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Effect of Aqueous Extract of *Momordica charantia* Leaf on Growth Performance, Organ Weight and Carcass Characteristics of Broilers

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ABSTRACT

This study evaluated the effects of Aqueous Extract of *Momordica charantia* Leaf (AEOMCL) on broiler growth performance, organ weight, and carcass characteristics. A total of 150-day-old broiler chicks were randomly assigned to five treatment groups in a completely randomized design, with three replicates of ten birds each. Treatments included: T1 (control, 0% AEOMCL), T2 (20% w/v AEOMCL + vaccine), T3 (20% w/v AEOMCL), T4 (40% w/v AEOMCL + vaccine), and T5 (40% w/v AEOMCL). The extract was prepared by soaking *M. charantia* leaves at 20% and 40% w/v for 12 hours before filtration. The experiment lasted eight weeks. Results showed a significant decrease ($p < 0.05$) in final weight, weight gain, and daily weight gain in treated groups, indicating an impact on growth performance. However, carcass yield and organ weight were not significantly affected ($p > 0.05$). These findings suggest that lower doses of *M. charantia* extract may be more beneficial for broiler growth. It is recommended that AEOMCL be administered at concentrations below 20% for optimal performance.

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INTRODUCTION

Poultry farming is a critical component of the global agricultural sector, providing an essential source of high-quality protein through meat and eggs. Poultry production, particularly broiler farming, is one of the most widespread and economically significant enterprises worldwide, contributing to food security and socio-economic development, especially in developing countries (Alders, 2005; Kawu 2023). Chickens are the most commonly raised poultry species, with broilers specifically bred for rapid growth, reaching marketable weight within 8–9 weeks under optimal management conditions (Akinsammi, 1994; Gayathry *et al*., 2022).

Despite the profitability of broiler production, the industry faces several challenges, including the high cost of feed and inefficiencies in feed conversion (Abbas, 2013). To enhance productivity, antibiotics have been widely used as growth promoters and for disease prevention. Commonly used antibiotics include virginiamycin, salinomycin, bacitracin, and tetracycline (Thomke & Elwinger, 1998; Phillips *et al*., 2004; Ghimire *et al*., 2023). However, concerns about antibiotic residues in poultry meat, the development of antimicrobial resistance, and potential health risks to consumers have led to strict regulations, including the ban on antibiotic growth promoters in the European Union (Butaye *et al*., 2000; Catala *et al*., 2008; Kawu. 2023). These concerns have driven the search for safer and more sustainable alternatives to antibiotics in poultry production.

Phytobiotics, which are plant-derived feed additives, have emerged as a promising alternative to antibiotics in animal nutrition. *Momordica charantia* (bitter melon) is a plant with significant medicinal and nutritional properties. It is rich in bioactive compounds such as flavonoids, saponins, alkaloids, and triterpenes, which exhibit antimicrobial, antioxidant, and immunomodulatory effects (Bakare *et al*., 2010; Oliveira *et al*., 2018). The plant is traditionally used in both human and animal medicine for its potential health benefits, including its hypoglycemic, anti-inflammatory, and antibacterial properties. In poultry production, *Momordica charantia* has been explored as a natural growth promoter and an alternative to synthetic antibiotics.

Given the increasing demand for antibiotic-free poultry products and the rising cost of conventional feed ingredients, this study aims to evaluate the potential of *Momordica charantia* as a phytogenic feed additive. The research specifically investigates the effect of aqueous leaf extract of *Momordica charantia* on growth performance, organ weight, and carcass characteristics of broilers. The findings from this study could contribute to the development of sustainable poultry feeding strategies, reducing dependence on synthetic antibiotics while enhancing productivity and profitability for poultry farmers.

MATERIALS AND METHODS

Experimental Site

This study was conducted at the poultry unit of the Agricultural Teaching and Research Farm, Faculty of Agriculture, Niger Delta University, Wilberforce Island, Amassoma, Bayelsa State, Nigeria.

Experimental Birds and Duration of Study

A total of 150-day-old Arbor Acre broiler chicks were purchased from CHI Farms Limited, Ibadan, Nigeria. The experiment lasted for eight weeks, including a one-week acclimatization period.

Experimental Design

The birds were randomly assigned to five treatment groups in a completely randomized design (CRD), with three replicates per treatment and ten birds per replicate.

Acclimatization Period

The birds underwent a one-week pre-experimental acclimatization period, during which they were provided with New Hope starter mash and clean drinking water ad libitum to help them adapt to their new environment.

Collection of Plant Material

Fresh *Momordica charantia* leaves were harvested from the Niger Delta University Teaching and Research Farm and surrounding areas in Amassoma Community.

