EFFICACY OF *MORINGA OLEIFERA* LEAF EXTRACT AS A PHYTOGENIC ADDITIVE ON HEMATOLOGICAL AND SERUM BIOCHEMICAL PARAMETERSIN FINISHERBROILER CHICKENS

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Target audience: Agricultural Extension Agents, Nutritionist, Fellow Researchers, Poultry Farmers

Abstract
A 28-day trial evaluated the effect of varying levels of *M. oleifera* leaf extract (MOLE) on the physiological parameters of 120 four-week-old 'Anak' broilers. The birds were randomly divided into four treatment groups in a completely randomized design, with 30 birds per group and three replicates of ten birds each. The groups ($T_1 – T_4$) received varying MOLE concentrations in water at 0ml, 20ml, 40ml and 60ml per litre, refreshed every three days to maintain the stability and potency of the bioactive compounds, minimize microbial growth, and ensure consistent exposure throughout the experimental period. All birds had ad libitum access to feed and water. Freshly harvested *M. oleifera* leaves were air-dried for five days, milled into leaf meal (MOLM), and analyzed for nutrients, showing high protein and ash content, highlighting its value as a supplement. Blood samples collected at week eight were analyzed for hematological and serum biochemical parameters. The analysis showed no significant differences ($P>0.05$) except for creatinine, which increased numerically with higher MOLE levels. Hematological and serum biochemistry values remained within normal ranges for healthy broilers. It was concluded that MOLE, at up to 60ml/L, can be safely administered in the drinking water of broiler chickens without adverse effects on their health.

Keywords: blood profile, leaf extract, *Moringa oleifera*, nutrition, proximate analysis

Description of Problem

The poultry industry holds significant potential for addressing the shortage of animal protein in developing countries. However, high production costs, primarily due to expensive feed, continue to hinder progress (1). Feed accounts for 60–70% of the total production cost, so reducing feed expenses can greatly lower the overall production cost (2). Efforts to create least-cost feed formulations have focused on replacing costly feed ingredients with affordable, locally available, non-conventional alternatives (3). This not only reduces feed costs but also makes meat and eggs more affordable for consumers.

Moringa oleifera has emerged as a sustainable, cost-effective feed alternative. A tropical plant in the Moringaceae family, it thrives in tropical climates and offers exceptional nutritional and phytochemical properties. Its rich carotenoid content enhances pigmentation in egg yolks and broiler meat (4). Additionally, moringa exhibits antibacterial, antifungal, anti-inflammatory, antihypercholesterolemic, and antioxidant properties. As a feed supplement or additive, moringa positively impacts production performance and haematological parameters in broiler chickens, contributing to reduced feed costs, healthier products, and a more sustainable environment (5).

Serum biochemical and haematological parameters serve as reliable indicators of an animal's physiological status, offering insights into environmental, nutritional, and pathological stresses (6). The health benefits and nutritional value of moringa make it an ideal additive to poultry diets.

The nutritional content of moringa leaves varies due to genetic, agronomic, and environmental factors. Characteristics such as leaf maturity, age, and color affect its nutrient composition (7). Geographical factors, including soil nutrients, climate, solar radiation, and humidity, also play a role in nutrient variation (8). Studies have shown that soil type, water availability, and fertilizer use influence protein and mineral content (9).

Currently, limited information exists regarding the nutritional composition of *Moringa oleifera* grown under south-eastern Nigeria's climatic conditions. Thus, the objective of this research is to evaluate the nutritional profile of moringa leaves and their effects on the blood parameters of broiler chickens when administered in drinking water.

Materials and Methods

The study was carried out at the Poultry Unit of the Student Research Site of the Federal College of Agriculture, Ishiagu (FCAI), Ivo Local Government Area, Ebonyi State, Nigeria. The sourcing, processing and preparation of the test ingredient as well as animal management procedures, followed the methods described by (10; 1). The experimental trial lasted over 28 days. Throughout the trial, 50 grams of feed from each bag of commercial vital broiler finisher feed (VBFF) that was opened were set aside and mixed together at the end of the study for proximate analysis. All feed samples (MOLM and VBFF) were analyzed for proximate composition using the procedures outlined by (11) and (10;1). Blood profile analysis was conducted following the methods described by (12) and (10;1). All generated data were analyzed using a one-way analysis of variance (ANOVA) with statistical analysis systems (13). Significant means were separated using the Duncan Multiple Range Test in the same statistical package, at a significance level of $p<0.05$.

Results and Discussion

Acute toxicity and Phytochemical profile of Moringa oleifera leaf aqueous extract

The acute toxicity and phytochemical profile of *Moringa oleifera* leaf extract (MOLE) was adopted from the studies of (14; 15 and 2). (15) found that oral administration of 2000 mg/kg aqueous methanol extract in non-pregnant female Wistar rats showed no adverse effects. Blood markers (AST, ALT, bilirubin) remained normal, indicating a lethal dose above 2000 mg/kg and confirming safety. The phytochemical analysis of the MOLE, revealed the presence of Bio-organic compounds like flavonoids, tannins, saponins, alkaloids, phenolics, terpenoids, sterols, steroids, glycosides, polyphenols, fatty acids, amino acids, vitamins, and minerals (14; 15). An in vitro study by (15) investigated the bioactive compounds contributing to the nutritional potential of Moringa oleifera. The authors concluded that its high content of proteins, lipids, and sulfur-containing amino acids, along with a relative absence of toxic components, supports its use as a valuable nutritional alternative for both humans and animals. (2) reported 3% mortality in broiler chickens fed MOLE over 16 weeks, compared to 4% in controls, with similar feed intake, supporting its safety.

