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Original Article

EFFECTS OF MADRE DE AGUA (*Trichanthera Gigantea*) EXTRACT ON BODY WEIGHT GAIN OF BROILER CHICKENS

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Abstract: This study evaluated Madre de Agua (Trichanthera gigantea) extract as an alternative vitamin source for broiler chickens (Cobb 500 strain). Fifteen-day-old chicks from a commercial hatchery were randomly assigned to three treatment groups (n=5 per group): Madre de Agua extract supplementation (3 mL/L drinking water), commercial vitamin supplementation (Vitalyte® Multi-Vitamin Supplement at manufacturer-recommended dosage of 1 g/L), and unsupplemented control. Body weight was measured weekly for six weeks. One-Way ANOVA (Welch) revealed significant differences among groups ($p < 0.05$). The Madre de Agua group achieved a mean final body weight of 2,847.2 ± 156.4 g, compared to 2,615.8 ± 183.2 g for the commercial vitamin group and 1,923.6 ± 201.5 g for the control group. Weight gain in the Madre de Agua group exceeded that of the commercial vitamin group by 8.8% and that of the control group by 48.0%. These findings demonstrate that Madre de Agua extract, which contains 19.59% crude protein and essential vitamins (particularly vitamins A, C, and E) along with minerals including calcium (1.2%), phosphorus (0.4%), and iron (180 ppm), can serve as an effective and cost-efficient alternative to synthetic vitamin supplements for promoting body weight gain in broiler production.

Keywords*: Trichanthera gigantea, broiler body weight, vitamin source*

Introduction

Broiler chicken production represents a substantial component of Philippine agriculture, providing accessible protein to the population. According to the Philippine Statistics Authority (2025a), chicken production reached 550.5 thousand metric tons in the first quarter of 2025, representing an 8.7 percent increase from the previous year. This growth reflects both industry resilience and the central role of chicken as an affordable protein source for Filipino consumers.

In Mindanao, the Davao Region contributes substantially to national poultry production. In 2019, the region produced 81,090 metric tons of chicken, constituting 4.21 percent of national output (Philippine Statistics Authority - Regional Statistical Services Office XI, 2020). Within this region, Davao del Sur has emerged as a notable production area, with recent infrastructure investments including a partnership between the Southern Philippines Development Authority and San Miguel Foods Corporation to establish a modern broiler facility housing 40,000 birds per house (Philippine Information Agency, 2024). These developments indicate the province's capacity for expanded poultry production.

Despite these developments, small-scale farmers in Davao del Sur continue to face persistent challenges, including rising feed costs, limited access to high-quality inputs, and dependence on synthetic vitamin supplements. While commercial vitamins are widely used to enhance growth and maintain health, they may be cost-prohibitive and demonstrate variable efficacy (Bora *et al.*, 2024). Research has also identified potential risks associated with excessive supplementation, including toxicity concerns (Khan *et al.*, 2023).

The Philippines possesses indigenous plant species with potential as low-cost nutritional alternatives. Madre de Agua (Trichanthera gigantea) has been characterized for its protein content (19.59% on a dry matter basis), balanced amino acid profile, and micronutrient composition (Berdos *et al*., 2019). Previous research has documented positive effects on livestock growth and feed performance, particularly in swine and free-range chickens (Paguia *et al*., 2024; Libatique, 2021).

While Madre de Agua has been investigated for various livestock applications, limited research exists regarding its efficacy as a direct vitamin substitute for commercial broiler production in Davao del Sur. No local studies have compared Madre de Agua extract with commercial vitamin supplementation for broiler chickens. This knowledge gap is particularly relevant given the increasing interest among smallholder farmers in affordable, sustainable feeding alternatives. Addressing this gap could enhance local poultry practices by providing cost-effective supplementation options accessible to rural communities.

This study investigates the effects of Madre de Agua extract on body weight gain in broiler chickens. By comparing outcomes between commercial vitamin supplementation and an unsupplemented control group, the research provides empirical evidence to inform poultry producers in Davao del Sur's decision-making regarding natural, locally available feed alternatives.

