



Research Article

Dietary Supplement of Moringa Oleifera Leaf Meal on Growth Performance and Carcass quality of Grower Broilers

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ABSTRACT

This study was conducted to assess the impact of *Moringa oleifera* leaf meal (MoLM) on the growth performance and carcass quality of broiler chickens at the growing and finishing stages. Fresh *Moringa oleifera* leaves purchased was washed and air dried for two weeks, milled and incorporated into feed. A total of 108 twenty-eight day-broiler chicks of initial average weight of 940g were used in this experiment. Birds were randomly assigned to three treatments of 36 birds each. Each treatment was sub divided into three replicates of 12 birds each. The three treatments were designated T1(0% MoLM), T2(T 1 + 1% MoLM) and T3 (T1 + 3% MoLM). The experiment lasted for 28 days. Dietary treatments, were labelled as T1 (0% MoLM), T2 (T 1 + 1% MoLM) and T3 (T1 + 3% MoLM). Feeding and watering of birds were served *ad-libitum*. Productive performance and carcass characteristics of experimental birds were measured. 1 % MoLM diet had the best feed conversion ratio, while those on the 3% MoLM diet recorded the highest average body weight gain. Carcass analysis indicated that the birds on the 3% MoLM diet had the highest dressing percentage. Sensory evaluation parameters were significantly improved by the inclusion of 3% MoLM in the diet. The 3% MoLM breast cut grilled meat produced highest overall likeness and product intended to buy mean values. In conclusion, MoLM inclusion to broiler diets up to 3% improved birds' performance at growing stage. After week 4, the growth promoting property of MoLM was not observed.

Keywords: Antibiotics, carcass characteristics, feed additives, growth promoter, moringa oleifera

INTRODUCTION

Antibiotics have long been used to improve poultry performance and to make the most of the nutrients in feed (Phillips *et al.*, 2004; Huyghebaert *et al.*, 2011). However, its indiscriminate application has led to traces of these antibiotics in meat and products of treated animals leading to antimicrobial resistance build up (Vidovic and Vidovic, 2020). As a result, the use of some major antibiotics in animal production including poultry has been banned in certain countries due to the increasing consumer demand for safe, natural, and nutritious animal-based foods. Consequently, it has become necessary to search for non-conventional, affordable, readily available, and less competitive additives that may be used in chicken diet formulation as an alternative source to antibiotics (Charoenying *et al.*, 2008). Several plants have been incorporated in poultry diets to improve the feeding strategies and consequent growth performance of poultry (Ali and Al-

Shuhaib 2021; Gafotor *et al.*, 2026). Examples include, ginkgo biloba leaves (Zhang *et al.*, 2013), white tea leaves (Abbas *et al.*, 2019), morinda (Diarra, *et al.*, 2019), or mixed proportions of these medicinal supplements (Aroche *et al.*, 2018). According to Srivanthi and Rao (2014), medicinal plants possess phytochemicals and bioactive elements, such as vitamins, alkaloids, carotenoids, polyphenols, lipids, carbohydrates, and proteins that have a lasting positive impact on health. Chickens among some monogastrics, have been fed with diets containing variety of plants leaves, including *Leucaena leucocephala*, *Gliricidia sepium*, *Sesbania sesban*, and *Manihot esculenta*, which has been shown to improve their performance (D'Mello *et al.*, 1987). One such example of these medicinal plants is *Moringa oleifera*. The plant known technically as *Moringa oleifera*, which belongs to the *Moringaceae* family and genus *Moringa*, is native to Asia and is widely dispersed throughout Africa (Francis *et al.*, 2005). Several studies suggest *Moringa oleifera* as a potential alternative growth promoter in poultry diet due to its good protein content (Chiseva, 2006; Sarkwa *et al.*, 2020; 2022; 2025). *Moringa oleifera* possess significant amount of nutritional and medicinal properties which are beneficial to human and livestock as well as poultry (Banjo, 2012; Rathnayake *et al.*, 2019).

The main objective of the study was to evaluate the impact of *Moringa oleifera* leaves powder on the growth, carcass quality and sensory characteristics of grower broilers.

