GROWTH PERFORMANCE, CARCASS CHARACTERISTICS AND ECONOMICS ANALYSIS OF FINISHER BROILER CHICKENS ADMINISTERED PHYTOGENIC HORSERADISH *(Moringa oleifera)* LEAF EXTRACT

[1,2]Essen, P.O., [2] Njoku, G.N., [1]Ewa, U.E., [2]Iwere, J.I., [2]Ewa, D.O., [2]Onya, G.U., and [1,2]Zachary, B.N.
[1]College of Animal Science and Animal Production, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria.
[2]Federal College of Agriculture, Ishiagu, Ebonyi State, Nigeria.

Corresponding author: essenpaulinus93@gmail.com **Telephone Contact:** +234(0)8131907537

Target audience: Agricultural Extension Agents, Nutritionist, Fellow Researchers, Poultry Farmers

Abstract
This study evaluated the effects of *Moringa oleifera* leaf extract (MOLE) on the growth, carcass traits, and economics of finisher broiler chickens. A total of 120 unsexed four-week-old Anak broilers were divided into four treatment groups in a completely randomized design, with 30 birds per group and three replicates. The groups received varying MOLE concentrations in water: 0ml/L (T1 - control), 20ml/L (T2), 40ml/L (T3), and 60ml/L (T4) per liter, refreshed every three days, alongside *ad libitum* feed and water. Data collection spanned 28 days. Results showed significant improvements *(P<0.05)* in feed conversion ratio and weight gain for the treated groups, with the 60ml/L MOLE group (T4) achieving the highest gains. MOLE treatments also significantly enhanced *(P<0.05)* dressing weight, dressing percentage, and drumstick weight, with T4 again outperforming other groups. However, no significant differences *(P>0.05)* were observed in economic parameters, though the 60ml/L group showed better sales performance. In conclusion, MOLE was well-tolerated by the broilers, and inclusion up to 60ml/L of water improved growth performance, carcass traits, and economic viability, offering cost benefits at the highest inclusion level.

Keywords: Animal production, broiler chickens, growth promoter, leaf extract, *Moringa oleifera*

Description of Problem

The poultry industry in Nigeria faces challenges related to the scarcity and fluctuating quality of feed ingredients. The increasing world population will further impact the animal industry as the demand for animal protein rises. Addressing this demand involves exploiting unconventional feed ingredients and identifying new feed resources that do not compete directly with human food (1). Historically, antibiotics have been used as feed additives and for treating infections, but this has led to antibiotic-resistant bacteria. Due to health concerns, antibiotics have been banned in many countries, increasing interest in alternatives (2). (3) noted that Phyto-additives in animal nutrition are gaining attention as potential growth promoters and antibiotic alternatives. Some leaf meal/extracts which have been used as growth promoters in broiler chickens include *Moringa oleifera* (4), *Ocimum gratissimum* (2), *Zingiber officinale* (5), *Annona muricata* (6), *Syzygium aromaticum* (7), *Cymbopogon citratus* (8), *Carica papaya* (9) and many others.

Moringa oleifera, from monogeneric family Moringaceae, is widely grown in Africa, tropical Asia, Latin America, and the Pacific Islands. It is easy to cultivate, drought-resistant, and available year-round. Known as the "miracle tree," it has been used traditionally to treat many diseases (10). The leaves are preferred for animal diets as leaf meal. *M. oleifera* leaves have appetizing, digestion-stimulating, and antimicrobial properties. Every part of *M. oleifera* has beneficial properties, highly nutritious and multipurpose plant used as vegetables, livestock fodder, green manure, herbal medicine, spices, biopesticide, and seed production. The leave extract is rich in amino acids, potassium,

calcium, iron, ascorbate, and growth-regulating hormones like zeatin, making it an ideal growth enhancer. It also contains vitamins, antioxidants, and anti-inflammatory, anti-mutagenic, and anti-cancer properties (4). The leaves, flowers, and pods are good sources of vitamins A, B, C, riboflavin, nicotinic acid, folic acid, pyridoxine, ascorbic acid, beta-carotene, calcium, iron, selenium, and alpha-tocopherol (Dahat). MOLE provides energy, crude protein, and immune-boosting antimicrobial compounds (11). Studies show MOLE improves bird performance without detrimental health effects (12) and supplementation enhances immune response and intestinal health in broiler chickens (13).

However, no reports exist on the effect of MOLE in the water of Anak poultry from the 4th week to the finisher phase. This study investigates the optimal level of MOLE to improve poultry weight and performance while reducing feed costs to increase farmers' income. This experiment aims to determine the most suitable MOLE level for poultry drinking water to maximize benefits.