Preparation of Aqueous Extract of *Momordica charantia*

The aqueous extract of *Momordica charantia* leaf (AEOMCL) was prepared following a standardized protocol to ensure consistency in concentration and quality. Fresh leaves of *Momordica charantia* were harvested, washed thoroughly with clean water to remove dirt, dust, and other contaminants, as described by Oboh *et al*. (2010) and Bakare *et al*. (2010).
The extract was prepared at two different concentrations:

20% w/v AEOMCL: 200 g of *Momordica charantia* leaves were weighed and blended using an electric blender.
40% w/v AEOMCL: 400 g of *Momordica charantia* leaves were similarly processed.

The blended leaf samples were soaked in 1 liter of clean water at room temperature (approximately 25–27°C) for 12 hours to allow for proper extraction of bioactive compounds, following the methodology described by Kumar *et al*. (2017). The mixture was then filtered through fine linen to remove solid residues, obtaining a clear aqueous extract.

The prepared extracts were stored in clean plastic containers and kept under refrigeration to prevent microbial contamination and maintain stability until use, as recommended by Dike and Aguiyi (2015).

Administration of Extract

The extract was administered orally via drinking water based on the birds' daily water requirement. The daily water intake per bird was estimated as 0.00528 L. The experimental treatments were:

T1 (Control): Vaccine only
T2: 20% AEOMCL + vaccine
T3: 20% AEOMCL
T4: 40% AEOMCL + vaccine
T5: 40% AEOMCL

Management of Experimental Birds

The birds were raised on a deep litter system using wood shavings as bedding material. Pens were disinfected three weeks before bird arrival, and a day before arrival, the brooding pen was preheated using a stove. Upon arrival, birds were given Glucose-D as an anti-stress measure. Feed and AEOMCL were provided ad libitum, and routine vaccinations (Lasota and Gumboro) were administered according to standard poultry management practices.

Data Collection

Water Intake (mL)

Daily water intake per treatment was determined by subtracting the leftover water from the initial quantity provided:
Water Intake = Initial Water Given - Leftover Water

Carcass Characteristics

At the end of the experiment, three birds per replicate were randomly selected for slaughter. Live weight was recorded before slaughter using a digital scale. After slaughtering via a killing cone, the birds were defeathered and partitioned, and carcass components (wings, thighs, breast, shank, and head) were weighed.

Organ Weight Examination

Three birds per replicate were randomly selected for organ weight assessment. Live and bled weights were recorded, followed by evisceration. The weights of internal organs (spleen, kidney, liver, heart, lungs, and gizzard) were measured using a digital scale.

Statistical Analysis

Data were analyzed using one-way analysis of variance (ANOVA) in MINITAB Version 16, based on a completely randomized design. Means were separated using Tukey's test at a 5% significance level ($p < 0.05$).

RESULTS

Effect of graded doses of aqueous extract of *Momordica charantia* leaf on performance of broiler birds

The effect of graded doses of aqueous extract of *Momordica charantia* leaf on performance of broiler birds is shown in Table 1. The result showed that Average Final Weight, Average Weight Gain and Average Daily Weight Gain were significantly different ($p<0.05$) while Average Initial Weight, Average Feed Intake, Feed Conversion Ratio, Feed Efficiency Ratio, Average Water Intake and Average Daily Water Intake were not significantly different ($p>0.05$).

The result revealed that Average final weight had the highest significant difference ($p<0.05$) in Treatment 1 (0%) and the least significant difference ($p>0.05$) in treatment 5 (40%). Result also showed that average weight gain had the highest significant difference ($p<0.05$) in treatment 1 and 2 (0% and 20%) respectively. While the least significant difference ($p>0.05$) was recorded in treatment 5 (40%). Average daily weight gain had the highest significant difference in treatment 1 and 2 (0% and 20%) respectively. And the least significant difference ($p>0.05$) in treatment 5 (40%).

Effect of graded doses of aqueous extract of *Momordica charantia* leaf on carcass yield of broiler birds

The effect of graded doses of aqueous extract of *M. charantia* leaf on carcass yield of broiler birds is shown in Table 2. The results revealed that there was no significant difference ($p>0.05$) in live weight, bled weight, carcass weight, thigh, shank, wing, head and breast weight across all treatment.

Effect of graded doses of aqueous extract of *Momordica charantia* leaf on organ weight of broiler birds

The effect of graded doses of aqueous extract of *Momordica charantia* leaf on organ of broiler birds is shown in Table 3. The results showed that there was no significant difference for all parameters (lungs, liver, Gizzard filled, Gizzard empty, heart, kidney and spleen) recorded across treatments.