MATERIAL AND METHODS

Location of the Research Study

The experiment was conducted at the Poultry Unit of Methodist University Ghana, Wenchi Campus, Department of Agriculture. Wenchi is located on an Altitude of 304m (997ft) above sea level and lies within latitudes 7.73° North and longitude 2.1° West. The location has a mean temperature of 25°C and a mean annual rainfall of above 1,100mm, which has its major season starting in April and ends in July, with a second season termed minor season that runs from September to November, while the main dry season is from November to March.

Preparation of Moringa Oleifera meal

Fresh *Moringa oleifera* leaves was acquired and carefully cleaned to get rid of dirt. Cleaned leaves were allowed to air dry for two weeks at 38°C, under locally manufactured solar dryer until they were brittle. The dried leaves were ground into a fine powder in using Hanghui Automatic Spice Grinder Pulverizer (WF-30B- China) to 1.0mm mesh. Ground leaves was incorporated into experimental diets.

Experimental Design, Diets and Bird Management

A total of 108 twenty-eight-day old of “Cobb 500” broiler chicks (brooded on a common diet) were randomly assigned to three dietary treatment groups as follows; T1= % MoLM (control diet); T2= 1 % MoLM, (control diet + 1% MoLM) and T3= 3 % MoLM (control diet + 3 % MoLM). Each treatment was replicated three times with 12 birds per replicate. Experiment lasted 28 days and diets consisted of a finisher diet (day 29-49). The composition of the finisher diets is shown in Table 1. Feed and water were provided *ad libitum*, and birds had 24 hours of light/ day throughout the experiment.

Table 1. Composition of basal diets (DM basis) and Nutrient Levels

Ingredient (%)	Finisher (d 29 to 42)		
	0%MoLM	1% MoLM	3% MoLM
Maize	56.62	56.62	56.62
Soya bean meal	23.55	22.55	20.55
Wheat bran	17.03	17.03	17.03
Moringa <i>oleifera</i> leaf meal	0.00	1.00	3.00
Limestone	1.50	1.50	1.50
Methionine	0.15	0.15	0.15
Lysine	0.15	0.15	0.15
DCP	0.20	0.20	0.20
Broiler premix*	0.30	0.30	0.30
NaCl	0.50	0.50	0.50
Nutrient Level			
Dry matter (%)	87.74	87.73	87.72
Ash (%)	5.45	5.41	5.44
Ether extract	3.09	3.11	3.13
Crude protein (%)	19.12	19.08	19.02
Crude fiber (%)	5.43	5.56	5.81
ME (Kcal/kg)	2966	2953	2934
Lysin (%)	1.01	1.12	1.14
Methionine (%)	0.45	0.43	0.42
Calcium (%)	1.26	1.32	1.51
Total phosphorus (%)	0.43	0.45	0.45

Growth Performance

Birds were weighed at the onset of the growth trial and subsequently at weekly intervals. Daily feed intake was recorded weekly. These values were used to estimate average daily feed intake (ADFI) and average daily weight gain (ADG). Feed conversion ratio (FCR) was calculated as the ratio of ADFI to ADG.

Carcass Analysis

Four Birds from each treatment were slaughtered and examined for defeathered, dressed carcass, internal organ, and abdominal fat weights according to (NY/T823-2004). Retail cuts weighed included neck, thighs, drumsticks, breast, and wings while internal organs comprised proventriculus, gizzard, liver, heart, and intestine.

Sensory Evaluation

Twenty panelists were screened for sensitivity to fishy and cardboard flavours using nine two-fold dilutions of exudates from fresh tilapia and 10g of cardboard boiled in distilled water for 1 hr. Each set of flavour profile was provided with a distilled water control. The panelists were also screened for tenderness and juiciness. Subsequently, 15 panelists were short-listed to participate in the sensory evaluation. This comprises, six males and nine females. The samples

were seasoned with the same amount of spices and grilled using Aoja BBQ Electrical griller (SKU: GE779H) separately based on treatments to an internal temperature of 71° C, for 45 minutes. The grilled chicken breast cuts were sliced into uniform sizes approximately 10 g; randomly assigned labels and packed into respective coded 30ml containers and covered and served to the panelists along with a questionnaire and pencil. The sensory panel used a 15 points hedonic scale to assess the products palatability, flavour, juiciness, tenderness, overall liking and product intended to buy. Water and apple juice were provided to rinse off lingering odours after every sample (Coleman *et al.*, 2018).

