

Growth Performance of Starter Broilers Fed Different Levels of Lemongrass and Pawpaw Leaf Meal

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ABSTRACT

Background and Objective: Plant-based substances have now become more popular in the poultry sector and because of this animal nutritionists have diverted interest from synthetic feed additives to plant herbal-based substances, such as leaves of plants to boost growth and suppress negative microbial population in poultry gastrointestinal tract which usually compete with the host animal for nutrients from the feed consumed. This research is therefore tailored towards determining the response of starter broilers fed graded levels of lemongrass and pawpaw leaf meal. **Materials and Methods:** A total number of 96, day-old broiler chicks of the Ross 308 strain were used for the research work. The experiment was conducted at the poultry site of the Federal College of Agriculture, Ishiagu in Ebonyi State, Nigeria. Four experimental diets were formulated at 3% inclusion levels, with diet 1 containing 0% lemongrass and pawpaw leaf meal, which served as the control. Diets 2, 3, and 4 contained lemongrass and pawpaw leaf meal at the levels and ratios of 0.75:2.25, 1.50:1.50, and 2.25:0.75, respectively. Data were analyzed using ANOVA, and significant means were compared with Duncan's Multiple Range Test at a 5% significance level. **Results:** Dietary effect on growth performance parameters reported showed that results obtained were not significantly ($p > 0.05$) affected across the treatment group for final body weight, body weight gain, daily feed intake, daily weight gain, and feed conversion ratio. Birds in treatment 1 had similar values of 885.72, 771.43, 790.48, and 800.00 g for final body weight. The feed conversion ratio had a value of 1.86 in treatment 1, which did not differ ($p > 0.05$) from the values of 2.13, 2.11, and 1.90 seen in treatments 2, 3, and 4. Values obtained for the cost of kg of feed had a value of 876 in treatment 1, which differed from the values of 802.55 seen in treatments 2, 3, and 4. Value for cost-benefit ratio was better off in treatment 1 with 5.35, while the least performed group was observed in treatment 2 with 11.67 which did not differ statistically from those in treatment 3. Treatment 4 had a cost-benefit ratio of 6.36. **Conclusion:** It can be concluded that processed lemongrass and pawpaw leaf meal are viable in the diet of starter broiler birds up to the inclusion level of 3% combination without any negative impact.

KEYWORDS

Response, lemongrass, pawpaw leaf meal, growth performance, cost-benefit, graded

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INTRODUCTION

The high cost of conventional feedstuff has continued to pose a major constraint to the poultry sector, especially in Nigeria and the world at large. Thus, the stiff competition for conventional materials between man and livestock has dominated the production sector and has contributed greatly to the rising cost of these feedstuffs in the local market¹. This calls for an Imperative need to explore an alternative use of non-conventional and potential feed ingredients that is relatively cheap and locally available and would ensure relatively high productivity of the birds at lower cost without necessarily compromising their health and consumers' interest in the long run. Herbal supplementations in the diet of poultry birds have over the years reduced mortality and improved growth and nutrient utilization which have ultimately led to lower costs of production. These medicinal herbs which include neem, turmeric, moringa, bitter leaf, lemongrass, pawpaw leaf, scent leaf, etc contain some chemical substance that produces a better physiological action in the animal system².

Carica papaya is a small, sparsely branched herbaceous plant in the tropics that belongs to the *Caricaceae* family. It is mainly found in the tropics and sub-tropic regions because of its easy cultivation, rapid growth, quick economic returns, and easy adaptation to diverse kinds of soils and climates³. It has been used as ethnomedicine for decades in the tropics and subtropics. The leaves of the plant also contain various kinds of vitamins ranging from vitamin C 140 mg, vitamin E 136 mg, vitamin B1 0.15 mg, fat 2.0 mg, calcium 35.3 g, phosphor 63 mg, and iron 0.80 mg, and also some enzymes which include chymopapain, papain and lipase which can degrade complex bond and hence increase the efficiency of nutrient digestibility and utilization in ratio⁴. The earlier report of Oloruntola⁵. indicated that the incorporation of pawpaw leaf meal in the diet of finishing and starter broilers improved performance, feed intake, weight gain, and feed conversion ratio, carcass, and organoleptic indices, respectively. Pawpaw leaf contains unique plant compounds that have demonstrated broad pharmacological potential in test-tube and animal studies. Papaya leaf is also known to contain a natural enzyme called papain. Papain is well known for its ability to break down large proteins into smaller, easier-to-digest proteins and amino acids. The leaf also contains flavonoids, vitamin E, etc.