Table 1: Performance Characteristics of Broiler Birds Administered Graded Doses of Aqueous Extract of *Momordica charantia* Leaf

Parameters	T_1 (0%)	T_2 (20%)	T_3 (20%)	T_4 (40%)	T_5 (40%)
Average initial weight (Kg)	0.29 ± 0.00	0.29 ± 0.00	0.29 ± 0.00	0.29 ± 0.00	0.29 ± 0.00
Average final weight (Kg)	3.02 ± 0.04^{a}	3.01 ± 0.02^{ab}	2.98 ± 0.07^{ab}	2.88 ± 0.05^{ab}	2.75 ± 0.08^{b}
Average weight gain (Kg)	2.77 ± 0.04^{a}	2.73 ± 0.03^{a}	2.69 ± 0.07^{ab}	2.57 ± 0.05^{ab}	2.45 ± 0.08^{b}
Average daily weight gain (Kg)	0.05 ± 0.00^{a}	0.05 ± 0.00^{a}	0.05 ± 0.00^{a}	0.05 ± 0.00^{a}	0.04 ± 0.00^{b}
Average Feed Intake (Kg)	6.85 ± 0.78	6.11 ± 0.01	6.33 ± 0.23	6.03 ± 0.01	6.24 ± 0.22
FCR (Kg)	2.47 ± 0.30	2.24 ± 0.0234	2.36 ± 0.12	2.35 ± 0.05	2.55 ± 0.03
FER (%)	41.47 ± 4.45	44.71 ± 0.46	42.63 ± 2.15	42.62 ± 0.88	39.30 ± 0.50
Average water intake (Kg/L)	18.35 ± 1.53	17.03 ± 0.01	16.99 ± 0.01	16.91 ± 0.03	16.91 ± 0.07
Average daily water intake (Kg/L)	0.33 ± 0.03	0.30 ± 0.00	0.30 ± 0.00	0.30 ± 0.00	0.30 ± 0.00

Means that do not share the same letter are significantly different.

MCALE: *Momordica charantia* aqueous leaf extract (T_1 (0%) – Control, T2 (20%) – 20%MCALE+ Vaccine, T3 (20%) – 20% MCALE, T_4 (40%) – 40% MCALE+ Vaccine, T_5 (40%) – 40% MCALE)

Table 2: Carcass Yield of Broiler Birds Administered Graded Doses of Aqueous Extract of *Momordica Charantia* Leaf

Parameters (g)	T_1 (0%)	T_2 (20%)	T_3 (20%)	T_4 (40%)	T_5 (40%)
Live weight	2.77 ± 0.09	2.67 ± 0.03	2.90 ± 0.10	2.70 ± 0.00	2.70 ± 0.06
Bled weight	2.50 ± 0.00	2.53 ± 0.03	2.73 ± 0.13	2.50 ± 0.00	2.53 ± 0.03
Carcass weight	2.13 ± 0.07	2.25 ± 0.13	2.32 ± 0.13	2.18 ± 0.02	2.33 ± 0.03
Thigh	285.67 ± 6.96	295.00 ±23.10	312.70 ±21.20	279.67 ±5.55	265.00 ± 38.40
Shank	48.33 ± 1.20	60.00 ± 5.51	50.00 ± 4.51	47.67 ± 1.20	53.33 ± 2.33
Wing	111.33 ± 8.95	106.33 ± 5.84	101.33 ± 8.51	110.33 ±0.88	103.00 ± 5.86
Head	81.00 ± 1.53	84.67 ± 6.69	77.67 ± 7.06	88.67 ± 3.84	82.67 ± 6.67
Breast	531.70 ± 19.40	513.00 ±16.60	440.00 ±55.70	556.70±57.50	566.30 ± 24.30

Means that share the same letter are not significantly different

MCALE: *Momordica charantia* aqueous leaf extract (T1 (0%) – Control, T2 (20%) – 20% MCALE+ Vaccine, T3 (20%) – 20% MCALE, T4 (40%) – 40% MCALE+ Vaccine, T5 (40%) – 40% MCALE)

Table 3: Organ weight of broiler birds administered graded doses of aqueous extract of *Momordica charantia* leaf

