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Variation in growth performance characteristics of broiler finisher birds fed three different leaf meals as additive

***Anyanwu, N.J,[1] Osuji V.C[1], Etela I [2], Kalio G.A [4], Ekpe I.I. [3], Odoemelam V.U[1], Okere P.C[1].**

[1].*Department of Animal Science and Technology, Federal University of Technology, Owerri*
[2]. *Department of Animal Science and Fisheries, University of Port Harcourt*
[3].*Department of Soil Science, Federal University of Technology, Owerri*
[4] *Department of Agric. Science, Ignatius Ajuru University of Education, Port Harcourt*

****Corresponding Author:** njanyanwu@yahoo.com* ***Phone Number:** 08187184503*

Target Audience: Poultry farmers, Feed millers, Livestock extension agents

Abstract

This study investigated the growth performance characteristics of broiler finisher birds fed three different leaf meals at 5% inclusion level in a 28-day trial. The leaf meals obtained from three forage plants namely, Moringa oleifera, Pueraria phaseoloides, and Pennisetum purpuruem were added as protein substitutes and partial supplements for soya bean in the diet and birds were fed ad libitum. A total of one hundred and twenty (120) 4 week old broiler birds were allotted to four treatment groups of 10 birds each with three replications in a completely randomized design (CRD). The results showed significant differences (P<0.05) in the feed intake, final weight gain and average weight gain but no significant differences were observed in feed conversion ratio. The control diet had the highest average weight gain of 1706.67g and Pueraria phaseoloides having the least value of 1208.33g. Pennisetum purpuruem exhibited the highest weight gains amongst the leaf meals under study. The shank and skin colouration was more apparent in the birds fed Moringa oleifera leaf meals showing that it may contain higher levels of xantophylls and other beneficial antioxidants. It could be concluded that Pennisetum purpuruem leaf meal in broiler finisher diet provided better results for optimum weight gain and productivity and is therefore recommended above Moringa and Pueraria.

Key words: *Growth Performance; Feed additive; Broiler Finisher; Anti-nutritive factors; Moringa oleifera; Pennisetum purpuruem. Pueraria phaseoloides*

Description of Problem

Poultry meat from broilers is in high demand by Nigerian households and that has developed the live chicken and processing segment of the value chain, evident in most urban markets across Nigeria. Despite the prevalence of smuggled frozen poultry in the market, consumers have preference for locally produced chicken (1). In addition, recent health concerns have led to preference for white meat over red meat. The high feed cost in broiler production has made many farmers to seek alternative methods to improve feed utilization for overall animal performance and profitability. The high cost of conventional feed ingredients especially maize and soya bean, has increased feeding cost to between 60-80% of the total cost of livestock production, especially for poultry and pigs (2). Addition of natural pigment to animal diets have been reported to improve efficiency of feed utilization and decreased mortality in fish (3) improved sow fertility and survival of healthy piglets (4). Leaf meal has also been included into the diets of poultry as means of reducing high cost of conventional protein sources and to improve profit margins (5,6.7 and 8). According to

(9), leaf meals do not only serve as a protein source but also provide some necessary vitamins, minerals and also oxycarotenoids which results to the yellow colour of broiler skin, shanks and egg yolk. In addition, they could also serve as biological agents as sources of trace elements, growth promoters, absorption enhancers, antimicrobial-agents and metabolic modifiers (10).

However, the contents of these nutrients in different plants may vary as well as the extent of utilization in broiler chickens, hence this study. Leaves and vegetables from forage plants are rich sources of beta-carotene, a precursor for vitamin A. They also have medicinal properties in addition to being natural source of therapeutic agents. Regrettably, some contain anti-nutritional factors such as cyanogenic glucoside; oxalate; phytate; saponin and tannin to mention but a few that may make them unsafe as feed additive (10).

In order to ensure the survival of the poultry industry in the region through reduction of cost of production, the search for alternative additives in broiler finisher diets becomes imperative. Based on the foregoing therefore, this study was initiated.