Statistical analysis

Data collected were all subjected to one-way ANOVA using Genstat statistical software (12th edition), and means separated with LSD.

RESULTS AND DISCUSSION

Growth performance and carcass characteristics

Weekly body weight and growth trend are presented in Figure 1. The data showed that birds fed with 1% MoLM had higher weight gain after the first week compared to the control, while the 3% MoLM group matched the control. By the second week, both 1 % and 3 % MoLM groups outperformed the control in weight gain (Figure 1). The highest gain in week one was seen in the control and 1 % MoLM groups (1.31 kg), while the 3 % group had the lowest (1.27 kg). By week three, the 3 % MoLM group showed the highest gain (2.87 kg), exceeding the control (2.73 kg). No differences were noted in week four. Overall, birds on MoLM diets showed slightly higher growth trends than the control.

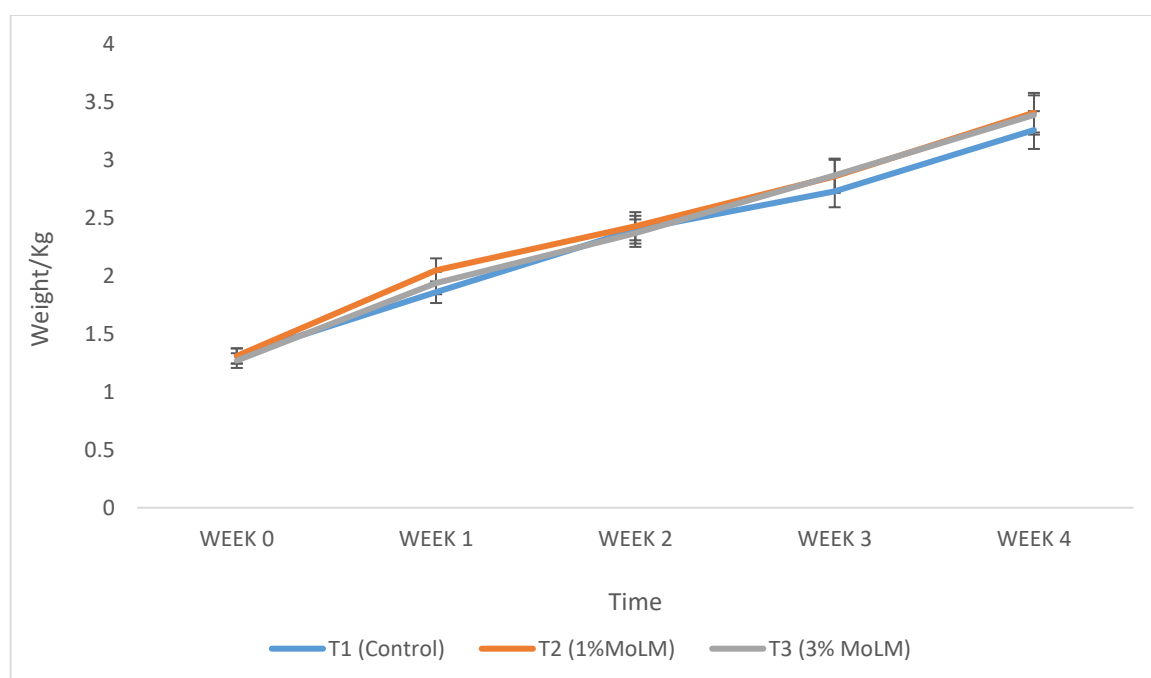


Figure 1: Growth trend of experimental birds within experimental period.