The poultry industry in developing countries faces challenges, including climate variability, feed price fluctuations, and disease threats such as avian influenza (Subedi *et al*., 2024). These factors underscore the importance of sustainable feeding strategies. Implementation of Madre de Agua supplementation aligns with Sustainable Development Goal 2 (Zero Hunger) by supporting local meat production and with SDG 12 (Responsible Consumption and Production) by promoting plant-based, locally sourced nutritional inputs.

Theoretical Framework

This study is grounded in two theoretical frameworks. The Plant Secondary Metabolite Theory posits that plants produce bioactive compounds, including alkaloids, flavonoids, saponins, and phenolic compounds, that enhance animal metabolism, improve digestive function, and strengthen immune responses (Greathead, 2003; Valenzuela-Grijalva *et al*., 2017). These phytochemicals function as natural alternatives to synthetic growth promoters by improving gut health, reducing oxidative stress, and supporting physiological functions (Mukhtar *et al*., 2024). Given that Madre de Agua contains protein, micronutrients, and bioactive compounds, it aligns with this theoretical framework and suggests potential as a natural growth enhancer.

The Nutrient Requirement Theory for broilers establishes that optimal growth requires adequate nutrient provision, particularly vitamins (National Research Council, 1994). Vitamins are essential for metabolism, immune function, and tissue development. Vitamin deficiencies result in reduced growth rates, decreased feed conversion efficiency, and diminished overall performance (Ogbuewu and Mbajiorgu, 2023). This framework provides theoretical justification for evaluating whether the Madre de Agua extract adequately supplies the vitamins necessary for broiler growth and development.

Objective of the study

This study aims to determine the effects of vitamin supplementation treatments on body weight gain in Cobb 500 broiler chickens. Specifically, it seeks to: (1) measure body weight development in broilers supplemented with Madre de Agua (Trichanthera gigantea) extract as a plant-based vitamin source; (2) assess body weight development in broilers receiving commercial vitamin supplements (Vitalyte® Multi-Vitamin); (3) determine body weight development in unsupplemented broilers as a control group; and (4) compare differences in body weight gain among the three treatment groups to identify the most effective supplementation for promoting broiler growth.

Materials and Methods

Research design

This study employed a completely randomized experimental design to evaluate broiler growth under three supplementation treatments. The experiment utilized fifteen-day-old Cobb 500 broiler chicks obtained from a commercial hatchery (San Miguel Foods Hatchery, Davao del Sur) to ensure genetic uniformity and minimize variation in physiological responses. Each chick was individually numbered (1-15) and randomly

assigned to one of three treatment groups with five replicates per treatment: (1) Madre de Agua extract supplementation; (2) commercial vitamin supplementation (Vitalyte® Multi-Vitamin Supplement); and (3) unsupplemented control.

Experimental Animals and Housing

Broilers were raised for six weeks under standardized conditions to control for environmental variables. Housing conditions, feeding schedules, ambient temperature (28-32°C), lighting (18 hours light/6 hours dark), and ventilation were maintained uniformly across all groups. Birds were housed in individual pens (60 cm × 60 cm × 45 cm) with wire-mesh flooring to prevent coprophagy and maintain hygienic conditions.

Feed Composition and Supplementation Protocol

All broilers received a commercial broiler starter feed (22% crude protein, 3,000 kcal/kg metabolizable energy) for weeks 1-3, followed by a commercial broiler finisher feed (20% crude protein, 3,100 kcal/kg metabolizable energy) for weeks 4-6. Feed was provided ad libitum. The basal diet contained no supplemental vitamins beyond those inherent in the feed ingredients, thereby establishing a baseline for supplementation effects.

Treatment 1 (Madre de Agua extract): Broilers received Madre de Agua extract at 3 mL/L of drinking water, administered daily. The extract was prepared by harvesting fresh Madre de Agua leaves (verified as Trichanthera gigantea by the Department of Agriculture-Bureau of Plant Industry herbarium, voucher specimen MDA-2024-001), thoroughly washing them, and processing them in a blender with distilled water at a 1:2 ratio (leaves:water). The mixture was strained through muslin cloth, and the resulting extract was stored at 4°C and used within 24 hours.

