Original Research Article

Evaluating the Effect of Moringa (*Moringa oleifera*) Leaf Supplemented Feed on the Growth and Carcass Quality of Broilers in Calabar

ABSTRACT

Background: Rapid population growth of human and livestock create increasing demands for food, nutrition security in developing countries and therefore alternative feed resources must be identified and evaluated. This study was carried out to investigate the effects of *Moringa oleifera* leaf meal (MOLM) on supplemented feed on the growth and carcass quality of broilers in Calabar.

Methodology: Fresh leaves of *Moringa oleifera* were bought and collected from Calabar, Nigeria. The leaves were dried for four days and milled. A total of 40 broiler chicks that 48 day-olds, unsexed (rose 308) were sourced from a reputable poultry farm in Calabar. The broiler chicks were randomly allotted to four treatment groups (A, B, C and D). 0%, 5%, 10% and 15% of MOLM were incorporated into the broiler feed which constituted the four treatment groups. Each group was replicated ten times at 10 birds per replicate. The following parameters were taken including feed intake, weight gain, feed conversion ratio, mortality rate and carcass quality. Data were subjected to statistical analysis.

Results: The diet supplemented with 5% of MOLM showed significantly high body weight and followed by 10% of MOLM. Feed intake values were significantly ($p<0.05$) different across the treatment groups. The weight gain (WG) was statistically similar for group B and C but significantly ($p<0.05$) different in group D; with birds fed with 10% MOLM based diet having the highest WG. The feed conversion ratio of the birds were not significantly ($p>0.05$) different in group B and C, but differed significantly ($P<0.05$) in group D when compared with the control in group A. Carcass characteristics showed higher values of dressing percentage in birds fed supplemented with 10% MOLM (group C). The levels of MOLM were not significantly different in terms of liver weight, heart weight, kidney weight and abdominal fat.

Conclusion: Overall, the best significant improvement in the response indices were obtained in birds fed 10% MOLM, while there was a reduced performance of birds feed with 15% MOLM.

Keywords: *Moringa oleifera*; growth; carcass quality; broilers; Calabar

1. INTRODUCTION

The rapid population growth of human and livestock create increasing demands for food, nutrition security in developing countries [1] and therefore alternative feed resources must be identified and evaluated. Commercial poultry meat production is expanding daily [1 – 3],

constituting an important pillar of food security improvement, socio-cultural and economic development in most countries [1 – 4]. Natural medicinal products originating from herbs, trees and spices have been used as feed additives for farm animals [1 – 2]. These natural products and their derivatives provide a rich source of drugs, food, vitamins and plant metabolites for man and animals [5-7]. As a result, it has become necessary to evaluate alternative protein sources, among which are the leaf meals. Presently, numerous studies are on-going into the viability of the *Moringa oleifera* leaf meal; especially because of the quality and quantity of food nutrients in it such as crude protein, water and fat-soluble vitamins, calcium, phosphorus and iron [8-12].

Moringa oleifera belongs to the family *Moringaceae*, which is widespread throughout the tropics and sub-tropics. It is a small to medium evergreen or deciduous tree that can grow to a height of 10–12 m (32–40 ft) and a trunk diameter of 45 cm (1.5 ft). The bark has a whitish-grey colour and is surrounded by thick cork. This plant has sparse foliage, white flowers and long pods, often planted in farms and compounds. Moringa flowers are pentamerous, zygomorphic, 7-11mm long and the fruit is typically 3-valved capsule; 10-60 cm in length [13-14]. The plant possesses multiple advantages because different parts of the tree (leaves, fruits, immature pods and flowers) are useful [15].