Lemongrass (*Cymbopogon citratus*) is an aromatic perennial tropical plant that belongs to the family Gramineae (*Poaceae*) and the genus *Cymbopogon*. They contain simple, bluish-green leaves with entire margins and are linear in shape. The blades can be as long as 18–36 inches in length. The plant is widely distributed throughout the world and especially in the tropical and subtropical regions of the world⁶. The compounds identified in *Cymbopogon citratus* are mainly terpenes, alcohols, ketones, aldehydes, and esters. Studies indicate that *Cymbopogon citratus* possesses various pharmacological activities such as anti-amoebic, antibacterial, antidiarrheal, antifilarial, antifungal, and anti-inflammatory properties. Other effects such as antimalarial, antimutagenicity, antimycobacterial, antioxidant, and hypoglycemic have also been studied⁷.

However, this present study is designed to determine the influence of processed lemongrass and pawpaw leaf meal on the growth performance and cost-benefit analysis of starter broiler birds.

MATERIALS AND METHODS

Experimental site: The research work was carried out at the poultry section of the Federal College of Agriculture, Ishiagu, Ivo Local Government Area of Ebonyi State from September to November 2024.

Source and processing of black plum leaf: The lemongrass leaf (6 kg) and pawpaw leaf (6 kg) that was used for the research were sourced from Enugu and Ishiagu, in Ebonyi State. The lemongrass and pawpaw leaf were obtained fresh and washed. The leaves were then sun-dried and later ground into a meal.

Experimental design and management of birds: The 96 day old broiler chicks of Ross 308 strains were used for the research work. The birds were randomly distributed into four treatment groups. Each treatment was replicated three times in a Completely Randomized Design (CRD) with 8 birds per

Table 1: Broiler vaccination/drug administration schedule

| | |
|--------------|--|
| Day 1 | Marek vaccine (This was given at the hatchery or point of collection of the chicks or on the arrival of the chicks to the farm); Source: COSIN farms, Enugu state. Manufacturer: BIOVAC Nigeria Ltd, Lagos state >Antistress plus multivitamin or glucose or sugar solution was given to the birds on arrival to ease transportation stress. Source: COSIN farms, Enugu state. Manufacturer: REFIT Animal Care Nigeria Ltd, Lagos state |
| Day 2 to 5 | Multivitamins and antibiotics (Mild antibiotics). Source: COSIN farms, Enugu state. Manufacturer: REFIT Animal Care Nigeria Ltd, Lagos state |
| Day 6 to 8 | Anticoccidia drug and vitamin (minus vitamin B1(thiamine)). Source: COSIN farms, Enugu state. Manufacturer: BIOVAC Nigeria Ltd, Lagos state |
| Day 9 | Gumboro vaccine (i/o-intraocular (via eye) or oral (drinking water)). Source: COSIN farms, Enugu state. Manufacturer: BIOVAC Nigeria Ltd, Lagos state |
| Day 10 | Vitamins. Source: COSIN farms, Enugu state. Manufacturer: REFIT Animal care Nigeria Ltd, Lagos state |
| Day 11 to 13 | Anticoccidia drug (Different from day6 to 8 brand) and vitamin (minus vitamin B1(thiamine)). Source: COSIN farms, Enugu state. Manufacturer: BIOVAC Nigeria Ltd, Lagos state |
| Day 14: | Lasota vaccine mix with skim milk. Source: COSIN farms, Enugu state. Manufacturer: BIOVAC Nigeria Ltd, Lagos state |
| Day 15 to 20 | Vitamins. Source: COSIN farms, Enugu state. Manufacturer: REFIT Animal Care Nigeria Ltd, Lagos state |
| Day 21 | Second Gumboro vaccine (i/o or oral). Source: COSIN farms, Enugu state. Manufacturer: BIOVAC Nigeria Ltd, Lagos state |
| Day 22 to 24 | Ordinary water |
| Day 25 to 27 | Vitamins. Source: COSIN farms, Enugu state. Manufacturer: REFIT Animal Care Nigeria Ltd, Lagos state |
| Day 28 | Second Lasota. Source: COSIN farms, Enugu state. Manufacturer: BIOVAC Nigeria Ltd, Lagos state. |
| Day 29 to 33 | Anticoccidia drug and vitamin (minus vitamin B1(thiamine)). Source: COSIN farms, Enugu state. Manufacturer: BIOVAC Nigeria Ltd, Lagos state (Drugs and Vaccines were purchased from COSIN farm Enugu, Enugu state) |

