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Evaluation of the Carcass Characteristics, Haematological Parameters, and Serum Biochemistry of Broiler Chickens Administered Moringa Seed Filtrate

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Abstract

This study examined the effects of Moringa oleifera seed filtrate (MSF) in drinking water on carcass characteristics, hematological parameters, and serum biochemistry of broiler chickens. A total of 120 Ross 308 broiler chicks (two weeks old) were assigned to four treatment groups, each with three replicates of 10 birds. The chicks were reared in deep litter pens using a completely randomized design and fed a commercial diet for 28 days. T1 (control) received only water, while T2, T3, and T4 received 60, 90, and 120mL MSF/L, respectively. Data on carcass traits and blood indices were analyzed using ANOVA and Duncan's test. Results showed significantly higher ($p < 0.05$) carcass weights in MSF-treated groups, with T3 yielding the best results. MSF improved blood indices within normal ranges. Thus, 90 mL MSF/L can enhance carcass quality, blood composition, and broiler production.

Keywords: *Feed additive, Carcass, Blood Indices, Moringa*

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Background to the Study

Synthetic feed additives or growth promoters are often used in raising poultry under an intensive system, to enhance productivity, through the improvement of digestibility, nutrient absorption, and elimination of pathogens resident in the gut. However, there is a growing demand all over the world, for foods containing natural, rather than synthetic additives and ingredients, due to the link between health and food additives. Synthetic additives also contribute to the higher cost of animal products. Researchers are therefore focusing more on the use of phytogenics in livestock production. These are herbs, spices, and plant extracts incorporated into animal feed or water, for their positive properties, including anti-inflammatory, antiseptic, sedative, anti-fungi activities, improvement of digestive enzyme secretion, stimulation of appetite and feed intake, immune responses and antibacterial, antiviral and antioxidant actions (Toghyani et al., 2011). The use of phytogenics in livestock production could contribute to food security in Nigeria.

Moringa oleifera plant is one of such herbs used mainly for its nutritional and medicinal potentials. It is commonly referred to as the Horse radish tree or Drum stick tree, a good source of protein and vitamins for livestock (Ogbunugafor et al., 2011). Moringa seed meal or powder contains phytochemicals that are biologically active compounds, such as alkaloids, flavonoids, saponins, phenols, steroids, and tannins that elicit physiological changes in farm animals, through their antimicrobial, antioxidant, and hypocholesterolemia effects (Sugiharto and Toana, 2011). Ijarotimi et al. (2013) reported that moringa seed meal is rich in crude protein, dietary fiber, essential amino acids, fatty acids, minerals, and vitamins, that are necessary for improved broiler chicken production. The high fiber level of the seed meal limits its proper utilization by poultry. Therefore, the use of moringa seed extract could be an alternative strategy of reducing the effect of high dietary fiber and the antinutritional factors (especially water-soluble condensed tannins), to allow the birds full access to the moringa's beneficial bioactive compounds (Egbu et al., 2022). Moringa leaves are eaten by humans as vegetables, while the seeds are taken for various medicinal purposes. However, there is a paucity of information on the utilization of moringa seed filtrate in poultry production. This study therefore aimed at investigating the carcass characteristics, haematology, and serum biochemical indices of broiler chickens fed different levels of moringa seed filtrate.

Materials and Methods

This experiment was carried out at the poultry unit of Geokon's Farm, Umuguma, in Owerri West Local Government Area, Imo State, Nigeria.

Treatment Sources and *Moringa* Processing Technique

Dry moringa oleifera seeds were gathered from different compounds in Owerri. The seeds were dehusked manually, dried further under the sun for 3 days, and ground to get the seed meal/powder. 200g of the seed meal was soaked in 2000ml of distilled water for 24 hours. A clean white cotton cloth was used to sieve out the fiber while the resultant filtrate was poured into a clean plastic container and kept in a refrigerator for the experimental work. Within the study period, the filtrate was each time diluted with fresh drinking water for the treatments as

scheduled: T1 – control, only clean drinking water, T2 – 60ml of moringa seed filtrate (MSF) per liter of water, T3 – 90ml of MSF/L of water and T4 – 120ml of MSF/L of water. The commercial broiler starter and finisher broiler diets used for the study were purchased from Elim feed shop at Amakohia, Owerri, Imo State.