Moringa oleifera is one of the plants that can be introduced into livestock production feedstock to increase feed quality and quantity or availability. This plant can be used as a cheap protein supplement to improve the digestibility of other diets and also proffer medicinal values. *Moringa oleifera* has been widely valued as a versatile plant due to its multipurpose uses. The leaves, fruits, flowers and immature pods of the species are edible and form part of traditional recipes in many tropical and sub-tropical countries [15-16]. The leaves of *Moringa oleifera* are a good source of protein, vitamins A, B and C, and minerals such as calcium and iron [17]. Moringa leaves are used in animal diets as leaf meal because of high nutritional and medicinal qualities as

documented by researches [1, 18-20]. *Moringa oleifera* can play an imperative role in the economy of the poultry industry. In Nigeria, precisely Calabar, there is the rising cost of conventional protein-rich feeds. The high and increasing prices for conventional feeds have compelled researchers to direct their attention to non-conventional feeds; with particular emphasis on protein substitutes. Also, there are contradictory results on the effects of *Moringa oleifera* leaf meal inclusion in the diet of broilers concerning growth performance and carcass quality in some populations investigated [9-12, 18-20]. Against this backdrop, there is an urgent need for an updated evaluation of *Moringa oleifera* leaf supplemented the feed of broilers in Calabar, Cross River State. Therefore, this study aimed at evaluating the growth and carcass quality of broilers using *Moringa oleifera* leaf supplemented feed in a dose-dependent manner in Calabar.

2. METHODOLOGY

2.1 Study Location and Duration of the Research

The study was carried out at the animal house, Department of Genetics and Biotechnology, University of Calabar, Calabar. The birds (broilers) were brooded and raised for 12 weeks.

2.2 Source and Preparation of Plant Samples

Fresh *Moringa oleifera* leaves were purchased from farmers and some harvested within Calabar environs. The collected plant samples were authenticated in the herbarium unit, Department of Plant and Ecological Studies, Faculty of Biological Sciences, University of Calabar, Calabar, Cross River State. The entire plant was washed with clean water, air-dried under shade for 4 days

before powdering using **an** electric blender (Qlink-Q15L40). This was used as a supplement suitable for incorporation into the broilers' diets.

2.3 Experimental animals

A total of 40 broiler chicks that was forty-eight day-old were purchased from a reputable farmer in Calabar for this experiment. Generally, the study was conducted following the recommendations from the declarations of Helsinki on guiding principles in the care and use of animals.

2.3.1 Housing and management of experimental animals

The birds were randomly allocated to a deep litter brooder pen and given a floor space of 1.45m per bird as suggested by Emam *et al*. [3]. Before commencing the experiments, the house was cleaned and disinfected using the formalin solution. Dry sawdust was used as a litter material with a depth of approximately 6 cm. Each of the chicks was wing tagged and examined physically to ensure fitness and general body soundness. Each pen was supplied with a clean feeder and a drinker of diameter 40 and 20cm respectively. The light was provided for 24 hours throughout the experiment period. The electrical bulbs were initially kept at about 15 cm above the ground to provide heat and then raised gradually to 1.75m height towards the end of the experiment period. The birds were brooded and raised for 12 weeks placed on the same diet as recommended by NRC, 1994 [21] for chick and growing pullets. Water, the feed was given and all necessary vaccinations, medication was administered to the birds accordingly, as a certified veterinary doctor. Chicks immediately after hatching were vaccinated against Marek's disease and Newcastle disease.

2.4 Experimental design and study parameters

Forty-eight day old, unsexed commercial broiler chicks (rose 308) was assigned into four groups of 10 chicks (replicates) in a pen, in a completely randomized design. Group one (A) was kept as control with 0.0% *Moringa oleifera* supplement while the other three groups (group B, C and D) were given experimental diets containing 5%, 10% and 15% *Moringa oleifera* supplement respectively. The following parameters were taken:

2.4.1 Feed intake

The food was weighed weekly to determine the average feed intake per chick for the different treatment groups the feed intake was calculated by obtaining the left-over food and divided by the number of each bird in each group per day than totalized to per week. Feed intake was calculated using the formula below:

Feed Intake = Introduced parts of foods – Residual parts of food

2.4.2 Weight gain

The weight of each bird was taken every two weeks to determine the average weight gain per chick for the different treatment groups. The weight gain was calculated as the difference between two successive weekly body weights as given in the formulae below:

Weight gain = Final weight – Initial weight

2.4.3 Feed conversion ratio (FCR)

The birds and feed were weighed weekly to determining the average FCR per groups. FCR was calculated by dividing the amount of feed consumed in gram with bodyweight gained in gram i.e.