Table 2 presents the findings for final live weight, carcass weight, dressing percentage, feed intake, and feed conversion ratio. Broilers fed the 3 % MoLM diet had the highest average live weight (4.38 kg), while those on the 1 % diet had the lowest (4.20 kg). However, these differences

were not statistically significant. The 3% moringa diet also produced the highest carcass weight (3.55 kg), though the differences among treatments were not significant.

In terms of dressing percentage, the 3% moringa group achieved the highest value (81.05%), while the control group had the lowest (78.95%). Feed intake was lowest in the 1% moringa group (4.68 kg) and highest in both the control and 3% moringa groups (4.95 kg). Feed intake for the 1% group was significantly different ($P < 0.5$) from the other two. Notably, the 1% moringa diet resulted in the most efficient feed conversion ratio (1.11) compared to the control group (1.17).

Table 2: Effect of Moringa Leaf meal on Live Weight, Carcass Weight and Dressing Percentage

Parameters	Control	1% Moringa Powder	3% Moringa Powder	P values
Live Weight (Kg)	4.23	4.20	4.38	0.77
Carcass Weight (Kg)	3.34	3.34	3.55	0.74
Dressing Percentage (%)	78.95	79.52	81.05	0.03
Feed Intake (Kg)	4.95	4.68	4.95	0.05
Feed Convention Ratio	1.17	1.11	1.13	0.00

Table 2.1 shows the results for primal cuts. Broilers fed with 1% moringa leaf powder had the highest breast weight (1290g), while those in the control group had the lowest (1180g), though the differences were not statistically significant ($P > 0.5$). The highest average drumstick weight (874g) was recorded in broilers on the 3% moringa diet, with the control group showing the lowest (839g).

Wing weights were also lowest in the control group (231g), compared to higher values in the 3% and 1% moringa groups (309g and 301g, respectively). The gizzard weight was greatest in the 1% moringa group (69.5g) and lowest in the control (62.3g), with treatments T2 and T3 being significantly different ($P < 0.5$) from the control.

Interestingly, broilers fed the control diet (0% moringa) had the highest values for heart weight (18g), liver weight (83.5g), and leg weight (137.5g). Meanwhile, the highest head weight (91.0g) was recorded in the 3% moringa group, compared to the control group, which had the lowest head weight (85.2g).

Table 2.1 Effect of Moringa Leaf Powder on Carcass Quality

Primal Cuts	Control	1% Moringa Leaf	3% Moringa Leaf	Lsd (5%)	Cv%
Breast (g)	1180 ^a	1290 ^a	1289 ^a	279.4	12.9
Drum sticks (g)	839 ^a	864 ^a	874 ^a	195.4	13.1
Wings (g)	231 ^a	301 ^a	309 ^a	119.8	24.7
Gizzard (g)	62.3 ^b	69.5 ^a	69.0 ^a	6.0	5.2
Heart (g)	18.0 ^a	16.0 ^a	16.0 ^a	3.26	11.3
Liver (g)	83.5 ^a	72.5 ^a	71.2 ^a	19.49	14.9
Leg (g)	137.5 ^a	126.0 ^a	135.2 ^a	45.44	19.8
Head	85.2 ^a	88.8 ^a	91.0 ^a	35.68	23.3

Means with the same superscript within the same row are not significant ($P > 0.5$)

Sensory Quality

The effect of moringa leaf powder on the sensory characteristics of broilers in terms of palatability, flavour, juiciness, tenderness, overall likeness, and product intended to buy are presented in Table 3. The results indicated that 1% moringa leaf powder-fed broiler meat had a higher palatability score (8.73) over that the control with least score (6.67) which was significantly different ($P < 0.5$) from T2 and T3 respectively. In terms of the meat flavour, 3% moringa leaf powder-fed broilers produced the best score (7.60) over the 0% moringa leaf powder-fed broiler meat (6.67). The T2 and T3 were significantly different ($P < 0.5$) from the T1. The 1% moringa leaf powder broiler meat had the best juiciness (7.67) of the finished product over the 0% moringa leaf powder fed broilers with the least mean value (6.20). Statistically, T2 and T3 were significantly different ($P < 0.5$) from T1. The results for meat tenderness indicated that 3% moringa leaf powder had the highest mean value (8.33) against the 0% moringa leaf powder-fed broilers which was significantly different ($P < 0.5$) from the T2 and T3. The 3% moringa leaf powder-fed birds significantly produced the highest overall likeness and product intended to buy mean values (9.73 and 9.27) respectively over the 0% moringa leaf powder-fed birds.