Chemical Analysis of Moringa Seed Filtrate

Samples of T2, T3, and T4 filtrates were chemically analyzed, to determine the quantitative values of the phytochemical components, such as tannin, alkaloid, phenol, saponin, flavonoid, steroid, terpenoid, glycoside, using gravimetric and titrimetric techniques according to the methods of Harborie (1995).

Experimental Birds, Management and Design

One hundred and twenty Ross 308 strain (Agrited) of broiler chicks were selected, after a brooding period of 2 weeks. The birds were weighed to obtain their initial body weights and randomly allotted to four experimental groups. Each experimental group was replicated thrice, with 10 birds per replicate. The twelve replicate groups were assigned to 12 deep litter pens in a completely randomized design. Routine management practices were carried out during the period of study, while the hygienic condition was ensured throughout the experimental period. The broilers had unlimited access to feed and drinking water. Data on feed intakes and final body weights were also collected and recorded.

Carcass Characteristics Study

At the end of the 4-week experimental period, a total of 12 birds (1 bird per replicate) were randomly selected, tagged for identifications, and weighted for carcass evaluation purposes. The slaughter procedure involved stunning and cutting of the broiler's jugular veins. The slaughtered birds were dipped inside water having a temperature of about 60-70oc for 40-60 seconds before being de-feathered. The birds were eviscerated and their dressed weights were recorded. The carcasses were cut into various parts and each weight was noted, including the weights of the organs. The weights of the parts were calculated as percentages of their live weights.

Blood Collection and Analysis

Before slaughtering the broiler chickens for carcass analysis, blood samples were taken from all the selected 12 birds, using syringes and needles through their wing veins. 10mls of blood were collected from each bird, out of which 5mls were put into a sterilized tube containing ethylene diamine tetra acetic acid (EDTA) as anticoagulant for haematological studies, while the other 5mls were collected into non-heparinized bottles for biochemical indices determination.

Statistical Analysis

All the data collected were subjected to analysis of variance (ANOVA) as outlined by Snedeccor and Cochran (2000) and differences between mean treatments were determined using Duncan's Multiple Range Test (DMRT) at 5% level of probability as described by Obi (1990).

Result and Discussions

Phytochemical Compositions of Moringa Oleifera Seed Filtrate

The result of the phytochemicals derived from the moringa seed filtrate used for the study is presented in Table 1. It showed that the filtrate contained alkaloids, phenols, carbohydrates, flavonoids, proteins, saponins, steroids, tannins, and terpenoids. Considering the protein value of moringa, it can augment the amino acid profile of poultry feed (Ogbunuafor et al., 2011). The amino acid content of moringa must have contributed to the increase in serum total proteins of the moringa seed filtrate-treated broilers. Okosun and Eguaoje (2017) reported that some phytobiotic properties of moringa aid in increasing the blood quality of birds. The chemical and biological properties of moringa that project it as a plant with high pharmacological potential depend on the presence of alkaloids, phenols, tannins, terpenoids, steroids, and saponins.

Table 1: Phytochemical Compositions of the Moringa Seed Filtrate Phytochemicals mg/l

Phytochemicals mg/l	**T_2**	**T_3**	**T_4**
Tannins	48.56	52.20	9.28
Saponnins	5.91	6.22	6.63
Alkaloids	8.45	8.86	9.32
Flavonoids	3.70	4.19	4.64
Phenols	17.83	18.37	19.55
Protein	32.29	33.30	34.50
Steroids	4.25	4.80	5.32
Terpeniods	18.36	18.89	19.35
Carbohydrates	2.75	3.20	3.40

Source: Field study, 2023.