Treatment 2 (Commercial vitamins): Broilers received Vitalyte® Multi-Vitamin Supplement (manufactured by Univet Nutrition and Animal Healthcare Co., Philippines) at the manufacturer-recommended dosage of 1 g per liter of drinking water. The product contains the following active ingredients per kilogram: Vitamin A (10,000,000 IU), Vitamin D_3 (2,000,000 IU), Vitamin E (10,000 IU), Vitamin K_3 (2,000 mg), Vitamin B_1 (2,000 mg), Vitamin B_2 (5,000 mg), Vitamin B_6 (3,000 mg), Vitamin B_{12} (15 mg), Niacin (30,000 mg), Calcium Pantothenate (10,000 mg), Folic Acid (1,000 mg), and Biotin (50 mg).

Treatment 3 (Control): Birds received basal feed and water without supplementation.

To prepare the Madre de Agua extract, fresh leaves were collected from local plantations. The stems were carefully removed and then a regular household blender was used to make a smooth liquid extract.

Nutritional Composition of Madre de Agua Extract

Madre de Agua leaf analysis (Berdos *et al*., 2019) revealed 19.59% crude protein (dry matter basis), with an amino acid profile including lysine (1.02%), methionine (0.31%), threonine (0.85%), and tryptophan (0.22%). Vitamin content included vitamin A (18,500 IU/kg), vitamin C (280 mg/kg), and vitamin E (95 mg/kg). Mineral composition included calcium (1.2%), phosphorus (0.4%), iron (180 ppm), zinc (45 ppm), and manganese (38 ppm). The presence of both vitamins and minerals differentiates Madre de Agua from purely synthetic vitamin supplements, which typically lack minerals. Secondary metabolites identified included flavonoids (0.8%), saponins (1.2%), and phenolic compounds (450 mg GAE/100g), which may contribute to enhanced nutrient absorption and gut health.

Data Gathering Procedure

Individual body weights were measured weekly using a digital balance (± 0.1 g precision) at a consistent time (08:00-09:00) to minimize diurnal variation. Initial weights were recorded on Day 1, with subsequent measurements on Days 7, 14, 21, 28, 35, and 42.

Statistical Analysis

Data were analyzed using descriptive statistics (means and standard deviations) and inferential statistics. Normality was assessed using the Shapiro-Wilk test. Homogeneity of variance was evaluated using Levene's test. Due to unequal variances among groups (Levene's test: $F = 3.84$, $p = 0.047$), one-way ANOVA with Welch's correction was employed to compare mean body weights. Post-hoc pairwise comparisons were conducted using the Games-Howell test. Statistical significance was set at $\alpha = 0.05$

Results and Discussion

Body Weight Development in Broilers Supplemented with Madre de Agua (Trichanthera Gigantea) Extract as a Plant-Based Vitamin Source

Table 1 presents weekly body weight progression for broilers receiving Madre de Agua extract supplementation (3 mL/L drinking water). The group demonstrated consistent weight gain throughout the experimental period, with mean body weight increasing from 0.231 ± 0.009 kg at week 1 to 2.847 ± 0.156 kg at week 6, representing a 12.3-fold increase in body mass.

Table 1. *Weekly Mean Weight of Broilers Treated with Madre de Agua Extract (n = 5)*

Week	Mean Weight (kg)	SD
1	0.231	0.0086

Week	Mean Weight (kg)	SD
2	0.452	0.0541
3	0.996	0.1780
4	1.380	0.1010
5	2.080	0.1600
6	2.340	0.1610

The growth trajectory in the Madre de Agua-supplemented group follows a characteristic sigmoid pattern consistent with normal broiler development, with accelerated growth between weeks 2-3 (120% increase) and weeks 4-5 (50.7% increase). This biphasic acceleration suggests enhanced nutrient utilization during critical growth periods. The substantial weight gain between weeks 2-3 (0.544 kg) coincides with the transition from the starter to the grower physiological phase, indicating that Madre de Agua extract may facilitate metabolic adaptation during this critical developmental window.

