

Histological Indices and Growth Performance of Noiler Chickens fed Dietary inclusion of Locust Bean Leaf Meal

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ABSTRACT

The growth performance and histological indices of Noiler chickens fed dietary inclusion of locust bean (*Parkia biglobosa*) leaf meal was the focus of this study. Two hundred and forty (240), day-old noiler chicks were used for the eight weeks experiment. The chicks were randomly divided into four treatments with 60 chicks per treatment in a completely randomized design. Each treatment has three replicates of 20. Four dietary treatments containing *Parkia biglobosa* leaf meal (PBLM) of 0%, 5%, 10%, and 15% levels of PBLM. Water and feed were made available *ad-libitum*. The results showed that there were distinctive differences in feed intake, daily weight gain and final live weight ($P < 0.05$). However, chicks fed 5% PBLM had the lowest feed conversion ratio which had a proportionate effect on the final live weight. Noiler chicks fed 5% PBLM had the highest feed intake, daily weight gain and final live weight. Histological indices of the intestines and gizzard showed normal epithelial covering at 0, 5% and 10% PBLM but vascular congestion was observed at 15% PBLM. It is therefore concluded that PBLM could be included at 5% for Noiler chickens without adverse effect on growth performance or internal organs structure.

Keywords (Times New Roman, bold, 9)

Growth; Histological indices; Noiler; Performance

Introduction

Global food security is the most important item on the strategy developmental agenda for developing countries. 50 to 70% increase in food productivity was estimated nutritionally to be needed by 2050 to feed two billion people in addition (Ericksen *et al.*, 2009; Ilea 2019). Obviously, with the increasing world population growth it is accompanied by an increase in the future projections of demand for animal products (Larsen 2014; Henchion *et al.*, 2017; King *et al.*, 2017), and this growth emphasizes the need to increase the productivity of each animal as well as an increase in the number of animals (Davis and D'Odorico, 2015). However, the rapid development of the poultry industry and increased demand for poultry feed have led to a substantial increase in feedstuff prices, unavailability of feed ingredients and inadequate feed quality and quantity, all of which hinder growth of animal production.

As a result, the feeding component of poultry farming is clearly a burden for farmer (Shiferaw *et al.*, 2013; Marangoni, *et al.*, 2015). This is due to the fact that poultry and humans have similar nutrition requirements, and that grains (such as corn) used in poultry diets are also consumed by humans. Besides, grains are also in competition with various industries as they are used as industrial raw material. In addition, the level of production of these important grains is not sufficient to meet the increasing demand of the poultry industry. Therefore, it is essential that scientific knowledge be improved on the utilization of low-cost and locally available agro-industrial by-products in poultry feed. This will help reduce the feed cost and increase profitability (Sissoko *et al.*, 2011; Kristjanson, *et al.*, 2012). Attempts to use cheap local by-products can benefit farmers by reducing feed costs, thereby reducing the total cost of chicken and egg production, and making them readily available in rural areas at a lower cost (Sage, 2012).

Studies have shown that there is a possibility of unconventional food resources being used in poultry rations (Ravindranath *et al.*, 2011). *Parkia biglobosa* (African locust bean) is an example of non-convectional feed source. It is a leguminous tree crop of the family Mimosaceae. The fruit of the locust bean tree is of high monetary significance: its consumable seeds are used as a food seasoning after fermentation (Urua *et al.*, 2013). The yellow component of the fruit (pulp) has a sweet taste and can be processed into a nutritious carbohydrate food (Vinceti *et al.*, 2018). In rural areas, locust bean products provide a source of income for women and children (Vinceti *et al.*, 2018). The bark has many traditional uses in folk medicine. A root decoction is reported to treat coccidiosis in poultry. Fish farmers utilize the green pods as a toxic substance to catch fishes in rivers. African locust bean trees are used as an ornamental plant. They are valuable soil improvers and their leaves provide green manure (Urua, *et al.*, 2013; Komolafe *et al.*, 2017). There are many researches on *P.biglobosa* bean seeds but few on *P.biglobosa* leaf meal as livestock feed. Hence, this study is designed to evaluate the growth performance of noiler chickens fed dietary inclusion of locust bean leaf meal.