The proximate composition of the test ingredient and experimental diet is presented in Table 1. Both were found to contain substantial levels of essential nutrients. However, analysis of the commercial feed showed that the CP and ME values for the broiler finisher diet were below the recommended ranges of 18-20% CP and 3000-3100 Kcal/kg ME, as suggested by Aduku, (16) and (17). This suggests that the birds may not have met their optimal energy and protein requirements during the study. *Moringa oleifera* is a highly nutritious and medicinal tree. It serves as a valuable source to combat malnutrition due to its essential nutrients (18). The higher values for proximate composition obtained in this study indicate that *M. oleifera* is a good source of nutrients for both humans and animals. In poultry nutrition, where protein is the most expensive and constitutes the second-highest proportion, MOLM can substitute other cereals ingredients, reducing competition,

production costs, and increasing farmers' income by promoting rapid and uniform weight gain in farm animals (19).

Blood profile parameters are essential for assessing the health status of birds and can reflect metabolic alterations in organs and tissues, particularly when unconventional feed materials are used (20). The haematological and biochemical indices of Anak broiler chickens administered graded levels of MOLE in their drinking water are shown in Table 2 and Table 3. Across treatments, no significant differences ($P>0.05$) were observed in the evaluated blood parameters, except for creatinine, with higher values noted in the treated groups compared to the control. The absence of significant changes in most blood parameters suggests that MOLE supplementation did not adversely affect the birds' physiological status.

Table 1: Proximate composition of test ingredients (Moringa oleifera leaf meal) and experimental diet (Commercial vital broiler finisher feed)

Nutrients (%)	***Moringa oleifera* leaf meal**	**Vital broiler finisher feed**
Dry matter	91.56	83.46
Crude protein (CP)	28.26	16.89
Crude fibre	10.16	5.6
Ether extract	7.62	4.51
Ash	12.36	10.05
Moisture	5.09	9.12
Carbohydrates	53.11	–
Nitrogen free extract	39.51	53.41
Metabolizable energy (ME) (Kcal/kg)	3010.55	2843.85

Table 2: Haematological indices of finisher broiler chickens administered graded levels of Moringa oleifera leaf extract (MOLE)

Parameters	**T_1(0ml)**	**T_2(20ml)**	**T_3(40ml)**	**T_4(60ml)**	**SEM**
PCV (%)	30.67±0.18	31.33±0.40	32.00±0.86	30.33±0.14	0.87
RBC ($x10^6$/L)	4.09±0.00	4.23±0.00	4.26±0.00	4.24±0.00	0.17
WBC ($x10^6$/L)	10.80±0.06	9.23±0.03	10.13±0.10	9.07±0.016	0.43
Hb (g/dL)	10.43±017	10.63±0.14	10.73±0.44	10.37±0.28	0.20
MCHC (g/dL)	34.04±0.37	33.93±0.29	33.53±0.040	34.18±0.31	0.12
MCH (pg)	25.63±0.44	25.18±0.56	25.30±0.19	24.55±0.51	0.39
MCV (fL)	75.25±0.13	74.18±0.36	75.46±0.40	71.82±0.77	1.04

PCV=Pack cell volume; RBC=Reed blood cell; WBC=White blood cell; Hb=Haemoglobin; MCHC=Mean corpuscular haemoglobin concentration, MCH=Mean corpuscular haemoglobin; MCV=Mean corpuscular volume; SEM= Standard error of mean

Table 3: Serum biochemistry of finisher broiler chickens administered graded levels of Moringa oleifera leaf extract (MOLE)

Parameters	**T_1(0ml)**	**T_2(20ml)**	**T_3(40ml)**	**T_4(60ml)**	**SEM**
Total protein (g/dL)	3.24±0.34	3.70±0.04	3.82±0.28	3.87±0.23	3.24
Albumin (g/dL)	2.27±0.11	2.33±0.11	2.43±0.02	2.97±0.15	1.03
Globulin (g/dL)	1.88±0.22	1.45±0.20	1.44±0.25	1.24±0.21	3.06
Glucose (mg/dL)	193.32±4.69	237.6±4.81	173.82±2.46	163.08±5.19	18.14
Urea (mg/dL)	5.12±0.02	3.69±0.05	4.71±0.02	6.13±0.03	0.73
Creatinine (mg/dL)	$2.27±0.00^b$	$2.09±0.01^a$	$2.61±0.01^c$	$2.53±0.00^{cd}$	0.08
Cholesterol (mg/dL)	106.41±6.76	135.64±5.03	117.94±4.94	153.07±6.44	15.36

a,b,c,d, means within the row with different superscript differ significantly ($P<0.05$) from each other.

Creatinine, a key marker in muscle metabolism (21), showed significant variation among treatments in this study. The recorded serum creatinine levels exceeded the normal range of 0.81–1.04 mg/dL reported by (22), but remained within the broader standard range of 2.09–2.67 mg/dL documented by (1). This finding aligns with (23), who reported no significant effects ($P>0.05$) from dietary supplementation of a phytogenic mixture in Cobb 400 broiler chickens. However, it contrasts with (24) and (1), who observed significant differences ($P<0.05$) in haematological and biochemical parameters, respectively, when feeding three different parts of *M. oleifera* to Cobb 500 broiler chickens and administering varying levels of scent leaf extract (SLE) to four weeks old Anak broiler chickens over a 28-day period.

Conclusions and Applications

1. Incorporating *Moringa oleifera* leaf extract as a feed additive enhances performance without negatively impacting the blood profile of broiler chickens.
2. Moringa oleifera leaf extract (MOLE) can be safely incorporated into broiler chicken diets to enhance growth and productivity as a natural alternative to synthetic additives, thereby promoting sustainable poultry production.

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