Materials and Methods

The study was carried out at the Poultry Unit of the Student Research Site of the Federal College of Agriculture, Ishiagu (FCAI), Ivo Local Government Area, Ebonyi State, Nigeria. The sourcing, processing and preparation of the test ingredient and animal management followed the method described by (2). The trial lasted over 28 days. Parameters of interest were collected following the methodology outlined by (14) and (15). All generated data were analyzed using a one-way analysis of variance (ANOVA) with statistical analysis systems (16). Significant means were separated using the Duncan Multiple Range Test in the same statistical package, at a significance level of $P<0.05$.

Results and Discussion

The growth performance of finisher broiler chickens administered graded levels of MOLE is shown in table 1. The result showed no significant ($P>0.05$) differences between the experimental groups, except for the feed conversion ratio (FCR). The non-significance ($P>0.05$) differences observed align with the finding of (14) who compared the performance traits of Anak and Marshal broiler strains at the finisher phase for 28 days. However, it disagrees with (2), who observed significant ($P<0.05$) impacts on broiler chickens' growth performance administered scent leaf extract (SLE) in drinking water for 56 days at 0, 30, 60, and 90ml/L SLE.

Table 1: Growth Performance of Finisher Broiler Chickens Administered Graded Levels of Moringa Oleifera Leaf Extract (MOLE) in the Drinking Water at 8 Weeks

Parameters	T_1(0ml)	T_2(20ml)	T_3(40ml)	T_4(60ml)	SEM
IBW (g)	1198.33±8.69	1286.00±8.71	1396.67±9.28	1331.67±7.96	36.09
FBW (g)	2081.30±21.12	2381.00±14.02	2218.37±20.45	2444.30±18.77	90.91
ADWG (g)	31.53±3.11	39.11±2.80	29.35±3.45	39.74±2.33	2.28
AWG (g)	882.97 ± 9.31	1095.00±9.45	821.70±7.60	1112.63±8.26	63.87
TFI (g)	4025.00±99.35	4311.70±87.51	4485.30±86.57	4147.70±98.40	86.28
ADFI (g)	143.75±7.06	153.99±8.68	160.19±6.53	148.13±6.87	3.10
FCR (%)	$4.56±0.55^{b}$	$3.96±0.85^{ab}$	$5.46±0.67^{bc}$	$3.73±0.72^{a}$	0.34
ADWI (g)	214.33±0.52	212.02±0.43	209.26±0.32	199.19±0.22	2.89
TWI (g)	6001.36±0.56	5936.57±0.31	5859.41±0.25	5577.39±0.14	80.87

a,b,c, means within the row with different superscript differ significantly ($P<0.05$) from each other, IBW= Initial body weight; FBW= Final body weight; ADWG=Average daily weight gain; TFI=Toal feed intake; ADFI=Average daily feed intake; AWG=Average weight gain; ADWI-Average daily water intake; TWI=Total water intake; SEM=Standard error of mean.

A lower FCR indicates better feed efficiency (17), and the results clearly show that MOLE at 60 ml/L (T4) enhanced both weight gain and FCR. Treated groups outperformed the control,

possibly due to its high protein, improved digestion and metabolism facilitated by *M. oleifera*'s bioactive compounds. (18) reported improved FCR in Vencobb-400 broilers fed 1.5% MOLM over 42 days. (19) similarly found better FCR (1.59; P<0.001) in Cobb broilers fed 3% MOLM. (20) observed significantly improved FCR with 90 ml/L and 120 ml/L MOLE (1.46 and 1.50, respectively) compared to the control (1.58) in Hubbard broilers. (4) reported the best FCR (6.12) with 90 ml MOLE, while (2) recorded an optimal FCR (3.38) in Anak broilers supplemented with 30 ml/L SLE over 49 days.

Table 2 illustrates the carcass and organ characteristics of Anak broiler chickens administered varying levels of MOLE in their drinking water. No significant differences (P>0.05) were observed among treatments in most carcass characteristics, except for dressed weight, dressing percentage, and drumstick. (19) and (21) similarly reported significantly increased dressed weight and dressing percentage in Cobb 500 and Anak broiler chickens fed 3% MOLM for 6 and 8 weeks, respectively. The results are consistent with (21) and (22), who reported increased carcass weight, dressing percentage, breast, thigh, and wing meat in broilers fed MOLM supplemented diets compared to the control group. However, the carcass characteristic values in this study were higher than those reported by (19) and (21) for broiler chickens after 42 and 56 days of rearing, respectively. This study demonstrates that MOLE can improve carcass yield in broilers.