Materials and Methods

This research was conducted in the poultry unit of the Teaching and Research Farm of Landmark University Omu-aran, Kwara state. It is located approximately 88 kilometers South of Ilorin, the capital of Kwara State and 16km North-East of Otun Ekiti, in Ekiti state.

Collection of locust bean leaf: *Parkia biglobosa* leaves have been collected from various locations in and around the Landmark University campus. Subsequently, in a well-ventilated

place of the teaching and research farm, the leaves of *P. biglobosa* were air-dried until the leaves became brittle while still retaining the greenish hue. The air-dried leaves were then crushed to produce leaf meal using a hammer grinding machine and stored in an airtight condition until utilization.

Animal Management: Two hundred and forty (240), day-old noiler chicks were used in the experiment. The chicks were randomly divided into four groups with 60 chicks per treatment in a completely randomized design. Each treatment has three replicates of 20 chicks in each. The experimental diets was with different inclusion level of locust bean leaf meal (LBLM) as replacement of soya bean meal and the experimental diets were designated as T1-0%, T2-5%, T3-10%, and T4-15%. The chickens were reared for 8 weeks. The birds were reared on a deep litter system, given Feed and water ad libitum and strict bio-security measures were kept in place. All birds were vaccinated against Newcastle and gumboro disease. Coccidiostat, antibiotics and vitamins were also administered to birds.

Table 1: Experimental Feed Diet

Ingredient	T1%	T2%	T3%	T4%
Maize	56.00	56.00	56.00	56.00
Soya bean meal	38.00	34.20	30.40	26.60
PBLM	0	3.80	7.60	11.40
Fish meal	2.00	2.00	2.00	2.00
Bone meal	3.00	3.00	3.00	3.00
Premix	0.30	0.30	0.20	0.30
Lysine	0.10	0.10	0.10	0.10
Methionine	0.20	0.20	0.20	0.20
Salt	0.30	0.30	0.30	0.30
Toxin binder	0.10	0.10	0.10	0.10
Total	100	100	100	100

Histological analysis: some organs such as heart, small intestines, gizzard, liver and spleen were preserved in formalin and taken for histological analysis in histopathology laboratory. Binocular Olympus Model CX21FSI Microscope and 12Mega Pixel Samsung Camera were used for photomicrographs of magnification X 10

Statistical analysis: Generated data were subjected to a one-way analysis of variance (ANOVA) and was analyzed using the general linear model procedure of SAS (2012). The design used was complete randomized design (CRD) and ranked with Duncan.

Results and Discussion

Table 2: Proximate composition of PBLM and experimental diet

Proximate Components	PBLM	T1	T2	T3	T4
Moisture	12.00	10.90	11.34	11.01	10.95
Dry Matter	88.00	89.10	88.66	88.99	89.05
Crude Protein	19.70	22.96	21.99	21.36	21.16
Ether Extract	9.00	8.34	10.21	9.86	9.44
Ash	3.50	5.90	3.50	4.25	4.40
Crude Fibre	7.90	5.22	6.50	6.55	7.25
Carbohydrate	59.90	57.58	57.80	57.98	57.75

As indicated in the Table 3, the result on growth performance characteristics of noiler chickens showed no significant difference in the initial weight of all the birds used for the experiment, however there were differences in feed intake, feed conversion ratio, daily weight gain and final live weight ($P < 0.05$). The birds fed T2 had the highest feed intake this could be due to the low energy content of the feed, Chickens are known to eat to meet their energy requirement (Mitchell, 2016). The birds fed T2 weighed more than those fed control diet for final live weight, this could be attributed to better feed conversion ratio of T2 compared to T1. Feed intake for birds fed T3 was similar to those fed T1; however, there was difference in final live weight.

