

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-old, unsexed (rose 308) were sourced from 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],

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

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47 *Moringa oleifera* belongs to the family *Moringaceae*, which is widespread throughout the tropics
48 and sub-tropics. It is a small to medium evergreen or deciduous tree that can grow to a height of
49 10–12 m (32–40 ft) and trunk diameter of 45 cm (1.5 ft). The bark has a whitish-grey colour and
50 is surrounded by thick cork. This plant have sparse foliage, white flowers and long pods, often
51 planted in farms and compounds. Moringa flowers are pentamerous, zygomorphic, 7-11mm long
52 and the fruit is typically 3-valved capsule; 10-60 cm in length [13-14]. The plant possess
53 multiple advantages, because different parts of the tree (leaves, fruits, immature pods and
54 flowers) are useful [15].

55
56 *Moringa oleifera* is one of the plants that can be introduced into livestock production feedstock
57 to increase feed quality and quantity or availability. This plant can be used as a cheap protein
58 supplement to improve digestibility of other diets and also proffer medicinal values. *Moringa*
59 *oleifera* has been widely valued as a versatile plant due to its multipurpose uses. The leaves,
60 fruits, flowers and immature pods of the species are edible and form part of traditional recipes in
61 many tropical and sub-tropical countries [15-16]. The leaves of *Moringa oleifera* are a good
62 source of protein, vitamins A, B and C, and minerals such as calcium and iron [17]. Moringa
63 leaves are used in animal diets as leaf meal because of high nutritional and medicinal qualities as

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

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77 **2. METHODOLOGY**

78 **2.1 Study Location and Duration of the Research**

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

82 **2.2 Source and Preparation of Plant Samples**

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

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

89 **2.3 Experimental animals**

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

94 95 **2.3.1 Housing and management of experimental animals**

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

109 **2.4 Experimental design and study parameters**

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

115 **2.4.1 Feed intake**

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

$$121 \quad \text{Feed Intake} = \text{Introduced parts of foods} - \text{Residual parts of food}$$

123 **2.4.2 Weight gain**

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

$$127 \quad \text{Weight gain} = \text{Final weight} - \text{Initial weight}$$

129 **2.4.3 Feed conversion ratio (FCR)**

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

$$133 \quad FCR = \frac{\text{Average feed intake}(g) \text{ of birds/week}}{\text{Average bodys weight gain}(g) \text{ of birds/week}}$$

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135 **2.4.4 Mortality rate**

136 The MR (%) was calculated using the formulae:

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

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138 **2.4.5 Evaluation of carcass quality**

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

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

145 **2.5 Data collection and statistical analysis**

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

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152 **3. Results**

153 **3.1 Body weight of broilers chicks fed with different levels of *Moringa oleifera* leaf mean**

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

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160 3.2 Performance of broiler chick fed with different levels of *Moringa oleifera* leaf meal

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

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165 3.3 Body weight of organ proportions of broiler carcass fed with different levels of 166 *Moringa oleifera* leaf meal

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

170 **Table 1: Body weight of broiler chicks fed on different levels of *Moringa oleifera* leaf**
 171 **meal (MOLM)**

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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	972.40±36.94 ^d

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

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183 **Table 2: Performance of broiler chicks feed on different levels of *Moringa oleifera* leaf meal**

184 (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
Body weight 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

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

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Table 3: Body weight 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

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

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195 **4. Discussion**

196 *Moringa oleifera* have proved to be a valuable plant that is useful in mitigation of food insecurity
197 and poverty reduction in poor rural settlements [17-20]. Therefore, incorporation parts of this
198 plant (leaf) in poultry feed formulation is necessary for cost reduction and enhancing the
199 performance and quality chicken carcasses; but in varying percentage as documented by
200 researchers [9-12]. The results of this present study showed significant body weight increment of
201 broiler chicks fed on different levels of *Moringa oleifera* leaf meal (MOLM) at 5% and 10%, but
202 there was no significant improvement at 15% of MOLM. These significant improvements in
203 body weight are indication for higher growth rate and could be attributed to the higher protein
204 content of the MOLM. This findings agrees with the results of other documented studies [1, 12].

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

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

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

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237 5. CONCLUSION

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

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