaf meal, and encapsulated extract (Baqer et al., 2023; Nguyen, 2022; Enyenihi et al., 2021; Akpan et al., 2025; Anyanwu et al., 2021; Rido, 2025). However, findings remain inconsistent regarding the optimum supplementation level (Kumar et al., 2020; Durrani et al., 2022), and relatively few studies have evaluated ethanolic turmeric extract administered through drinking water. Therefore, this study was conducted to determine the effects of different levels of ethanolic turmeric extract on the growth performance, feed utilization, and water consumption of broiler chickens and assess its potential as a natural alternative to synthetic growth promoters.

1.6 Alignment with Relevant Sustainable Development Goals (SDGs)

This study supports SDG 2: Zero Hunger by exploring a natural feed additive that may improve broiler productivity and contribute to sustainable livestock production. It also aligns with SDG 8: Decent Work and Economic Growth by promoting cost-effective poultry production practices that may enhance farmers' productivity and income.

1.7 Importance of the Study to Multidisciplinary Sustainability

The study contributes to agricultural, food security, economic, and environmental sustainability by evaluating ethanolic turmeric extract as a natural alternative to antibiotic growth promoters. Its findings may support safer poultry production, reduce dependence on synthetic additives, improve production efficiency, and encourage sustainable farming practices that benefit poultry producers and consumers.

2. Material and methods

2.1 Research Design

The study employed an experimental research design using a Completely Randomized Design (CRD). Prior to the experiment, approval was obtained from the Institutional Animal Care and Use Committee (IACUC) after the research protocol was evaluated for scientific validity, animal welfare, and compliance with institutional guidelines.

Fresh turmeric (*Curcuma longa*) rhizomes were cleaned, sliced, dried, ground into powder, and stored in airtight containers before extraction. Ethanolic turmeric extract (ETE) was prepared through maceration by mixing turmeric powder with food-grade ethanol at a 1:10 (w/v) ratio. The mixture was allowed to stand for 24 hours with periodic stirring, followed by filtration through sterile cheesecloth. The filtrate underwent natural evaporation for 3–5 days to concentrate the extract before being stored in sealed containers under cool, dry conditions until use. The prepared turmeric powder was subjected to qualitative phytochemical screening at the Central Analytical Laboratory, Cagayan State University–Andrews Campus, Tuguegarao City, Cagayan. The analysis followed the methods of Guevarra (2005) to determine the presence of flavonoids, phenols, tannins, saponins, terpenoids, steroids, coumarins, anthocyanins, alkaloids, and glycosides. The ethanolic turmeric extract was diluted with distilled water to prepare four treatment concentrations: 5 g/L, 10 g/L, 15 g/L, and 20 g/L. Fresh treatment solutions were prepared daily and continuously administered through the birds' drinking water, while the control group received plain distilled water. A total of 150 one-day-old Cobb 500 broiler chicks were randomly assigned to five treatments with three replications, consisting of ten birds per replication. Figure 1 illustrates the Completely Randomized Design used in assigning the birds to the five treatment groups: plain drinking water (control), 5 g/L, 10 g/L, 15 g/L, and 20 g/L of ethanolic turmeric extract in drinking water.

2.2 Locale of the Study

The study was conducted at the instructional poultry house of Isabela State University–San Mariano Campus. The facility consisted of fifteen cages measuring 1.0 m × 1.25 m, constructed with concrete walls and GI-sheet roofing to promote adequate ventilation and lighting. Each cage was equipped with a 100-watt incandescent bulb to provide supplemental lighting throughout the experimental period.

2.3 Respondents of the Study

The experimental animals consisted of 150 day-old Cobb 500 broiler chicks procured from Sagittarian Agricultural Philippines, Inc., Ilagan City, Isabela. The birds served as the experimental units for evaluating the effects of varying concentrations of ethanolic turmeric extract administered through drinking water.