Carcass Characteristics of the Experimental Broiler Chickens

The carcass analysis result in Table 2 showed that significant differences ($P<0.05$) existed between the broiler chickens on control treatment and those of MSF treated groups. The dressed weight values of the birds in T_2, T_3 and T_4 were significantly higher ($P<0.05$), compared to T_1. The highest dressed weight was recorded in T_3 group, although the value was similar ($P>0.05$) to the values obtained in T_2 and T_4.

The feed conversion ratio of T_3 birds was the lowest (1.79) against 1.91, 1.82 and 1.86 for T_1, T_2 and T_4 respectively. Improvements in the carcass characteristics of the *moringa* treated broilers observed in this study, agrees with the finding s of Egbu et al. (2022), that *moringa* seed extract improved broiler finishers relevant carcass parts. The improvement in the carcass traits could be attributed to the beneficial phytobiotic properties of *moringa*. Obionwu et al. (2017), reported a significant increase in carcass yields, when a similar phytogenic additive known as turmeric was used on broiler birds. They explained that this might be due to the optimum antioxidant activity and stimulated protein synthesis by enzymic systems.

Tariq et al. (2015) linked the increased carcass yield to improvements in bone and muscle developments, resulting from growth stimulating property of *moringa*. The internal organ weights of the broilers in all the treatment groups were similar. Matshogo et al (2021) made a similar observation, stating that elimination on non-starch polysaccharides by the *moringa* seed extract reduces, fibre level, which has direct relationship with internal organ sizes.

Table 2: Carcass and Internal Organ Characteristics of the Experimental Broiler Birds

Treatment levels of *Moringa* seed filtrate (ML/L of water)					
Parameters	**T_1 (MSF**	**T_2 (MSF 60)**	**T_3 (MSF 90)**	**T_4 (MSF 120)**	**SEM**
Live weight (kg)	2.15	2.25	2.30	2.20	0.06
Dressed weight (kg)	1.50^{b}	1.70^{a}	1.75^{a}	1.60^{a}	0.05
Dressing percentage	69.76^{b}	75.55^{a}	76.09^{a}	72.72^{ab}	1.02
Breast weight (%LW)	21.02	22.97	23.08	22.82	0.87
Thigh/Drumstick (%LW)	20.84	21.59	21.72	21.18	0.58
Wing (%LW)	6.17^{c}	6.79^{b}	7.18^{a}	6.26	0.13
Heart (%LW)	0.68	0.68	0.69	0.71	0.02
Gizzard (%LW)	2.20	2.25	2.25	0.27	0.04
Liver (%LW)	1.50	1.51	1.52	1.53	0.02
Kidney (%LW)	0.16	0.16	0.16	0.17	0.01

abc means within the same row with different superscripts are significantly different ($p<0.05$).
MSF = *Moringa* Seed filtrate

Haematological Indices

The result of the haematological analysis in this study as summarized in Table 3, showed that there was no treatment effect ($P>0.05$) on the haematological parameters, except for red blood cell count, where the value obtained in T_1 was significantly ($p<0.05$) decreased compared to T_2, T_3 and T_4 values. The nutraceuticals in the *moringa* seed filtrate is believed to be responsible for the improved blood qualities of the T_2, T_3 and T_4 birds. The decreased number of granulocytes and agranulocytes are indications that the test ingredient resulted to reduced pathogenic conditions. Banerjee (2015), reported that higher values of white blood cells mean increased infections, toxins or inflammation. Use of turmeric rhizome meal, a similar phytogenic as a feed additive in broiler finisher birds also decreases intestinal microbial population and selectively increases *lactobaccilus* count (Namagirilakshmi et al., 2010). *Moringa* leaves have quality attributes that makes it a potential supplement in non-ruminant diets. Packed cell volume and white blood cells were significantly ($p<0.05$) improved in birds fed *moringa* leaf meal treated diets (Okosun and Eguoje, 2017).

However, all the haematological values obtained in this study were within the normal ranges, as reported by Banerjee (2013) for healthy finisher broiler chickens. This infers that the *moringa* seed filtrate did not inflict any adverse effect on the blood constituents of the broilers. *Moringa* seed extract has positive effect on haemoglobin counts and platelets values of broiler finisher chickens, suggesting improvements in oxygen diffusion and a lower risk of haemorrhage (Egbu et al., 2022).

