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Growth performance and cost benefit analysis of broiler chickens administered with a combination of three leaf meal extracts (neem, moringa and lemongrass)

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ABSTRACT: One major issue in broiler production is the rising cost of feed and poultry feed additives, which have over the years necessitated the need for alternative sources of materials that can conveniently replace costly feed ingredients and remove or reduce the negative impact of synthetic feed additives. Thus, the study focuses on the impact of broiler birds fed three different leaf meal extracts (neem, moringa and lemongrass). A total number of one hundred and eighty one-day-old Sayeed broiler chicks were used to conduct the experiment. The chicks were randomly selected to four treatment groups, each consisting of forty-five birds, which were partitioned three times, with each replicate having a total of fifteen birds set out in the completely randomised design (CRD) pattern. Data were analysed using ANOVA, and significant means were separated by Duncan's Multiple Range Test at a 5% level of significance. Results obtained for growth performance differed ($p<0.05$) among the groups studied. Higher values of 3357.45g, 3178.35g, 64.86g and 1.58 for final body weight, body weight gain, daily weight gain and feed conversion ratio were obtained in treatment 4 with 15 ml/liter leaf meal extract. Cost benefit analysis proved better in treatment 4, where the total cost of production was relatively lower with a higher revenue, net profit and cost benefit ratio of ₦12758.31, ₦5253.11 and 1.43, respectively. It can be concluded that the administration of leaf meal extract of neem, moringa and lemongrass can be used up to the rate of 15 ml/liter, with the best results obtained in treatment 4 (15ml/l).

Keywords: Broiler birds, cost benefit, feed additives, growth performance, poultry.

INTRODUCTION

Poultry bird nutrition stands out as one of the most vital factors in fostering and maximising production (Agu *et al*., 2021; Jiwuba *et al*., 2016; and David *et al*., 2024). The high cost of feed and feed ingredients of conventional feeds has recently led to the shift of farmers and nutritionists to non-conventional and potential sources of feed (Alagbe, 2017; Oke *et al*., 2017). Synthetic feed additives in poultry nutrition have become the norm for most farmers as this gives an advantage in growing the poultry industry (Zhang *et al*., 2017). But the negative impact and side effects of the use of these synthetic substances have, over the years, proven destructive both to the animals and humans who are the end users of the products (Azodo *et al*., 2023). Thus, the restriction on using antibiotics, growth promoters, and other growth hormones in the poultry sector has created an opportunity for the use of feed additives of natural origin such as probiotics, prebiotics and phytogenic materials (Olabode *et al*., 2024; Tesfaye *et al*., 2013). The use of synthetic feed additives comes along with its own negative effects. At higher levels of usage, some of them, such as tannins, haemagglutinins, saponins, cyanogenic substances or other components, may exert an anti-nutritional effect in animals.

The efficiency and effectiveness of biological operations of plant preparations depend on species, phytogenic substances, their stability and degree of purity as well as on mode of action (Hafeez *et al*., 2016). Plant extracts are standardised products and are characterised by several

functional activities, which include antimicrobial, antiviral, antifungal activity, stimulation of appetite and secretion of endogenous enzymes, beneficial effect in the course of gastrointestinal disorders and respiratory problems, and antioxidant and immune-stimulating properties of plant substances have been reported by various authors (Amos *et al*., 2024; and Olabode *et al*., 2023). Poultry production efficiency and effectiveness have, over the period of time, accelerated the creation of feed additives, which have now become a major material utilised in animal nutrition (Onyimonyi and Ernest, 2009; and Oloruntola *et al*., 2018). Compared to polygastric animals, poultry do not possess the necessary microbial population that can break down the glycosidic bond in the roughage feed. Thus, ruminants have certain resistance and low immunity against infection due to colonisation by pathogenic microorganisms. This is why the constant use of growth promotants for the inhibition of pathogenic bacteria has been recommended to increase production and help stabilise the health of the animal. However, with the continuous negative impact of mutation and resistance by microbes, the World Health Organisation (WHO) have banned the continuous use of these substances as it possesses a risk to both animals and humans (Azodo *et al*., 2023).