2.4 Sample and Sampling Procedure

A total of 150 day-old Cobb 500 broiler chicks were procured from Sagittarian Agricultural Philippines, Inc., Ilagan City, Isabela. The birds were randomly assigned to five treatment groups with three replications, each consisting of ten birds, using a Completely Randomized Design (CRD). Prior to chick placement, the poultry house was thoroughly cleaned and disinfected to maintain proper sanitation. The broilers received commercial starter feed during the first three days, followed by a formulated home-mixed ration for the remainder of the study. Feed and clean drinking water were provided ad libitum throughout the experimental period, and the birds were managed under uniform environmental and husbandry conditions.

2.5 Research Instrument

The study utilized fresh turmeric (*Curcuma longa*) rhizomes, food-grade ethanol, distilled water, poultry production facilities, and standard measuring equipment. The turmeric powder underwent qualitative phytochemical screening at the Central Analytical Laboratory, Cagayan State University–Andrews Campus, following the methods of Guevarra (2005) to determine the presence of major bioactive compounds. Growth performance was evaluated using body weight, weight gain, percentage rate of growth, feed consumption, feed conversion ratio, feed conversion efficiency, dressing percentage, and water consumption.

2.6 Data Gathering Procedure

Ethical clearance was obtained from the Institutional Animal Care and Use Committee (IACUC) before the study. Fresh turmeric rhizomes were cleaned, dried, ground, and extracted with food-grade ethanol through maceration, followed by filtration, evaporation, and proper storage. The extract was diluted to prepare four treatment concentrations (5 g/L, 10 g/L, 15 g/L, and 20 g/L), while the control group received plain distilled water. One hundred fifty (150) Cobb 500 broiler chicks were randomly assigned to five treatments with three replications under a Completely Randomized Design. Figure 1 illustrates the random distribution of birds into the treatment groups. The birds received commercial starter feed during the first three days, followed by a formulated home-mixed ration. Table 1 presents the ingredient composition of the starter and finisher diets, while Table 2 summarizes their calculated nutrient composition. Feed and water were provided ad libitum, and body weight, feed consumption, water consumption, dressing percentage, feed conversion ratio, feed conversion efficiency, and growth rate were recorded throughout the experimental period.

2.7 Data Analysis Techniques

The collected data were analyzed using Analysis of Variance (ANOVA) under a Completely Randomized Design (CRD) through the Statistical Tool for Agricultural Research (STAR). Significant differences among treatment means were determined using the Honestly Significant Difference (HSD) test.

3. Results and Discussion

3.1 Growth Performance of Broiler Chickens

3.1.1 Body Weight

The broilers remained healthy and exhibited normal growth throughout the study. Initial body weights were comparable among treatments, indicating uniformity at the start of the experiment. No significant differences were observed from the first to the fifth week. However, significant differences occurred during the sixth week, with the 15 g treatment recording the highest final body weight, followed closely by the 5 g treatment, while the 10 g treatment obtained the lowest body weight. The remaining treatments showed intermediate values. These findings indicate that moderate supplementation levels were more effective in improving final body weight than higher or intermediate concentrations. The results support those of Khanghahi et al. (2023), Baqer et al. (2023), Rido (2025), and Nguyen (2022), who reported that turmeric enhances growth through improved digestion and nutrient utilization. The lower performance at the intermediate level is consistent with Enyenihi et al. (2021), suggesting that inappropriate inclusion levels may reduce feed utilization efficiency. Overall, the results demonstrate that turmeric extract can enhance broiler growth when administered at an optimum level.

3.1.2 Weight Gain

Although weight gain varied among treatments, no significant differences were observed throughout the experiment. The 5 g treatment recorded the highest total weight gain, whereas the 10 g treatment obtained the lowest value, indicating that the response to turmeric supplementation was not directly proportional to dosage. The findings suggest that moderate turmeric supplementation is more beneficial than higher inclusion levels. Similar observations were reported by Baqer et al. (2023), Aglipay et al. (2024), and Rido (2025), who found that turmeric supplementation improves performance only at appropriate concentrations. These results emphasize the importance of determining the optimum dosage to maximize growth performance.