$$FCR = \frac{Average\ feed\ intake(\ \ )\ of\ birds/week}{average\ body\ weight\ gain\ (g)\ of\ birds/week}$$

2.4.4 Mortality rate

The MR (%) was calculated using the formulae:

$$MR = \frac{number\ of\ death}{number\ of\ fatal\ chicks}\ x\frac{100}{1}$$

2.4.5 Evaluation of carcass quality

At the end of the experiment, two chicks from each replicate with each treatment were randomly selected from each grouping. The birds were weighed to obtained live body weight after fasted for about 12 hours. They were sacrificed without stunning, washed and allow to dry under wooden tables. Evisceration was performed by a ventral cut and visceral as well as thoracic organs were removed. The heart, liver, kidney, abdominal fat, head, shanks, lungs, reproductive organs were weighed and calculated as the percentage of live body weight using the formulae:

$$Dressing\ percentage = \frac{dressing\ carcass\ weight}{live\ body\ weight} x\frac{100}{1}$$

2.5 Data collection and statistical analysis

All data collected were subjected to analysis using Statistical Packages of the Social Science (SPSS) software version 20.0. Analysis of variance (ANOVA) for a completely randomly design according to Stell and Torrie [22] was used to test for significance. Duncan's Multiple Range Test (DMRT) was used to separate significant differences between means as reported by Little and Hills [23]. Statistical significance was set at $P \leq 0.05$.

3. Results

3.1 Bodyweight of broilers chicks fed with different levels of *Moringa oleifera* leaf mean

The results presented in Table 1 showed the body weight of broiler chicks fed on a different level of *Moringa oleifera* leaf meal. The result showed significant difference at all levels of the *Moringa oleifera* leaf meal when compared to the control in group one designated as A. The diet supplemented with 5% of MOLM showed significantly high body weight and followed by 10% of MOLM.

3.2 Performance of broiler chick fed with different levels of *Moringa oleifera* leaf meal

The performance of broiler chicks fed on a different level of *Moringa oleifera* leaf meal **(**MOLM) is shown in Table 2, indicating that there was a significant difference in all measured parameter concerning the control group. There was no mortality in any of the groups.

3.3 Bodyweight of organ proportions of broiler carcass fed with different levels of *Moringa oleifera* leaf meal

Table 3 shows the bodyweight of organ proportions of broiler chicks feed on a different level of MOLM. The levels of MOLM were not significantly different in terms of liver weight, heart weight, kidney weight and abdominal fat.

Table 1: Bodyweight of broiler chicks fed on different levels of *Moringa oleifera* leaf meal (MOLM)

Age (weeks)	A	B	C	D
0	40.20±10.61[a]	40.65±28.81[a]	40.05±16.30[a]	40.68±28.67[a]
2	102.46±28.30[a]	163.38±62.30[b]	158.37±19.81[c]	154.52±87.10[c]
4	319.28±67.90[a]	380.42±16.34[b]	379.24±29.16[c]	380.44±13.81[c]
6	608.89±21.30[a]	690.53±32.40[b]	654.11±34.41[c]	438.21±16.71[d]

8	816.25±33.16[a]	873.31±12.19[b]	848.16±24.90[c]	690.13±44.85[d]
10	939.18±10.51[a]	992.61±34.16[b]	974.30±16.81[c]	834.13±48.86[d]
12	236.14±37.70[a]	1716.79+22.10[b]	1692.21±26.70[c]	9.72.40±36.94[d]

a-b Values in the same row with different superscripts are significantly different (P<0.05).

Table 2: Performance of broiler chicks fed on different levels of *Moringa oleifera* leaf meal (MOLM)

Parameter	A	B	C	D
Initial body weight (g)	40.20±10.6	40.65±28.81	40.5±96.30	40.68±28.67
Final live weight	40.20±37.70[a]	1716.79±22.10[b]	1692.21±26.70[c]	792.40±36.54[d]
Bodyweight gain (g)	1195.94[a]	1676.14[b]	1651.95[b]	931.72[c]
Total feed intake (g)	2642.81[a]	2864.31[b]	2721.91[c]	2486.31[d]
Feed conversion ratio (g)	2.21[a]	1.71[b]	1.65[b]	1.16[c]

a-b Values in the same row with different superscripts are significantly different (P<0.05).