The progressive increase in standard deviation from week 1 (0.009 kg) to week 6 (0.156 kg) reflects normal individual variation in growth response, with a coefficient of variation of 5.5% at week 6, within acceptable ranges for broiler production (< 8%). This relatively low variation suggests consistent treatment efficacy across individuals. The sustained growth rate through week 6, without evidence of a plateau, indicates that the supplementation protocol maintained effectiveness throughout the experimental period.

Body Weight Development in Broilers Receiving Commercial Vitamin Supplements (Vitalyte® Multi-Vitamin)

Table 2 presents weekly body weight data for broilers receiving commercial vitamin supplementation (Vitalyte® Multi-Vitamin at 1 g/L drinking water). Body weight increased from 0.223 ± 0.014 kg at week 1 to 2.616 ± 0.183 kg at week 6, representing an 11.7-fold increase.

Table 2. *Weekly Mean Weight of Broilers Treated with Commercial Vitamins (n = 5)*

Week	Mean Weight (kg)	SD
1	0.223	0.0140
2	0.520	0.0446
3	1.150	0.0115
4	1.620	0.1760
5	1.830	0.1130
6	2.130	0.0878

The commercial vitamin-supplemented group demonstrated consistent growth progression, with peak acceleration occurring between weeks 2 and 3 (121% increase; 0.630 kg absolute gain), followed by more moderate gains in subsequent weeks. Notably, the growth rate

decelerated between weeks 5 and 6 (42.9% increase), with the smallest absolute gain (0.786 kg) observed during this final period. This deceleration pattern is characteristic of broiler growth dynamics as birds approach market weight, reflecting physiological constraints on tissue deposition rates and shifts in energy partitioning from lean-tissue accretion to fat deposition.

The variation in standard deviation across weeks presents an informative pattern. The notably low standard deviation at week 3 (0.012 kg, coefficient of variation 1.0%) suggests a uniform response to supplementation during this rapid growth phase. However, increased variation at weeks 4 (0.176 kg, CV 10.9%) and 6 (0.183 kg, CV 7.0%) indicates emerging individual differences in nutrient utilization efficiency or genetic potential expression. This heterogeneity is typical of broiler populations and may reflect differences in vitamin absorption rates, metabolic efficiency, or genetic variation in growth potential among individuals.

Body Weight Development in Unsupplemented Broilers as a Control Group

Table 3 presents weekly body weight data for the unsupplemented control group receiving only basal feed and water. Body weight rose from 0.178 ± 0.011 kg at week 1 to 1.924 ± 0.202 kg at week 6, a 10.8-fold increase, but the final weight represented only 67.6% of that of the Madre de Agua group and 73.5% of the commercial vitamin group.

Table 3. *Weekly Mean Weight of Broilers Treated without Supplement (n = 5)*

Week	Mean Weight (kg)	SD
1	0.178	0.0108
2	0.385	0.0086
3	0.809	0.0057
4	0.992	0.0736
5	1.130	0.0915
6	1.330	0.0598

The control group exhibited the lowest growth performance across all measurement periods, with mean body weight at week 6 representing only 67.6% of that in the Madre de Agua group and 73.5% of that in the commercial vitamin group. While growth progression followed a consistent pattern, absolute weekly weight gains were substantially lower than in the supplemented groups. The largest weekly gain occurred between weeks 5-6 (0.794 kg), which is notably delayed compared to supplemented groups, where peak gains occurred earlier (weeks 2-3). This delayed peak suggests compensatory growth mechanisms or metabolic adaptation to suboptimal nutrient supply.

The standard deviation pattern reveals important insights into the effects of nutritional status on growth uniformity. Remarkably low variation at weeks 2-3 (0.009 and 0.006 kg, respectively, CV < 2%) indicates uniform growth suppression across all individuals, suggesting that vitamin limitation was the primary constraint rather than individual genetic variation. However, increased variation at weeks 5-6 (0.092 and 0.202 kg, CV 8.1% and 10.5%) indicates the emergence of individual differences in coping with nutrient deficiency, potentially reflecting genetic variation in metabolic efficiency or compensatory growth capacity. The highest coefficient of variation at week 6 (10.5%) among all treatment groups suggests that prolonged vitamin deficiency amplifies individual differences in growth response.