replicate. The birds were obtained from 'Cosin farm' in Enugu, Enugu state. The birds were raised on a cemented floor covered with wood shavings as a source of litter. The pens were also divided into partitions such that each partition accommodated 8 birds. Feed and water were given *ad libitum*. Routine vaccination and medication necessary for the birds' good health during the entire growth cycle from day old to the end of the research work was strictly adhered to according to laid down specification⁸ Table 1.

The cost-benefit analysis was calculated using the formula given below⁸:

$$\text{Cost of chick} = \text{Amount expended or spent on purchase of chick}$$

$$\text{Cost per kg of feed} = \text{Cost of feed}/25 \text{ kg}$$

$$\text{Cost of feed consumed} = \text{Total feed intake} \times \text{cost per kg of feed}/1000$$

$$\text{Other cost or managerial cost} = \text{Cost expended on transportation, litter materials, vaccines, drugs, etc}$$

$$\text{Total cost of production} = \text{Cost of bird} + \text{cost of feed consumed} + \text{managerial cost}$$

$$\text{Revenue} = \text{Average final weight of birds} \times \text{cost per kg of the current market price of 1kg meat of broiler}/1000$$

$$\text{Benefit/Profit} = \text{Revenue} - \text{cost of production}$$

$$\text{Cost-benefit ratio} = \text{Cost of production}/\text{Benefit}$$

Four experimental diets were formulated with a 3% inclusion level. Diet 1, serving as the control, contained 0% lemongrass and pawpaw leaf meal. Diets 2, 3, and 4 included lemongrass and pawpaw leaf meal in ratios of 0.75:2.25, 1.50:1.50, and 2.25:0.75, respectively Table 2.

Table 2: Experimental diet for starter broiler birds fed graded levels of lemongrass and pawpaw leaf meal

| Ingredient | Treatment | | | |
|-------------------------|-----------|---------|---------|---------|
| | T1 | T2 | T3 | T4 |
| Maize | 52.00 | 51.00 | 51.00 | 51.00 |
| Wheat offal | 7.75 | 5.75 | 5.75 | 5.75 |
| Soya bean meal | 28.15 | 28.15 | 28.15 | 28.15 |
| Fish meal (72%) | 3.50 | 3.50 | 3.50 | 3.50 |
| Blood meal | 3.50 | 3.50 | 3.50 | 3.50 |
| Lemongrass leaf meal | 0.00 | 0.75 | 1.50 | 2.25 |
| Pawpaw leaf meal | 0.00 | 2.25 | 1.50 | 0.75 |
| Limestone | 1.50 | 1.50 | 1.50 | 1.50 |
| Bonemeal | 2.50 | 2.50 | 2.50 | 2.50 |
| Methionine | 0.35 | 0.35 | 0.35 | 0.35 |
| Lysine | 0.15 | 0.15 | 0.15 | 0.15 |
| Starterpremix | 0.35 | 0.35 | 0.35 | 0.35 |
| Salt | 0.25 | 0.25 | 0.25 | 0.25 |
| Total | 100 | 100 | 100 | 100 |
| Calculated value | | | | |
| Crude protein (%) | 23.85 | 24.12 | 24.09 | 23.94 |
| Energy (Kcal/kg) | 2830.40 | 2823.70 | 2826.35 | 2828.92 |
| Crude fiber (%) | 3.58 | 3.69 | 3.68 | 3.69 |
| Ether extract (%) | 4.20 | 4.24 | 4.23 | 4.19 |
| Calcium (%) | 1.25 | 1.27 | 1.27 | 1.27 |
| Phosphorus (%) | 0.56 | 0.56 | 0.56 | 0.56 |
| Methionine (%) | 0.65 | 0.65 | 0.65 | 0.65 |
| Lysine (%) | 1.25 | 1.25 | 1.25 | 1.25 |

Statistical collection: Data obtained were subjected to Analysis of Variance (ANOVA) and significant means were compared using Duncan's Multiple Range Test at a 5% significant level.