Table 3: Bodyweight of organ proportions of broiler carcass fed on different levels of *Moringa oleifera* leaf meal (MOLM)

Parameter	A	B	C	D
Liver weight (g)	3.20±16.81[a]	3.21±81.20[a]	3.20±16.31[a]	3.21±16.71[a]
Heart weight (g)	1.04±19.70[a]	0.03±28.30[a]	1.03±81.71[a]	1.04±28.41[a]
Kidney weight (g)	4.22±10.80[a]	4.21±2060[a]	4.21±18.10[a]	4.21±69.2[a]
Abdominal fat weight (g)	2.13±19.31[a]	2.14±71.13[a]	2.17±17.173[a]	2.19±69.10[a]
Dressing percentage (%)	68.51±1.71[a]	68.74±1.90[a]	69.32±1.81[a]	67.84±1.57[a]

a-b Values in the same row with different superscripts are significantly different (P<0.05).

4. Discussion

Moringa oleifera has proved to be a valuable plant that is useful in mitigation of food insecurity and poverty reduction in poor rural settlements [17-20]. Therefore, incorporation parts of this plant (leaf) in poultry feed formulation are necessary for cost reduction and enhancing the performance and quality chicken carcasses; but in varying percentage, as documented by researchers [9-12]. The results of this present study showed significant body weight increment of broiler chicks fed on different levels of *Moringa oleifera* leaf meal (MOLM) at 5% and 10%, but there was no significant improvement at 15% of MOLM. These significant improvements in body weight are an indication for a higher growth rate and could be attributed to the higher protein content of the MOLM. These findings agree with the results of other documented studies

[1, 12]. The significant reduction in body weight noticed with 15% MOLM in this study could be as a result of excess protein which may not be metabolized by the broiler chicks. This is not in tandem with the results reported by Tijani *et al*. [9], where high body weight was observed in birds fed at 15% of MOLM.

In our present study, there was a reduction in weight gain, feed efficiency and body weight as a result of the addition of a higher level of MOLM (15%) to broilers diet. This may be due to the presence of phytate which is an anti-nutritional factor found in moringa seed and can be probably found in the leaf of moringa. Phytate was reported to reduce the bioavailability of minerals in non-ruminant animals [24], and decline digestibility of starch and protein [25]. Furthermore, it was observed that *Moringa oleifera* and *Moringa stenopetala* methanol and n-hexane seed extracts produced an inhibitory effect on *Salmonella typhi*, *E. coli* and *Vibrio cholerae* which normally cause waterborne diseases [26]. *Moringa oleifera* proved to be a good source of fat, protein, antioxidants and minerals (Mg and Zn), hence malnutrition due to micronutrients deficiency in children could be overcome [27]. However, an increment in abdominal fat weight with increased supplementation level of MOLM to broiler chicks' diet might be due to the higher level of fat content in Moringa leaves and seeds as observed by Compaoré *et al*. [27]. The absence of death cases among the broilers might be due to antimicrobial and availability of vitamins, proteins and minerals in Moringa plant, besides the good house management during the experiment. This is in tandem with the findings of Abbas [18] that reported no case of death in the broilers used for the study. The inclusion of MOLM did not significantly affect abdominal fat, heart, liver and kidney weight of broilers. Although the reason behind this result is still not clear but it is suspected that the internal organs were able to effectively regulate their nutrient

requirement through the metabolic function of the liver. This result is similar to the findings of Zanu *et al,* [28] that reported no significant differences in carcass parameters of birds fed diets containing MOLM supplement and Nuhu [29] who reported that there were no significant differences among treatments for carcass characteristic for weaner rabbits fed *Moringa oleifera* leaf meal. There was no significant ($P<0.005$) difference in carcass dressing percentage in all the dietary treatments. However, the highest carcass dressing percentage was recorded in birds fed MOLM diet at 10% and followed 5%.

5. CONCLUSION

This present study provides credible information on the performance of broiler chicks fed at different levels of MOLM. The results showed a net body weight gain, feed intake and feed conversion ratio of birds at 5% and 10% of MOLM, while there was a reduced performance of birds feed with 15% MOLM.

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