Table 3 Effect of Moringa Leaf Powder on Sensory Quality

Parameters	Control	1% Moringa Leaf	3% Moringa Leaf	Lsd	Cv%
Palatability	6.67 ^b	8.73 ^a	8.33 ^a	0.75	12.9
Flavour	6.67 ^b	7.53 ^a	7.60 ^a	0.68	12.9
Juiciness	6.20 ^b	7.67 ^a	7.47 ^a	0.67	12.9
Tenderness	6.73 ^b	8.20 ^a	8.33 ^a	0.73	13.0
Overall Likeness	7.27 ^c	8.73 ^b	9.73 ^a	0.84	13.3
Product Intended to buy	5.67 ^c	8.00 ^b	9.27 ^a	0.86	15.4

Weekly Body Weight Gain

The similar body weights between broilers on the control and 3% MoLM diets may be due to reduced feed intake caused by the lower palatability and possible anti-nutritional factors in the higher moringa inclusion. These factors can limit nutrient absorption and affect early growth. By the second week, birds on the 1% MoLM diet showed the highest weight gain, followed by those on 3%, with the control group lowest. This agrees with the earlier study by Alidou *et al.* (2016) and Nduku *et al.* (2020) that lower feed intake in MoLM-fed birds might be due to anti-nutritional factors in moringa leaves that inhibit the bioavailability of the nutrients and affect production parameters negatively, including body weight during the commencement of the study.

Previous studies support that MoLM up to 10% does not harm performance, especially when birds are introduced to it from the start while levels above 10% showed negative impacts on performance (Abou-Elezz *et al.*, 2011; Gadzirayi *et al.*, 2012; Banjo, 2012). In this study, growth patterns were consistent across treatments, indicating no negative effects from MoLM. The improved final live weight may be attributed to the nutritional and antibacterial properties of moringa, as well as the birds' adaptation to the diet. MoLM enhanced performance during the grower stage, but its growth-promoting effects were less evident at the finisher stage (Eilert *et al.*, 1981).

Effect of MoLM on Weight, Feed Intake and Feed Conversion Ratio

Broilers fed with **3% Moringa leaf meal (MoLM)** and the **control** had the highest feed intake, while those on **1% MoLM** had the **lowest feed intake** but achieved the **best feed conversion ratio (FCR)**. Despite this, the 1% Moringa group showed the best feed conversion ratio (FCR), followed by the 3% group, with the control group having the poorest FCR. Since FCR is the ratio of feed consumed to body weight gained, MoLM improved feed efficiency and growth performance. These results support findings by Imoru *et al.* (2019), who suggested MoLM as a cost-effective alternative to expensive protein sources like soybean meal and groundnut cake due to its rich nutrient content.

The final live weight of the birds was highest in the group fed 3% Moringa leaf meal, supporting earlier studies that MoLM enhances broiler growth performance (Verma *et al.*, 2021; Compaore *et al.*, 2011). This improvement is linked to Moringa's rich content of vitamins, minerals, and antioxidants, which boost feed efficiency and weight gain. The study aligns with findings by Compaore *et al.*, (2011), who identified Moringa leaves as a good source of fats, proteins, and essential micronutrients like magnesium and zinc, making it effective in addressing malnutrition and improving broiler growth.

Carcass Parameters

Carcass weight is measured after slaughter, bleeding, plucking, and evisceration. Birds fed 3% Moringa (Treatment 3) recorded the highest carcass weight, live weight, dressing percentage, and feed conversion ratio, despite having similar feed intake to the control group. This suggests better feed utilization. Surprisingly, the control group had good feed intake and live weight but lower carcass yield, likely due to increased feather weight.

