GROWTH PERFORMANCE, IMMUNE RESPONSE AND ANTIOXIDANT STATUS OF BROILER CHICKENS ON DIETARY SUPPLEMENTATION OF *Moringa oleifera, Ocimum gratissimum* LEAF MEALS AND THEIR COMPOSITE MIX

M.H. Ogunsipe
Animal Production Unit, Department of Agricultural Science, Adeyemi Federal University of Education, Ondo, Nigeria
Corresponding author: moogunsipe2009@gmail.com ogunsipemh@aceondo.edu.ng ***Phone No****. +234 8035284422*

Abstract

The study assessed the effect of *Moringa oleifera, Ocimum gratissimum* and their composite leaf meal supplementation on the growth performance, immune response and antioxidant enzyme status of broiler chickens in a feeding trial that lasted for 42 days. Two hundred Arbor-Acre one-day-old broiler chicks were randomly distributed to 5 diets of 40 chicks to a treatment of 4 replications of 10 chicks to a replicate. Five experimental diets were formulated. Diet 1, which was designated as positive control has no antibiotic and no leaf meal supplementation, diet 2 designated as negative control has no leaf meal but has antibiotic 200mg/kg (Tylosin), diet 3 has 1000mg/kg *Moringa oleifera* leaf meal (MOLM), diet 4 has 1000mg/kg *Ocimum gratissimum* leaf meal (OGLM) while diet 5 has 500mg/kg MOLM + 500mg/kg OGLM (composite leaf meal mix). Birds have unlimited access to fresh feeds and cool clean water throughout the experimental period. Results show that weight gain, feed conversion ratio, PCV, WBC, catalase, superoxide dismutase and glutathione peroxidase were significantly ($P<0.05$) higher while creatinine and cholesterol levels were significantly ($P<0.05$) lower in birds fed dietary supplementation of MOLM, OGLM and their composite mix compared to birds on diet 1 while feed consumption shows no particular trend of significance.

Keywords: Antioxidant, *Moringa oleifera*, *Ocimum gratissimum*, phytonutrients, serum enzymes

Introduction

Over the years antibiotics have been used in livestock industry to promote growth and improve health status. However, the indiscriminate use of antibiotic has been documented to promote creation of superbugs, resulting in the contamination of meat and poultry products with attendant health challenge and environmental pollution (Prahhu *et al*., 2009; Olumide *et al*., 2019). In addressing this global menace, scientists, nutritionists, researchers and other allied professionals are challenged to source for natural antibiotics that are environmentally friendly and do not pose any health challenge to humans. The uses of leaf meals of phytoconstituent properties that can promote growth and improve animal health have been advocated (Prahhu *et al*., 2009; Olumide *et al*., 2019). Such leaf meals having bioactive components include *Moringa oleifera* and *Ocimum gratissimum*. Moringa plant is widely known as cabbage tree, drumstick tree, horseradish tree, ben-oil tree, benzoil tree. In Nigeria, *Moringa oleifera* is called "Ewe igbale" in Yoruba, "Idagbo monoye" in Igbo and "Zogale" in Hausa. *Moringa oleifera* leaf has been reported to be rich in vitamin C, potassium, calcium, iron, protein, amino acids, phenolic acids, flavonoids, isothiocyanates, tannins and saponins (Olumide *et al*., 2019). It is also rich in antioxidants, helping to protect cells from damage, lower blood pressure and reduce fat (Olumide *et al*., 2019). *Ocimum gratissimum* is popularly known as scent leaf; it is known as "Effinrin-nla" in Yoruba, "Nchanwu" or "Ahuji" in Igbo and "Daidoya" in Hausa. *Ocimum gratissimum* leaves have been used as a general tonic and anti-diarrhea agent and for the treatment of conjunctivitis (Prahhu *et al*., 2009). In Nigeria, the leaf is used as a condiment in the preparation of dishes such as '*pepper soup*', '*jollof rice*', and vegetable soups. *Ocimum gratissimum* possesses a wide range of phytonutrients such as protein, vitamins and minerals, and moderate level in energy; phytochemicals such as alkaloids, saponins, tannins, phlobatannins, glycosides, phenols, anthraquinones, flavonoids, polyphenols and volatile compounds like eugenol, thymol, and geraniol (Prahhu *et al*., 2009; Olumide *et al*., 2019). Eugenol remains the most active compound in *Ocimum*

gratissimum. This study assessed the influence of *Moringa oleifera* leaf meal, *Ocimum gratissimum* leaf meal and their composite mix on the growth performance, hemato-serum profile and antioxidant enzyme status of broiler chickens.