Parameters (g)	T_1 (0%)	T_2 (20%)	T_3 (20%)	T_4 (40%)	T_5 (40%)
Lungs	12.67 ± 1.67	12.67 ± 1.76	13.33 ± 1.33	12.00 ± 1.00	12.67 ± 2.19
Liver	37.33 ± 1.86	43.00 ± 7.51	38.00 ± 2.89	44.67 ± 1.86	36.33 ± 3.84
Gizzard filled	53.00 ± 5.69	56.67 ± 4.26	64.00 ± 3.79	62.00 ± 7.09	59.33 ± 6.17
Gizzard empty	45.00 ± 4.51	44.67 ± 1.76	51.67 ± 6.01	51.33 ± 7.13	49.33 ± 5.21
Heart	9.33 ± 0.67	9.00 ± 1.73	9.33 ± 0.33	9.33 ± 0.33	8.67 ± 0.33
Kidney	11.33 ± 0.88	13.67 ± 2.19	9.0000 ± 0.00	9.00 ± 1.00	10.67 ± 0.67
Spleen	4.67 ± 0.67	3.33 ± 0.33	3.667 ± 0.67	4.00 ± 1.15	4.00 ± 0.00

Means that share the same letter are not significantly different (P>0.05)
MCALE: *Momordica charantia* aqueous leaf extract (T1 (0%) – Control, T2 (20%) – 20% MCALE+ Vaccine, T3 (20%) – 20% MCALE, T4 (40%) – 40% MCALE+ Vaccine, T5 (40%) – 40% MCALE)

DISCUSSION

This study evaluated the effects of graded doses of aqueous *Momordica charantia* leaf extract (AEOMCL) on the performance, carcass characteristics, and organ weights of broiler birds. The findings revealed significant effects on growth performance but no significant impact on carcass yield or organ weight.

Growth Performance

The results indicated a significant decline ($p < 0.05$) in Average Final Weight (AFW), Average Weight Gain (AWG), and Average Daily Weight Gain (ADWG) across the treatment groups. Birds in the control group (T1, 0% AEOMCL) had the highest AFW (3.02 kg), while birds in T5 (40% AEOMCL without vaccine) recorded the lowest AFW (2.75 kg). This reduction in weight could be attributed to the presence of tannins in *Momordica charantia*, which have been reported to bind proteins and impair growth in broilers (Medugu *et al*., 2012; Hassan *et al*., 2003). Similarly, Hagerman *et al*. (2011) noted that tannins negatively affect dry matter intake and weight gain in poultry. However, contrary to this finding, Zuhra *et al*. (2018) reported that supplementing drinking water with 3% *Momordica charantia* extract improved broiler body weight. Additionally, Guler *et al*. (2023) observed no significant effects of *Momordica charantia* supplementation (0.15–0.45 g/kg) on broiler performance.

The decline in AWG across treatment groups was notable, with T1 (2.77 kg) and T2 (2.73 kg) exhibiting the highest gains, while T5 recorded the lowest. This supports previous findings that higher tannin concentrations negatively affect protein utilization and growth performance in poultry (Medugu *et al*., 2012). Furthermore, ADWG was similar across T1–T4 (0.05 kg) but significantly lower in T5 (0.04 kg), reinforcing the negative impact of higher AEOMCL doses.

Conversely, no significant differences ($p > 0.05$) were observed in Average Initial Weight, Average Feed Intake, Feed Conversion Ratio, Feed Efficiency Ratio, Average Water Intake, or Average Daily Water Intake among the treatment groups. This finding differs from Guler *et al*. (2023), who reported a significant decline in feed intake in broilers supplemented with *Momordica charantia* extract.

Carcass Characteristics

The analysis of carcass yield parameters, including Live Weight, Bled Weight, Carcass Weight, Thigh, Shank, Wing, Breast, and Head, showed no significant differences ($p > 0.05$) among treatments. This suggests that *Momordica charantia* supplementation had no adverse effects on carcass composition. Similar findings were reported by Guan *et al*. (2023), who observed no significant impact of dietary *Momordica charantia* on carcass quality in pigs.

Organ Weight

The evaluation of organ weights (Lungs, Liver, Gizzard Filled, Gizzard Empty, Heart, Kidney, and Spleen) also revealed no significant differences ($p > 0.05$) across treatments. This indicates that AEOMCL did not impair organ function or cause hypertrophy in broilers. These findings align with Kawu (2023), who also reported no significant effect of *Momordica charantia* supplementation on broiler organ weights.

CONCLUSION

This study demonstrated that while lower doses of *Momordica charantia* leaf extract had minimal effects on broiler growth performance, higher doses (40%) negatively impacted weight gain, likely due to tannin content. However, AEOMCL did not significantly alter feed and water intake, carcass characteristics, or organ weights. These results suggest that *Momordica charantia* can be used as a feed additive at lower concentrations but should be limited to avoid growth suppression in broilers. Further research is recommended to explore optimal inclusion levels that maximize benefits while minimizing anti-nutritional effects.

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