Materials and Methods

Experimental Site and source of birds: The study was carried out at the poultry unit of the Teaching and Research Farm, Federal University of Technology Owerri. A total of one hundred and twenty (120) day old unsexed and healthy commercial broiler chicks of B-knot strain brooded on a partitioned deep litter house, were randomly assigned into four dietary treatment groups of thirty birds each. Each group was sub-divided into three replicates of ten (10) birds each in a randomized complete block design. The birds were vaccinated, and fed appropriately and water was supplied *ad libitum*. The brooding house and its environments were thoroughly cleaned, washed with detergent, and disinfected. Electric bulbs and coal pots were used as source of light and heat. Black polythene was used to cover the brooding house for the first four weeks to facilitate a warm environment for the birds. The polythene was gradually uncovered from the third week of the experiment to prevent excessive heat in the brooder house.

Sample preparation: The leaves of *Moringa oleifera, Pueraria phaseoloids* and *Pennisetum purpureum* (Elephant grass) used for this research were collected from a fallow farmland at Umuanunu farm settlement in Obinze Port Harcourt Road, Owerri, Imo State. They were harvested in a fresh state and authenticated by a taxonomist of the Department of Forestry and Wild Life Technology Owerri, Imo State. The leaves were plucked out, one after the other from the cut vines of the legume and chopped into smaller bits for faster and effective drying. The chopped leaves were air-dried until they became crispy while still retaining the greenish colouration. The air-dried leaves were then milled in a hammer mill to produce leaf meal comprising of ground leaf materials of variable particles sizes. A sample of the leaf meal was subjected to proximate analysis according to (11). The variety of other feedstuffs used to compound the experimental diets were purchased from a commercial feedstuff dealer.

Experimental Diets

The experimental diets were formulated to contain three different leaf meals at 5% inclusion namely, *Moringa oleifera, Pueraria phaseoloides* and *Pennisetum purpureum as* T2, T3, and T4 with T1 representing the control treatment with 0% inclusion. Table 1 shows the composition of experimental diets and calculated chemical composition respectively.

Table 1: Composition of Experimental Diets (%)

Feed materials	T1 (0%)	T2 (5%)	T3 (5%)	T4 (5%)
Maize	50	50	50	50
Palm kernel cake	10	10	10	10
Wheat offal	10	10	10	10
Soybean	24	19	19	19
Leaf meal	0	5	5	5
Fish meal	2	2	2	2
Oyster shell	1	1	1	1
Bone meal	2	2	2	2
Methionine	0.25	0.25	0.25	0.25
Lysine	0.25	0.25	0.25	0.25
Broiler premix*	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25
Total	**100**	**100**	**100**	**100**
Dry matter	93.42	91.98	92.18	91.82
Moisture content	6.58	8.02	7.82	8.18
Ash	5.7	6.31	6.06	5.94
Crude fat	5.98	5.30	5.41	5.74
Crude fiber	4.47	4.30	5.40	7.45
Crude protein	19.81	19.12	19.35	18.71
Nitrogen free extract	57.46	56.95	55.96	53.98
ME(Kcal/kg)	**3212.75**	**3112.95**	**3150.95**	**3032.05**

Data Collection

The following parameters were measured in the course of the 28 days trial, namely, initial body weight, final body weight, weekly body weight, average daily body weight, average daily feed intake and feed conversion ratio. Each bird was individually weighed at the beginning of experiment and at the end of each week and the weight recorded. The average weight per treatment was obtained by dividing the total weight of birds in the treatment by the number of birds in that treatment group.

A pre-weighed diet was fed *ad libitum* each day and the left-over feed weighed at the beginning of the next day. The difference between the amount fed and left-over fed represented the quantity of feed consumed. Average feed consumption in a treatment was obtained by dividing the weight of feed consumed in that treatment by the number of birds in that treatment group expressed in grams per bird per day. The feed conversion ratio (FCR) was calculated as follows

$$FCR = \frac{feed\ intake\ (g)}{weight\ gain\ (g)}$$

Mortality records of each replicate were kept on daily basis throughout the duration of the experiment.

Statistical Analysis: Data on each of the parameters were subjected to analysis of variance using the (ANOVA) as a completely randomised design (CRD). The Duncan New Multiple Range test was used to determine differences between treatment means in accordance with (12).