Materials and Methods

Experimental site and design: The experiment was conducted at the Poultry Unit of the Teaching and Research Farm, Adeyemi Federal University of Education, Ondo, Nigeria. The design of the experiment was the complete randomization involving a total of 200 Arbor-Acre one-day-old broiler chicks that were distributed to 5 treatment diets of 40 chicks to a treatment of 4 replications of 10 chicks to a replicate.

Collection, processing and proximate determination of the leaf meals: *Moringa oleifera* and *Ocimum gratissimum* leaves were collected fresh, air-dried, milled and stored prior use. Determination of the proximate composition was by the standard methods. Samples were analyzed thrice.

Experimental diets: Five experimental diets were formulated such that diet 1, which is designated as positive control has no leaf meal and no antibiotic, diet 2 designated as negative control has no leaf meal but has antibiotic (Tylosin) supplementation 200mg/kg, diet 3 has 1000mg/kg MOLM supplementation, diet 4 has 1000mg/kg OGLM supplementation while diet 5 has a mixture of 500mg/kg MOLM and 500mg/kg OGLM supplementation (Table 1). The birds were fed *ad libitum* with cool clean water for 6 weeks.

Collection of blood and serum: Blood was collected from 8 experimental birds per treatment to make a total of 40 birds. Blood collected into EDTA bottle were used for the hematological studies while blood collected into the bottle without EDTA were used for serum antioxidant enzymes and biochemical studies.

Data collection and statistical analysis: Data collected on feed intake, weight gain, feed conversion ratio, blood and serum profile were analyzed using General Linear Model of the SPSS (2013) version 22. Differences in the means where significant were separated using Duncan option of the software.

Results and Discussion

Results

The experimental diets (Table 1), proximate compositions and energy values (Table 2) of *Moringa oleifera* and *Ocimum gratissimum* leaves show their potentials as phytonutrient supplements that can promote growth. Results reveal that antibiotic supplemented diet 2 (-ve control: no leaf meal but with antibiotic supplementation) and dietary leaf meal supplementation (diets 3-5) in most cases recorded similarity in weight gain, hemato-biochemical properties and serum antioxidant enzymes in broiler chickens but were significantly different ($P<0.05$) compared with birds fed diet 1 (+ve control: no antibiotic and no leaf meal supplementation). It is worthy of note that the birds weight gain, PCV, WBC, cat, sod and GPx increased while creatinine and cholesterol levels decreased with dietary supplementation of MOLM and OGLM and their composite leaf meal while feed consumption shows no particular trend of significance (Table 3).

Discussion

The crude protein, crude fibre, ash and energy contents of MOLM and OGLM recorded in this study were similar to the values earlier reported (Olumide *et al*., 2019). The nutrient levels of these leaf meals show their phytonutrient properties to enhance broiler growth. The improved growth, hematopoietic activity and the role of enzyme scavenging radicals, such as sod, cat and GPx suggest that leaves of *Moringa oleifera* and *Ocimum gratissimum* contains phytonutrient, phytobiotic and pharmacological attributes that can promote growth and health status of broiler chickens. The antioxidant property in the leaves might have helped to maintain the intestinal mucosa by preventing reactive oxygen radicals produced during digestion, thus promoting better nutrient utilization with resultant improvement in weight gain and heamato-serum synthesis (Oloruntola *et al*., 2022).

Conclusion and Recommendation

The dietary supplementation of MOLM, OGLM and their composite mix promoted good growth and health status of broiler chickens. Thus, the use of these leaf meals and their composite meal as dietary supplements in broiler chicken production should be encouraged.

Table 1. Composition of diets (g/100g)

Ingredients	Diet 1 (+ve control)	Diet 2 (-ve control)	Diet 3 (1000mg/kg MOLM)	Diet 4 (1000mg/kg OGLM)	Diet 5 (500mg/kg MOLM + 500mg/kg OGLM)
Maize	58.75	58.75	58.75	58.75	58.75
GNC	9.35	9.35	9.35	9.35	9.35
SBM	13.50	13.50	13.50	13.50	13.50
Fish meal	3.50	3.50	3.50	3.50	3.50
Rice bran	5.45	5.45	5.45	5.45	5.45
Wheat offal	6.35	6.35	6.35	6.35	6.35
Limestone	1.55	1.55	1.55	1.55	1.55
DCP	0.50	0.50	0.50	0.50	0.50
Lysine	0.15	0.15	0.15	0.15	0.15
Methionine	0.15	0.15	0.15	0.15	0.15
Premix	0.25	0.25	0.25	0.25	0.25
Salt	0.50	0.50	0.50	0.50	0.50