Medicinal herbs and plant extracts are a recent and potent class of natural feed additives in poultry nutrition. Thus, the fact that phytogenic compounds could encourage feed consumption has not been fully proved. More so, it is believed that phytogenic compounds can improve digestive enzyme activity and nutrient absorption (Hong *et al*., 2012). Many other research work conducted over the years have displayed their antioxidant and antimicrobial activity *in vitro*, but in-vivo these results are limited. Phytogenic feed additives (PFA) are compounds which are of plant origin, usually incorporated into animal feeds to improve farm animal productivity through effective consumption, digestibility of feed, proper nutrient absorption and elimination of pathogen waste in the animal digestive system (Aroche *et al*., 2018). The different varieties of natural compounds used are put together according to where they come from. This includes herbs, spices, oils, extracts, etc. (e.g neem, garlic, cinnamon, pepper, rosemary and thyme and their extracts). The extracts involve the use of water-soluble substances such as polyphenols (flavonoids), which are normally utilised indirectly in animal growth, development and immune build-up (Mashayekhi *et al*., 2018). The content of active substances in these products can vary greatly depending on what part of the plant is used (grains, leaves, roots, bark, flowers or buds), the harvest season and geographical origin. The technique of treatment (cold, steam distillation, extraction or maceration with non-aqueous solvents) also changes the active substances and related compounds in the final product (Windisch *et al*., 2008). The use of feed additives is generally subjected to regulatory restrictions. In general, they are considered as products applied by the farmers to healthy animals for nutritional purposes permanently, in contrast with veterinary drugs which are applied for the prophylaxis and treatment of diagnosed diseases under veterinary supervision for a limited time followed by a waiting period (Onyimonyi and Ernest, 2009; Sariozkan *et al*., 2016). They must be tolerated by the animals, the users and the environment (Olabode *et al*., 2023).

Their anti-oxidative activities are due to phenolic terpenes. Plants rich in flavonoids such as green tea and other Chinese herbs have been described as natural antioxidants (Fascina *et al*., 2012). The antioxidant properties of several PFAs can contribute to dietary lipid protection from oxidation. The use of PFA as an antioxidant is not only important for poultry health, but also for the oxidative stability of their products (meat mainly) (Azodo *et al*., 2023).

Thus, the effect of natural additives on livestock growth and production performance over the years has shown tremendous results. Hafeez *et al*. (2016) measured production parameters in chickens grown on feed supplemented with a mixture of essential oils of oregano, bay leaf, sage and citrus. They observed that these mixtures have significantly improved feed conversion, which is a result of high nutrient availability to the birds due to changes in the intestinal ecosystem. Lippens *et al*. (2005) and Akpan *et al*. (2011) have attempted to assess the effectiveness of a mixture composed of cinnamon, oregano, thyme, cayenne pepper, citrus extracts and another mixture of plant extracts and organic acids in comparison with the avilamicine in chicken feed. The group of animals supplemented with plant extracts reached a much larger body weight than the other groups. Apparently, the increase in body weight was due to the increase in feed intake. This was attested by a reduced feed conversion in animals of the plant extracts group. Also, garlic, thyme and cornflower as feed supplements have recently been reported to exert a wide range of beneficial effects on the production performance (which includes weight gain, feed conversion, egg production and quality) of broilers and laying hens (Cross *et al*., 2007).

The industrialisation of poultry husbandry and the improvement of feed nutritional efficiency have accelerated the introduction of feed additives, which became widely used in animal feed for many decades (Lutful Kabir, 2009). The objectives outlined by scientists are to increase production while maintaining animals in good health. The use of antibiotics in feed as a growth promoter is beneficial in the improvement of production parameters and disease prevention (Ahsan *et al*., 2016).

MATERIALS AND METHODS

Experimental site

The research work was conducted at Olatioye's poultry farm at Owode-Ede, in Osun State, from the month of July to September, 2025.