Birds fed T4 had lower daily weight gain and final live weight when compared to those fed T1. Birds fed T1 weighed more than those fed T3, the difference could be as a result of increased level of anti-nutritional factor at the increased level of 10% replacement. Ramah et al., (2020) reported that high tannin group chickens had decreased daily gain, daily feed intake, final body weight, and relative weights of lymphoid organ and T2 the difference could be as a result of increased level of inclusion of *Parkia biglobosa* which may contain higher content of anti-nutritional factors responsible for reduced weight gain. The feed conversion ratio for T4 was the least however with increased level of the replacement of the PBLM the nutrient in the feed may not be available for utilization by the birds. Cost per kilogram weight gain shows some level of significance ($P < 0.05$) at 10% dietary inclusion (T3) had the highest cost of per kilogram weight gain while at 5% dietary inclusion (T2) had the lowest cost per kilogram weight gain which showed that it is more economical to feed with T2 compared to other treatments. Cost of feed per kilogram also had some level of significance ($P < 0.05$) while treatment with 5% dietary inclusion has the lowest feed cost, other treatment diets has slightly higher feed cost.

Table 3: Growth performance characteristics of Noiler chickens fed PBLM as affected by the dietary inclusions (%)

GROWTH CHARACTERISTICS	TREATMENT DIETS (%)					
	T1	T2	T3	T4	SEM	Pr>F
Initial live weight (g/bird)	77.08	77.08	77.08	77.08	2.08	1.000
Final live weights (g/bird)	672.92 ^{ab}	760.42 ^a	658.33 ^b	635.42 ^b	24.85	0.0581
Daily weight gains (g/bird/day)	12.41 ^a	12.24 ^{ab}	11.33 ^b	11.63 ^b	0.51	0.0564
Feed intake (g/bird/day)	42.42 ^b	42.62 ^{ab}	42.26 ^b	43.207 ^a	0.53	0.0599
Feed conversion ratio	3.41 ^a	3.37 ^a	3.73 ^b	3.72 ^b	0.21	0.0909
Cost per kg weight gain (N)	520.31	461.16	444.38	442.92	31.36	0.2336
Cost of feed/kg (N)	4.42	3.81	3.41	3.29	0.00	<0.001
% Mortality	1.30 ^a	1.33 ^a	4.33 ^b	8.16 ^c	0.40	0.7520

SEM= Standard error of mean; LOS= Level of Significance; *= $P < 0.05$; ^{a,b,c,d} Means with different superscript along the same rows are significantly ($P < 0.05$)

The dietary intake of tannin in the diet can exert different effects on the immune system. The results showed that the daily gain, final body weight, daily feed intake and relative weight of lymphatic organs of chickens with high tannin content decreased (Ramah *et al.*, 2020).

Histological Analysis - Histological studies were carried out on the gizzard and small intestine of the four treatments; the organs were collected and fixed in 10% neutral buffered formalin solution according to the method of Fischer *et al.*, (2008). As seen in the photomicrographs, the histological analysis of noiler chickens as influenced by the treatment diet PBLM shows normal epithelial covering of the gizzard and intestines in control, 5% and 10% PBLM dietary inclusion but at 15%, result shows prominent vascular congestion. The vascular congestion may be as a result of anti-nutritional factors present in PBLM