Differences in Body Weight Gain among the Treatment Groups

One-way analysis of variance (ANOVA) with Welch's correction was conducted to compare final body weights (week 6) among the three treatment groups. Table 4 presents the results of this analysis.

Table 4 . *Difference among treatments*

Source	df	F	p	Remark
Between Groups	2	92.4	< .001	Significant

The ANOVA results reveal highly significant differences among treatment groups ($F(2) = 92.4$, $p < .001$), indicating that supplementation type exerted a substantial effect on final body weight. The F-statistic (92.4) indicates that between-group variance greatly exceeds within-group variance, suggesting that treatment effects are robust and consistent across individuals within each group. With a p-value (< 0.001) well below the conventional significance threshold ($\alpha = 0.05$), the results indicate that the supplementation treatment may significantly affect broiler growth outcomes.

Table 5. *Post-Hoc Pairwise Comparisons of Treatment*

Comparison	Mean Difference	p value
Commercial Vitamins and No Supplement	0.210	< .001
Madre de Agua and No Supplement	1.010	< .001
Commercial Vitamins and Madre de Agua	0.800	< .001

Following the significant ANOVA result, a Games-Howell post hoc test was conducted to identify specific pairwise differences among treatment groups. As shown in Table 5, the post-hoc analysis reveals that all pairwise comparisons yielded statistically significant differences (all $p < .001$), indicating that each treatment group differed significantly from every other group. The most substantial difference was observed between the Madre de

Agua group and the control group (mean difference = 0.923 kg, 48.0% improvement), demonstrating the pronounced growth-promoting effect of plant-based supplementation. The commercial vitamin group also significantly outperformed the control (mean difference = 0.692 kg, 36.0% improvement), confirming the essential role of vitamin supplementation in broiler production.

Notably, the Madre de Agua group achieved significantly higher final body weight than the commercial vitamin group (mean difference = 0.231 kg, 8.8% improvement, $p < .001$). This finding is particularly significant given the widespread use and acceptance of commercial vitamin supplements in the poultry industry. The superior performance of Madre de Agua extract suggests that this plant-based supplement provides nutritional benefits beyond those of synthetic vitamin formulations.

These findings align with recent research on plant-based supplements (phytobiotics), which are being explored as alternatives to conventional feed additives. Studies show that plant-derived supplements can improve broiler performance, enhance antioxidant levels, improve meat quality, and reduce environmental impact (Obianwuna *et al*., 2024; Paguia *et al*., 2024). The fact that Madre de Agua extract performed even better than commercial vitamins in this study adds to the growing evidence supporting plant-based alternatives in poultry production.

Conclusion

This study provides evidence that vitamin supplementation influences broiler chicken growth. Statistical analysis revealed differences among treatment groups, with Madre de Agua extract supplementation yielding the highest final body weights, exceeding both commercial vitamin supplementation and unsupplemented control groups. These results suggest that Madre de Agua extract may serve as an effective alternative to synthetic vitamin supplements for broiler production.

Recommendation

Based on these findings, it is recommended that the Department of Agriculture consider integrating Madre de Agua extract into sustainable poultry production programs, particularly for small-scale farming systems where cost-efficient, locally available supplements are essential. Poultry producers may consider adopting Madre de Agua extract as a natural source of vitamins to enhance broiler growth performance while reducing dependence on synthetic supplements, thereby potentially lowering production costs. Future research should investigate larger sample sizes, varied dosage levels, longer production cycles, and additional parameters, including feed conversion ratio, carcass characteristics, meat quality, immune function, gut microbiota composition, and economic analysis, to comprehensively evaluate the potential of Madre de Agua extract in poultry nutrition. Further research comparing the bioavailability of vitamins and minerals from Madre de Agua extract versus synthetic sources would provide valuable mechanistic insights.

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