Ethical consideration: All ethical standards relating to the safety of lives of humans and animals were duly put into consideration, and at the same time keeping a high standard of research work

RESULTS AND DISCUSSION

Growth performance parameters of starter broiler birds fed diets supplemented with graded levels of lemongrass and pawpaw leaf meal were presented in Table 3. Dietary effect on parameters studied for growth performance showed that all parameters were not significantly affected across the treatment groups. Final body weight had a value of 885.72 g in treatment 1, which did not vary from the values of 771.43, 790.48, and 800 g obtained for birds in treatments 2, 3, and 4, respectively. It suggests that the test ingredients did not impact the birds at this stage of their growth as the birds were unable to draw bio-nutrients and maximize the phytochemicals to their advantage them. The results obtained in this work disagreed with the work carried out by previous studies (Olabode *et al*⁹ and Olabode *et al*¹⁰) where they observed significant differences when herbal plant leaves were used to fortify the diets of broiler starter birds. The result obtained in the present study also contradicts the report of Khan *et al*¹¹ and Abdulsalam *et al*¹² who observed higher body weight when dietary moringa leaf meal was used in broiler birds. This research was in agreement with the findings of Olugbemi *et al*¹³ here they observed lower body weight in diets fortified with moringa leaf meal in broiler birds. Data obtained for daily feed intake were not significantly influenced with the value of 66.06g obtained in treatment 1 closely related to those observed in treatments 2, 3, and 4 with values of 64.09, 65.38, and 59.73 g, respectively. The trend observed showed that the daily feed intake decreased from the control through the treatments fortified with the test ingredient. This research work was similar to the work of Olabode *et al*² and Gakuya *et al*¹⁴ who observed lower feed intake when lemongrass and moringa leaf meal were used for the broiler. These they attributed to the presence of anti-nutritional factors in moringa leaves used in the experiment diets as row basis.

Table 3: Growth performance characteristics and cost-benefit analysis of starter broiler birds fed supplemental levels of lemongrass and pawpaw leaf meal

| Component (%) | Treatment | | | | SEM |
|------------------------------|----------------------|----------------------|----------------------|-----------------------|-------|
| | T1 | T2 | T3 | T4 | |
| Initial body weight (g) | 139.83 | 139.87 | 140.13 | 140.13 | - |
| Final body weight (g) | 885.72 | 771.43 | 790.48 | 800.00 | 20.06 |
| Body weight gain (g) | 745.89 | 631.56 | 650.35 | 659.87 | 20.08 |
| Feed intake (g) | 1387.26 | 1345.89 | 1372.98 | 1254.33 | 26.05 |
| Daily body weight gain (g) | 35.52 | 30.07 | 30.97 | 31.42 | 0.96 |
| Daily feed intake (g) | 66.06 | 64.09 | 65.38 | 59.73 | 1.24 |
| Feed conversion ratio | 1.86 | 2.13 | 2.11 | 1.90 | 0.06 |
| Cost of birds at day old (₦) | 930.00 | 930.00 | 930.00 | 930.00 | - |
| Cost of kg of feed (₦) | 876.00 | 802.55 | 802.55 | 802.55 | 15.02 |
| Cost of feed consumed (₦) | 1215.24 ^a | 1080.14 ^a | 1101.89 ^a | 1006.66 ^{ab} | 35.42 |
| Managerial cost (₦) | 690.00 | 690.00 | 690.00 | 690.00 | - |
| Total cost of production (₦) | 2835.24 ^a | 2700.14 ^b | 2721.89 ^a | 2626.66 ^b | 28.03 |
| Revenue (₦) | 3365.74 ^a | 2931.43 ^b | 3003.82 ^b | 3040.00 ^b | 62.85 |
| Benefit/Net profit (₦) | 530.50 ^a | 231.29 ^d | 281.93 ^c | 413.34 ^b | 35.53 |
| Cost-benefit ratio | 5.35 ^b | 11.67 ^a | 9.66 ^a | 6.36 ^b | 0.87 |