Table 2: Carcass and Organs Characteristics of Finisher Broiler Chickens Administered Graded Levels of Moringa Oleifera Leaf Extract (MOLE) in the Drinking Water at 8 Weeks

Parameters	**T_1(0ml)**	**T_2(20ml)**	**T_3(40ml)**	**T_4(60ml)**	**SEM**
Live Weight (g)	2310.00	2100.00	2200.00	2216.70	70.24
Dressed Weight (g)	1647.00^{b}	1503.30^{a}	1530.00^{ab}	1790.00^{c}	56.64
Dressed Percentage (%)	74.37^{b}	71.41^{ab}	69.83^{a}	77.95^{c}	1.55
Premium cuts					
Breast (%)	30.41	30.36	27.67	30.65	0.61
Thigh (%)	13.98	15.59	16.98	15.17	0.54
Drumstick (%)	12.46^{a}	16.32^{c}	15.03^{b}	14.38^{ab}	0.70
Wings (%)	10.79	13.49	12.85	12.99	0.52
Back-cut (%)	19.78	18.16	20.48	21.01	0.96
Neck (%)	5.41	5.35	4.79	4.63	0.36
Internal organs and offal					
Gizzard (%)	2.12	1.86	1.82	2.22	0.11
Heart (%)	0.47	0.51	0.49	0.48	0.01
Liver (%)	2.82	1.86	2.5	2.04	0.28
GIT (%)	5.26	5.99	5.98	5.67	0.40
Spleen (%)	0.13	0.13	0.15	0.14	0.01
Kidney (%)	0.62	0.66	0.50	0.47	0.04
Lungs (%)	0.60	0.62	0.73	0.79	0.04
Head (%)	3.01	3.02	3.09	3.26	0.06
Shank (%)	4.64	4.70	4.72	4.73	0.75

a,b,c means within the row with different superscript differ significantly (P<0.05) from each other.

Table 3 presents the economic performance indices of finisher broiler chickens administered varying levels of *Moringa oleifera* leaf extract (MOLE) in their drinking water. Statistically significant differences (P<0.05) were observed across most cost-analysis parameters. The cost per kilogram of feed remained consistent across all treatments, ensuring unbiased evaluation.

Notably, broilers treated with 60 ml/L MOLE (T4) generated the highest income and gross margin, indicating reduced production costs and enhanced profitability. This supports (23), who emphasized profit as a key indicator of economic value in poultry production. Several studies corroborate these findings. (24) reported similar economic benefits with MOLE supplementation. (25) found that Isa Brown layers reared under the deep litter system yielded the highest revenue (₦1384.56). (26) and (24) noted that a cost-benefit ratio (CBR) above 1 indicates profitability, equal to 1 signifies break-even, and below 1 reflects loss. In this study, T4 achieved the highest CBR, confirming economic viability.(27) reported reduced production costs and improved net revenue in ginger-treated broilers, while (28) observed elevated CBR values (1.4–1.5) in large-scale poultry units during the pandemic—both aligning with the current findings. (14) reported lower revenue/bird (₦518.71 and ₦435.02) and gross margins (₦320.37 and ₦212.31) compared to this study. Similarly, (29) and (30) recorded lower gross margins in Anak and Marshal broilers, respectively. (31) emphasized that optimized diets enhance growth at reasonable cost—a principle validated by the profitability of 60 ml/L MOLE supplementation in this study. (32) also reported higher gross margins (₦518.74) and net profit (₦408.54) in MOLM-fed broilers, consistent with the present results.

Table 3: Economic Production Indices of Finisher Broiler Chickens Administered Graded Levels of Moringa Oleifera Leaf Extract (MOLE) in the Drinking Water at 8 Weeks

Parameters	T_1(0ml)	T_2(20ml)	T_3(40ml)	T_4(60ml)	SEM
Cost/Kg feed	115.75±0.00	115.75±0.00	115.75±0.00	115.75±0.00	0.00
TCFC	465.89±12.55^{a}	499.08±14.00^{c}	519.17±15.82^{d}	480.10±13.31^{b}	11.58
Cost/Kg WG	527.82±32.56^{b}	458.37±25.23^{c}	632.00±36.66^{d}	431.75±23.05^{a}	44.72
CoP	466.05±23.54^{a}	501.92±32.65^{c}	519.31±35.45^{d}	480.38±30.65^{b}	11.74
Revenue	1324.46±0.01	1642.50±0.10	1232.55±0.00	1668.95±0.21	110.57
Gross margin	858.41±23.56	1140.58±23.69	713.24±30.76	1188.57±30.45	113.69
CBR	2.84	3.27	2.37	3.47	0.29

a,b,c means within the row with different superscript differ significantly (P<0.05) from each other, TCFC= Total cost of feed consumed; WG= weight gain; CoP= Cost of production; CBR= Cost-benefit ratio

Conclusions and Applications

1. Inclusion of *Moringa oleifera* leaf extract (MOLE) at 60 ml/L in drinking water significantly improved growth performance, carcass traits, and profitability in Anak broiler chickens.
2. *Moringa oleifera* leaf extract (MOLE) presents a cost-effective, plant-based alternative to synthetic growth promoters, with no adverse effects on key production parameters.
3. Poultry farmers, animal nutritionists, and extension agents are encouraged to adopt MOLE supplementation, while further studies should investigate its safety and efficacy across different broiler breeds and plant parts.

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