Table 3: Haematological Parameters of the Experimental Broiler Chickens

Parameters	Treatments T_1	T_2	T_3	T_4	SEM
Haemoglobin (Hb) g/dl)	8.49	9.30	9.22	0.12	0.06
Red Blood Cell Count ($x10^{12}$/L)	2.34^b	3.00^a	2.83	3.19^a	0.11
Mean Cell Haemoglobin (Pg)	36.85	32.06	31.80	31.13	3.10
Mean Cell Haemoglobin Concentration (g/dl)	34.72	35.40	32.00	34.46	0.33
Mean Cell Volume (fl)	104.5	90.66	93.40	87.60	9.02
Pack Cell Volume (%)	23.33	25.87	24.40	24.63	1.83
Granulocytes (%)	3.44	3.34	3.32	3.36	0.09
Agranulocytes (%)	78.01	74.50	69.29	69.88	3.48

abc means within the same row with different superscripts are significantly different ($P<0.05$)
SEM = Standard Error Mean

Broiler Finishers Biochemical Indices

Data on the serum biochemical indices of the broiler birds in Table 4, showed that administration of MSF did not result to significant differences ($p>0.05$) in the values of all the parameters analysed. However, the levels of total proteins and globulins in the MSF treated groups were higher compared to the control group. This suggests that *moringa* could improve the quality and quantity of proteins in poultry diets. The increased values of creatinine in T_2, T_3 and T_4 agrees with the notion of Imaseum and Ijeh (2018), that increased serum creatinine is common under increased metabolism of muscle protein, brought about by increased protein degradation enzymes that are responsible for creatinine levels regulation.

The hypocholeterolemic effect of *moringa* was evident in this study, when the concentration of cholesterol in T_2, T_3 and T_4 were compared with that of control. All the serium biochemical values recorded in this study were within the normal recommended ranges for clinically healthy broiler chickens as reported by Banerjee (2013)

Table 4: Serum Biochemical Indices of the Experimental Finisher Broiler Birds

Parameters	Treatments levels of MSF (ML/L) T_1	T_2	T_3	T_4	SEM
Total protein (g/dl)	64.47	65.58	66.40	67.21	1.54
Albumin (g/dl)	21.05	21.83	22.19	22.36	0.55
Globulin (g/dl)	43.42	43.75	44.21	44.85	1.58
Urea (g/dl)	2.20	2.28	2.37	2.35	0.40
Creatinine (ug/dl)	8.05	8.10	8.33	8.56	0.69
Cholesterol (mmol/L)	3.73	3.54	3.48	3.40	0.21
Alkaline phosphatase (iu/L)	26.33	27.10	26.66	27.41	0.51
Aspartate aminotransferase (iu/L)	11.20	11.00	11.18	11.22	0.10
Alanine aminotransferase (iu/L)	149.10	148.00	145.70	147.33	2.26

Source: abc means within the same row with different superscripts are significantly different ($P<0.05$)
SEM – Standard Error Mean, MSF = *Moringa* Seed Filtrate

Conclusion

This study demonstrated that administering Moringa oleifera seed filtrate (MSF) through drinking water positively influenced the carcass characteristics, hematological parameters, and serum biochemistry of broiler chickens. The presence of bioactive phytochemicals such as alkaloids, flavonoids, and proteins contributed to these beneficial effects. Statistical analysis revealed that birds supplemented with MSF had significantly higher ($p < 0.05$) carcass weights, with the best results observed at 90 mL MSF/L (T3). MSF improved hematological indices, particularly red blood cell counts, without exceeding normal physiological ranges, indicating enhanced blood quality without adverse effects. Additionally, MSF-treated birds showed improved protein metabolism and a reduction in serum cholesterol levels, suggesting potential health benefits. Given these findings, MSF at 90 mL/L can be recommended as a natural growth enhancer for sustainable broiler production, improving both yield and overall physiological health.

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