3.1.3 Percentage Rate of Growth

The percentage rate of growth showed no significant differences among treatments from the first to the sixth week. Although slight numerical improvements were observed during the final week, these variations were not statistically significant. The results indicate that turmeric supplementation did not consistently influence weekly growth rate. This agrees with Aglipay et al. (2024), who reported no significant effects of turmeric on growth-related parameters, and Baqer et al. (2023), who noted that responses may vary depending on dosage and management conditions. Thus, turmeric appears to influence cumulative growth performance more than weekly growth rate.

3.2 Feed Utilization Efficiency

3.2.1 Feed Conversion Ratio and Feed Conversion Efficiency

Numerically, the 5 g treatment achieved the lowest feed conversion ratio, indicating the most efficient feed utilization, while the 15 g treatment recorded the highest feed conversion efficiency. However, statistical analysis revealed no significant differences among treatments for either parameter. Although turmeric supplementation produced slight numerical improvements, its effects on feed utilization were not statistically significant. These findings are consistent with Aglipay et al. (2024), who also reported comparable feed conversion ratios among broilers receiving turmeric supplementation. The results suggest that moderate supplementation may improve feed efficiency, but the improvement was insufficient to produce significant treatment differences.

3.2.2 Feed Consumption

Feed consumption did not differ significantly among treatments throughout the experimental period. Although numerical variations were observed, no consistent trend favored any supplementation level. The findings indicate that turmeric extract did not influence feed palatability or voluntary feed intake. Similar observations were reported by Aglipay et al. (2024) and Khanghahi et al. (2023), who concluded that turmeric generally affects nutrient utilization rather than feed consumption. This suggests that differences in growth performance were more likely associated with improved nutrient utilization than increased feed intake.

3.3 Water Consumption

Water consumption showed slight numerical variations among treatments during the six-week period, but no significant differences were detected in either weekly or cumulative intake. Overall, the birds maintained comparable drinking patterns regardless of turmeric supplementation level. The results indicate that ethanolic turmeric extract did not significantly affect water intake. This supports the findings of Chala Kinati et al. (2022) and Enyenihi et al. (2021), who reported that turmeric

supplementation generally does not alter the feeding or drinking behavior of broiler chickens when provided at moderate levels.

4. Conclusion and Recommendations

The study found that supplementation of turmeric (*Curcuma longa*) extract in the drinking water of broiler chickens had no significant effect on most growth performance, feed utilization, carcass, and immune response parameters. However, significant improvements were observed in final body weight and selected cut-up parts. Broilers supplemented with 15 g turmeric extract achieved the highest final body weight, while 20 g produced the highest breast weight and 5 g resulted in the highest wing weight, best feed conversion ratio, and greatest economic return. These findings indicate that moderate levels of turmeric extract, particularly 5 g to 15 g, can improve selected production traits and serve as a potential natural growth-promoting additive in broiler production.

Based on the findings, turmeric (*Curcuma longa*) extract may be used as a natural supplement in the drinking water of broiler chickens because it did not adversely affect growth performance, carcass characteristics, feed utilization, or immune organ development. Supplementation at 5 g may be considered to improve feed efficiency and economic return, while 15 g may be used to enhance final body weight. Further studies are recommended to determine the optimum supplementation level between 5 g and 15 g and to evaluate meat quality, blood biochemical parameters, antioxidant status, gut health, immune response, and the effects of turmeric extract under different environmental conditions, management systems, and broiler strains.

The study was limited to evaluating the effects of five levels of turmeric extract supplementation administered through drinking water on broiler growth performance, feed utilization, carcass characteristics, immune response, and economic return under the management conditions of a single experimental site using Cobb 500 broiler chickens. The assessment covered only the production period and did not include detailed evaluations of meat quality, blood biochemical parameters, antioxidant status, or gut health, which may provide additional information on the effects of turmeric supplementation.

Compliance with ethical standards

The authors declares no conflict of interest, and this study received no external funding. The study was conducted at Isabela State University–San Mariano Campus, and all procedures involving broiler chickens were carried out following the approved Institutional Animal Care and Use Committee (IACUC) protocol; data were collected using non-invasive production measurements, and no identifying information was disclosed. The researchers acknowledge the institution for providing the facilities used in the study, and participation in the research procedures was voluntary, with informed consent obtained from the appropriate individuals involved before the conduct of the study.

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