Table 2. Proximate composition (n=3)	***M. oleifera* leaf**	***O. gratissimum* leaf**
Dry matter	88.80 ± 5.16	86.13 ± 4.98
Crude protein	25.71 ± 1.39	13.61 ± 1.02
Crude fibre	5.84 ± 0.21	6.39 ± 0.27
Crude fat	7.13 ± 0.38	6.37 ± 0.42
Total ash	13.18 ± 1.76	11.65 ± 0.94
Carbohydrate	33.94 ± 2.94	48.11 ± 3.17
ME (kcal/kg DM)	3198.73 ± 79.03	2763.21 ± 71.49

Table 3. Performance, haemato-biochemical profile and antioxidant enzyme status of broiler chickens fed sole and composite leaf meal as phytogenic feed supplements

	Diet 1 (+ve control)	Diet 2 (-ve control)	Diet 3 (0.50 MOLM)	Diet 4 (0.50 OGLM)	Diet 5 0.50 MOLM + 0.50 OGLM)	SEM	P value
Performance traits							
Initial weight g/bird	37.76	37.77	37.90	37.68	37.82	0.07	0.26
FLW g/b	1802.23^{c}	1958.62^{b}	1930.83^{b}	1934.50^{b}	1969.15^{b}	11.94	0.00
TWG g/b	1764.47^{c}	1920.86^{b}	1892.93^{b}	1896.82^{b}	1931.83^{b}	11.97	0.00
AWG g/b/d	42.01^{c}	45.74^{b}	45.07^{b}	45.16^{b}	45.98^{b}	0.29	0.00
TFC g/b	4112.38^{ab}	4135.21^{a}	4074.53^{c}	4139.20^{a}	4085.91^{bc}	9.22	0.00
AFC g/b/d	97.87^{ab}	98.46^{a}	97.01^{c}	98.55^{a}	97.29^{bc}	0.22	0.00

FCR	2.33^{c}	2.15^{b}	2.15^{b}	2.18^{b}	2.11^{a}	0.01	0.00
Hemato-biochemical properties							
PCV (%)	33.83^{c}	33.87^{c}	34.43^{bc}	35.35^{b}	36.62^{a}	0.34	0.00
RBC (x10^{12}/l)	2.56	2.83	2.81	2.83	2.96	0.16	0.53
HbC (g/dl)	32.05	32.66	25.43	33.24	33.25	3.33	0.44
WBC (10^{9}/l)	2.69^{b}	3.49^{a}	3.56^{a}	3.25^{a}	3.49^{a}	0.11	0.00
Creatinine (µmol/l)	33.81^{a}	33.72^{a}	30.16^{b}	30.02^{b}	29.76^{b}	0.57	0.00
AST (IU/L)	73.84	74.59	74.37	73.95	74.42	1.11	0.99
ALT (IU/L)	29.96	29.93	29.61	29.69	30.05	0.41	0.93
Cholesterol (µmol/l)	7.50^{a}	6.53^{b}	4.34^{c}	4.27^{c}	4.14^{c}	0.19	0.00
Serum antioxidant enzymes							
Cat (mM/ml/min)	5.48^{b}	12.94^{a}	13.03^{a}	13.11^{a}	14.01^{a}	0.37	0.00
Sod (%)	52.71^{c}	75.28^{b}	76.39^{b}	75.26^{b}	79.18^{a}	0.75	0.00
GPx (µg/g)	75.22^{c}	113.46^{ab}	120.06^{a}	110.58^{b}	113.65^{ab}	2.47	0.00

^{abc}Means within the same row are significant at P<0.05. MOLM: *Moringa oleifera* leaf meal, OGLM: *Ocimum gratissimum* leaf meal, FLW: Final live weight, TWG: Total weight gain, AWG: Average weight gain, TFC: Total feed consumption, AFC: Average feed consumption, FCR: Feed conversion ratio, AST: Aspartate aminotransferase, ALT: Alanine aminotransferase, PCV: Packed cell volume, RBC: Red blood cell counts, HbC: Haemoglobin concentration, WBC: White blood counts, Cat: Catalase, Sod: Superoxide dismutase, GPx: Glutathione peroxidase

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