Plate 1

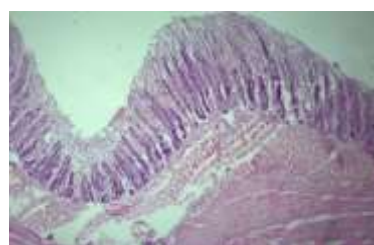


Plate 2



Plate 3

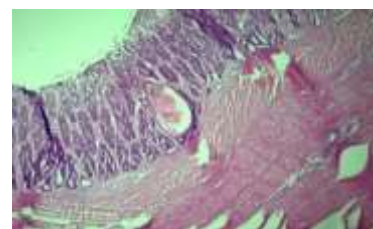


Plate 4

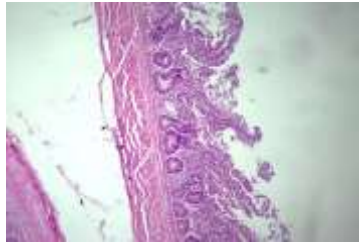


Plate 5

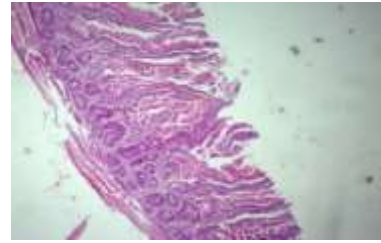


Plate 6

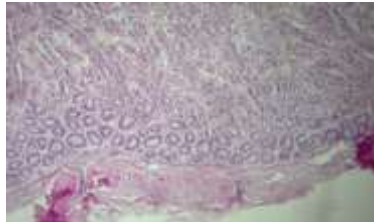


Plate 7

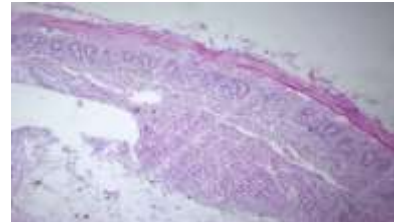


Plate 8

Plate 1 (T1): Shows normal epithelial covering of the gizzard.

Plate 2 (T2): Showing normal epithelial covering of the gizzard.

Plate 3 (T3): Showing normal epithelial covering of the gizzard.

Plate 4 (T4): Shows a normal epithelial covering of the gizzard with prominent vascular congestion.

Plate 5 (T1): Showing normal epithelial covering of the Intestine.

Plate 6 (T2): Shows a normal epithelial covering of the intestine.

Plate 7 (T3): Showing normal epithelial covering of the intestine.

Plate 8 (T4): Showing a focal area of epithelial ulceration in the Intestine.

The existence of anti-nutritional factors restricts the use of African locust beans and other legumes as protein sources, these anti-nutritional factors are a variety of natural compounds in many tropical plants (Yahaya *et al.*, 2019). The test ingredient, (Parkia) shows some degree of toxicity at a higher level (15%) in the organs, as evidence by congestion of the epithelial lining of the gizzard (Photomicrograph 4) and mucosa ulceration of the intestine (Photomicrograph 8) and at a lower level of 5% and 10% PBLM, there was no evidence of toxicity seen. The intestine is the essential part of the digestive tract in which the complex process of changing feed into the muscles occurs. Furthermore, the intestine not only plays the role of digestion and absorption of nutrient from the ingested feed but also shows the overall wellbeing of the animal. Yahaya *et al.*, (2019) reported that Nitrate had the highest percentage occurrence of 82.2% in *Parkia biglobosa* leaf. Nitrate can be broken down into nitrite, which can cause health complication (Kadiri and Asagba, 2019). Cyanide is another anti nutritional factor found in *Parkia biglobosa* leaf. Studies have also shown that cyanide is a neurotoxin that stimulates intracellular generation of reactive oxygen species (ROS). Part of its biological toxicity effects may be mediated through the attack of generative reactive oxygen species on certain target organs (such as the liver, kidney, heart, and brain).

Conclusion

Noiler is raised on low quality feedstuffs to provide high quality meat and eggs. This present study makes the prospects of utilizing *parkia biglobosa* leaf meal at 5% as a source of protein feasible because they are much cheaper and available throughout the year. From this study, the incorporation of *Parkia biglobosa* leaf meal in the diet of Noiler chicken up to 5% level is recommended because chickens had higher weight gain compared to the control and other treatments. Inclusion level of 5% has no adverse effect on growth performance or internal organs structure.

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