Although Treatment 2 (1% Moringa) had lower live weight, it still outperformed the control in carcass weight and dressing percentage. Statistical analysis showed no significant differences ($P > 0.5$) among treatments, supporting previous studies (Tekeli *et al.*, 2011) that Moringa inclusion or plant extracts may not significantly affect growth performance. Differences in feed nutrient content likely explain the observed trends. Birds fed Moringa diets had improved carcass traits, even with similar or lower feed intake, indicating its potential as a nutritious and efficient feed supplement.

The **3% MoLM group** recorded the **highest final live weight and carcass weight**, with a strong correlation between better feed utilization and enhanced growth. Though there were **no statistically significant differences ($P > 0.5$)** among treatments in weight gain or feed efficiency, broilers on MoLM diets generally outperformed the control group.

MoLM's nutritional benefits such as proteins, minerals, and antioxidants likely contributed to improved performance. The **1% MoLM group**, despite its lower feed intake, recorded the **highest breast weight**, suggesting superior nutrient utilization. Meanwhile, the control group showed high feed intake but poor conversion, possibly due to higher feather growth inflating live weight without improving muscle mass.

In terms of **carcass quality**, birds on Moringa diets had better-developed external parts (breast, drumsticks, wings, and head) and smaller internal organs. This indicates efficient nutrient allocation for meat development. These results are consistent with prior studies (Safa, 2012; Onunkwo and George, 2015; Bamgbose *et al.*, 1999), which showed that Moringa leaf meal enhances carcass traits and feed efficiency due to its rich nutrient profile and digestibility.

Sensory Evaluation

The inclusion of MoLM significantly influenced the sensory characteristics of the grilled breast cut of the chicken. The 3% inclusion of MoLM in the broiler finish diet significantly produced the best overall likeness and a product intended to buy (9.73 and 9.27) respectively. The present study agreed with findings of Maju and Bidhan (2025) who stated that inclusion of *Moringa oleifera* leaf powder at 3% scored the highest mean value for overall acceptability of the meat as compared to the other treatments. Harshini *et al.* (2022) reported that incorporation of 5% to 15% level of *Moringa oleifera* leaf powder recorded greater mean values for sensory attributes.

Moringa oleifera is noted to contain high levels of antioxidant compounds (Siddhuraju and Becker, 2003), and it moderates meat quality (Mielnik *et al.*, 2003). The higher sensory scores recorded among MoLM fed broilers could be attributed to the dietary antioxidants content in *Moringa oleifera* which can help lessen rancidity of fat in the meat and enhance the sensory characteristics of meat, and improve meat product shelf life (Lahucky *et al.*, 2010; Qwele *et al.*, 2013) and thus improve the palatability, flavour, and the overall liking as well as the product intended to buy by the sensory evaluators.

The tenderness, flavour and juiciness in MoLM fed broiler meat could be attributed to presence of a thin fat film which agreed with findings of Cui *et al.* (2022), that marbling significantly improved the tenderness, flavour and juiciness of pectoral meat of chickens. The present findings suggest that MoLM did not only maintain acceptability, but equally improved the eating superiority and market appeal of the meat. The fact that flavour, juiciness, tenderness, and palatability were all superior to the control agreed with the view that moringa acted as a functional phyto-genic feed additive rather than just a nutrient supplement.

The present results were in agreement with Biswas *et al.* (2015) in their study with inclusion of 0.5 and 2% of *Moringa oleifera* leaf powder fed broiler chicken scoring mean values for texture, juiciness, and overall acceptability when the products were evaluated. According to Sultana (2020), *M. oleifera* leaves are rich in certain alkaline minerals, such as calcium, magnesium, and potassium, and these could be attributing factors of the higher sensory scores for the broiler fed on MoLM diet.

CONCLUSION

In conclusion, *Moringa* leaf meal especially at 3% inclusion can serve as a valuable, cost-effective alternative protein source in broiler diets, enhancing growth performance, carcass yield, and feed efficiency without negative effects. The inclusion of moringa leaf meal in the broiler feed improved the sensory quality of broiler meat, with 3% inclusion producing the highest scores for overall liking and purchase intent, followed by 1%, while the control treatment recorded the lowest acceptability of grilled meat.

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Conflicts of interest: The authors declare no conflicts of interest.

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