Results and Discussion

Chemical Composition of Leaf meals

The results of the chemical composition of *Moringa oleifera (MO), Pueraria phaseoloids (PP)* and *Pennisetum purpureum* (PPM) leaf meals is presented in Table 2. The proximate compositions were in line with those reported for some tropical forage crops (13). The highest crude protein content was reported for PP, 31.74% and ash with 7.76%, while MO had a crude protein content of 27.15% and ash 12.29%.– PPM was found to contain 18.96% CP and 4.83% ash which is lower than the other two leaf meals. The crude protein content of the MO and PP leaf meals (27.15% and 31.74%) were higher than 20.72% reported by (14) for *Moringa oleifera*. It also compares favourably with (21.8%) of fluted pumpkin leaves reported by (15). In addition, it also compared with 22.2% and 22.5% reported for *Leucaena spp.* and *Gliricidia spp* respectively (16). The CP content was higher than that of *Vernonia amygadalina* (17.92%) as reported by (17). It is also higher than the report by (18), (18.3%) but conforms to that reported by (19), (21.7%). The fibre content of MO (12.55%), PP (14.26%) and PPM (13.69%) were lower when compared with that reported for *Leuceana* leaf meal (18.9%) by (20), and *Moringa oleifera* leaves (19.25%) by (21). The ash content of MO (12.29%) was higher when compared to (11.0%) reported for *Leucaena leucocephala* by (22) while ash values of (7.76%) and (4.83%) for PP and PPM respectively, were lower when compared to (15.4%) reported by (19) and (16.7%) reported for cassava leaf by (23). However, it compares with (7.13%) reported on *Moringa* leaves and *Vernanonia amygadalina* by (21). The fat content of MO (3.85%), PP (12.47%) and PPM (18.39%) is higher compared with (5.4), (2.4%) and (5.4%) respectively, reported by (24). Also, it is comparable to (2.23%) reported for *Moringa* leaves by (21).

Table 2: Proximate composition of *Moringa oleifera (MO)*, *Pueraria phaseoloides (PP)* and *Pennisetum purpureum (PPM)* leaf meals

Nutrients (%)	MO	PP	PPM
Dry matter	86.09	83.79	81.87
Moisture	13.91	16.21	18.13
Crude protein	27.15	31.74	18.96
Crude fat	3.85%	12.47	18.38
Crude fibre	12.55%	14.26	13.69
Ash	12.29	7.76	4.83
NFE (Carbohydrates)	30.25	17.56	26.02

Table 3: Performance indices of broiler finishers fed dietary *Moringa oleifera* (T2*)*, *Pueraria phaseoloids* (T3) and *Pennisetum purpureum* (T_4) leaf meals

Parameters	T1	T2	T3	T4	SEM
Average initial body weight (g)	476.66	418.33	433.3	451.66	9.65
Average final body weight (g)	2183.33 ^{a}	1670.78 ^{b}	1641.66 ^{b}	1916.66 $^{a\ b}$	109.30
Average final weight gain (g)	1706.67 ^{a}	1252.45 ^{b}	1208.33 ^{b}	1465 $^{a\ b}$	93.48
Average daily weight gain (g)	60.95^{a}	44.73^{b}	43.15^{b}	52.32^{ab}	5.8
Average daily feed intake (g)	106.46 ^{a}	72.58 ^{c}	75.98b ^{c}	81.75 ^{c}	4.4
Feed conversion ratio	1.74^{a}	1.62^{a}	1.76^{a}	1.52^{a}	0.15

SEM= standard error of mean
abc= Means with different superscript on the same horizontal row are statistically different at p<0.05

Growth performance

The growth performance data are presented in Table 3. There were significant differences ($p<0.05$) between the control diet and the trial diets with the *Pennisetum purpureum* supplement recording the highest final body weight values amongst the leaf meals although not significant. This implies that addition of *Pennisetum purpureum* leaf meal could improve feed utilization and enhanced final weight gains in broilers more than *Moringa oleifera (MO)* and *Pueraria phaseoloides (PP)* while reducing feed cost. There were no significant differences ($p>0.05$) in the average daily body weight gain among the various treatments as shown in Table 3 although the control was numerically higher.

The results of feed intake showed that the birds on control diet consumed more feed than the experimental diets although there were no significant ($p>0.05$) differences amongst the trial diets. It was observed that during the first week of adding the leaf meal to the diet, feed intakes reduced when compared to the control group. As the birds gradually adjusted to the leaf meal, their feed intake increased as seen in subsequent periods.