^{abcd}Means on the same row with different superscripts are significantly ($p < 0.05$) different, SEM: Standard Error of Mean and ₦: Naira

Dietary effects on daily body weight gain were not significantly affected across the treatment group. Birds in treatment 1 had a value of 35.52 g which did not differ from the values of 30.07, 30.97, and 31.42 g obtained for daily body weight gain in treatments 2, 3, and 4. It can be observed from the results that the value obtained in treatment 1 is higher numerically when compared to those in treatments treated with the test ingredients. This work disagrees with the report of Agu *et al*¹⁵ who observed enhanced weight gain as compared to the control group when turmeric powder and moringa leaf meal were used in broiler birds. This they attributed to the immune-modulatory effect of the leaf meal.

Data reported for feed conversion ratio was not significantly affected. However, better performance was observed for birds in treatment 1 with a value of 1.86, which did not differ from the values of 2.13, 2.11, and 1.90 observed for birds in treatments 2, 3, and 4, respectively. This work disagrees with the study conducted by Abdulsalam *et al*¹² and Olabode *et al*¹⁰ where they reported that feed conversion efficiency was highest for birds fed diets containing 750 g/100 kg moringa leaf meal and black plum leaf meal and observed declined as the proportion of it in the diets decreased progressively.

Cost-benefit analysis of starter broiler birds fed supplemental levels of lemongrass and pawpaw leaf meal were presented in Table 3. The cost of birds at day old and managerial cost was constant across the treatment group. The cost of birds at the same value of ₦930, while managerial cost had ₦690 across the treatment group, respectively. Values obtained for cost of kg of feed had a value of ₦876 in treatment 1, which differed from the values of ₦802.55 seen in treatments 2, 3, and 4. The effect of diets on the cost of feed consumed was significantly different across the treatment group. A superior value of ₦1215.24 was obtained for the cost of feed consumed in treatment 1 which was similar to the values of ₦1080.14 and ₦1101.89 observed in treatments 2 and 3. The lowest value of ₦1006.66 was reported in treatment 4, respectively. Total cost of Production was highest in treatment 1 with values of ₦2835.24 which did not differ from the value of ₦2721.89 obtained in treatment 3. The lowest value of ₦2626.66 was seen in treatment 4 which did not differ from the value of ₦2700.14 obtained in treatment 2, respectively. Values obtained for revenue were significantly different with treatment 1 showing the largest value of ₦3365.74, while the smallest value was seen in treatment 2, which was not significantly different from the values of ₦3003.82 and ₦3040 obtained in treatments 3 and 4, respectively. The effect of diet on net profit was significant. Treatment 1 had a value of ₦530.50 which was significantly different from the value of ₦413.34 and ₦281.93 obtained for net profit in treatments 4 and 3 which were by themselves different from each

other. The least value for net profit was obtained in treatment 2. Value for cost-benefit ratio was better off in treatment 1 with 5.35, while the least performed group was observed in treatment 2 with 11.67 which did not differ statistically from those in treatment 3. Treatment 4 had a cost-benefit ratio of 6.36.

CONCLUSION

Processed lemongrass and pawpaw leaf meal can be incorporated into the diet of starter broiler birds at up to a 3% inclusion level without any adverse effects. This is evident from the non-significant differences observed in key performance parameters, particularly final body weight and feed conversion ratio, although numerically, the control group (Treatment 1) showed slightly better performance.

For future research, it is recommended to explore higher inclusion levels to determine the optimal threshold for growth performance. Additionally, further studies should investigate the long-term effects of these plant-based additives on gut health, immunity, and meat quality to enhance their potential application in poultry nutrition.

SIGNIFICANCE STATEMENT

The significance of the present study is to solve the current problem created by synthetic feed additives which have necessitated the need for alternative sources, which have less or no side effects on the animals and on the end users which is the humans. And also, to find a way of ameliorating the high cost involved in the production of poultry birds which has over time led to the closure of many farms. Thus, from the research carried out it can be realized that lemongrass and pawpaw leaf meal do not support better growth at the starter phase using the ratio in the present study, but propel a better cost-benefit at the starter phase of growth.

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