The control treatment showed superior performance compared to the other trial diets for all the parameters measured except treatment 4 (PPM). This is not in conformity with previous reports that leaf meal inclusion level in poultry diet, led to improvement in growth performance (8, 9 and 27). It would appear that different leaf meals exert different effects, both positive and adverse, when added to poultry diets. In the case of this experiment, it can be seen that of all the leaf meals under study, *Pennisetum purpureum* leaf meal resulted in the highest weight gains which was comparable to the control. This may imply that *Pennisetum purpureum* leaf meal served as better source of trace elements, growth promoters, absorption enhancers, antimicrobial-agents and metabolic modifiers (10). It may also mean that the leaf meals of *Moringa oleifera* and *Pueraria phaseoloides* had higher contents of fibre and anti-nutritional factors such as cyanogenic glucosides; oxalate; phytate; saponin and tannins, which needed to be removed before addition to the broiler diets (24). The birds on control diet consumed higher feed than the bird on *Moringa oleifera* (T2*), Pueraria phaseoloides* (T3) and *Pennisetum purpureum* (T4) diets. It is worthy to note that (T4) showed numerically higher weight gain than the rest of the trial treatments. This could be attributed to the higher content of crude fat recorded in the chemical analysis (Table 2). This is also supported by (25), which reports higher contents of ether extract for *Pennisetum spp*. when compared with *Pueraria phaseoloides* and *Moringa oleifera*. This may have resulted to an increase in the energy level available to the birds. Besides all the three leaf meals contain the same amount of gross energy of 18.5 MJ/kg DM (26). Furthermore, although there has been a lot of research interest on the use of *Moringa* leaf meal as an alternative feed ingredient for poultry due to its high contents of protein, the digestibility of diets containing *Moringa* leaf meal was found to be lower than that of control diet, especially for crude protein (and therefore amino acids), which was partly due to the fibre content, which also limits its energy value in poultry (27). More so, with a crude protein content range of 15% to 30% DM, the stage of maturity and the proportions of leaflets, petioles and stems, could drastically reduce the protein content, in addition to a fibre content that could be as high as 30%.

While *Moringa* leaves contain high levels of minerals (about 10% DM), particularly Ca and Fe they are also rich in a wide range of vitamins (ß-carotene, ascorbic acid, vitamin B1, B6 and niacin) and flavonoids which are powerful antioxidants. It also contains relatively high contents of saponins (8%) and limited amounts of cyanogenic glucosides (28).

Similarly, although *Pueraria phaseoloides* contained higher amounts of crude protein than *Pennisetum pupuruem*, it contained much higher contents of lignin which are capable of binding the soluble carbohydrates contained therein. This might be linked to the advanced stage of maturity of the plant which may contain higher amounts of lignin. Additionally, (29), had reported previously that *Pueraria phaseoloides* depressed growth rate in broilers although (30) suggested it could be used in Lohmann Browns laying birds. High levels of leaf meals included in the diet could cause nutrient imbalances and inhibit metabolism, thus negatively affecting growth performance. The higher feed intake recorded by birds on control group over the experimental diet agrees with earlier reports that diets containing leaf meal results in low feed intake due to higher fibre content (8). Since, the birds in the control group consumed higher quantity of feed, their daily weight gain was expectedly, to be significantly higher than the treatment diets. From the feed conversion ratio, it could be seen that the birds on control diet utilized their feed more efficiently than the birds on experimental diets.

Also, the yellow colouration observed on the shank and body of the bids on experimental diets showed that *Moringa oleifera* (T2*), Pueraria phaseoloids* (T3) *Pennisetum purpureum* (T4) diet contained higher levels of carotene and xanthophylls which can be extracted. Further trial is recommended to conclusively confirm the above observations.

Conclusion and Applications

From the result of this study, it is evident that:

1. *Pennisetum purpureum* was the most suitable for use as a leaf meal in broiler finisher diets than *Moringa oleifera* or *Pueraria phaseoloids* leaf meals.
2. The implication of this study is that commercial preparations of leaf meals should be subjected to some purification in order to remove some of the fibre and anti-nutritional compounds.
3. In addition, the stage of maturity of the leaf is a critical factor to consider during the harvest, by ensuring that the plant is harvested before flowering.
4. It is recommended that trials on the elimination of anti-nutritive compounds in leaf meals before feeding may be necessary to further confirm results from this study.
5. *Moringa oleifera, Pueraria phaseoloids* and *Pennisetum purpureum* leaf meals without the antinutritive compounds, can serve as cheap sources of protein and can be considered as a raw material for compounding livestock feeds to reduce costs.

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