Source and processing of raw materials

Leaves of neem, moringa and lemongrass were plucked within Olatioye's farm and the Owode-Ede environment. The leaves were air-dried for about a week, after which the leaves were allowed to sun-dry for 2 hours to make it crispy to enable proper grinding. The leaves were turned into powder using a mini-hammer mill on the farm site.

Experimental design and management of birds

One hundred and eighty one-day-old broiler chicks of Sayeed breed were used for the experiment. They were selected into four treatment groups, each treatment divided thrice in a completely randomised design (CRD) with 15 birds each per replicate and a total of 45 birds per treatment. The chicks were brooded for a week and raised thereafter on a cemented floor covered with wood shavings as a source of litter materials. One quality diet was produced for the research work (Tables 1 and 2). The feed was given *ad libitum* throughout the experiment. Drugs and vaccines were administered as and when due (Table 3).

Data collection

Growth performance

Initial body weight: This was determined by weighing the birds at the beginning of the experiment.

Final body weight: This was determined by weighing the birds at the end of the experiment.

Weight gain: This was determined by subtracting the initial weight from the final weight of the birds.

Feed intake: This was determined by subtracting the leftover feed from the total quantity of feed given to the birds the previous day.

Feed conversion ratio: This was determined by dividing the feed intake by the weight gain.

Cost benefit analysis

Cost benefit analysis was calculated using the formula given by Olabode *et al.* (2022) as follows:

Cost of chick: Amount expended or spent on purchase of chick.

Cost per kg of feed: Cost of feed/25kg.

Cost of feed consumed: Total feed intake x cost per kg of feed/1000.

Table 1. Experimental diet for starter broiler birds administered with three different leaf meal extracts.

Ingredients	Quantity
Maize	54.00
Wheat offal	7.90
Soya bean meal	12.00
Groundnut cake	13.95
Fishmeal	3.50
Blood meal	3.50
Limestone	1.50
Bonemeal	2.50
Lysine	0.20
Methionine	0.35
Starter premix	0.35
Salt	0.25
Total	100
Calculated value	
Crude protein (%)	22.69
MEnergy (Kcal/kg)	3001.90
Crude fiber (%)	4.30
Ether extract (%)	4.97
Calcium (%)	1.20
Phosphorus (%)	0.58
Methionine (%)	0.62
Lysine (%)	1.10

Table 2. Experimental diet for finisher broiler birds administered with three different leaf meal extract.

Ingredients	Quantity
Maize	58.00
Wheat offal	6.90
Full fat soya	5.00
Groundnut cake	14.00
Fishmeal	1.50
Blood meal	3.50
Palm kernel cake	6.00
Limestone	1.50
Bone meal	2.50
Lysine	0.20
Methionine	0.30
Starter premix	0.35
Salt	0.25
Total	100
Calculated value	
Crude protein (%)	19.75
MEnergy (Kcal/kg)	3062.50
Crude fibre (%)	5.30
Ether extract (%)	4.97
Calcium (%)	1.20
Phosphorus (%)	0.58
Methionine (%)	0.62
Lysine (%)	1.15

Table 3. Vaccination/drug administration schedule for broiler birds.

Days	Vaccination/drug administration
Day 1	Marek vaccine (This was given at the hatchery or point of collection of the chicks or on arrival of the chicks to the farm); Antistress plus multivitamin or glucose or sugar solution was given to the birds on arrival to ease transportation stress
Day 2 to 5	Multivitamin and antibiotics (Mild antibiotics)
Day 6 to 8	Anticoccidia drug and vitamin (minus vitamin B1 (thiamine))
Day 9	Gumboro vaccine (i/o-intraoccular (via eye) or oral (drinking water))
Day 10	Vitamins
Day 11 to 13	Anticoccidia drug (Different from day 6 to 8 brand) and vitamin (minus vitamin B1(thiamine)
Day 14	Lasota vaccine mix with skin milk
Day 15 to 20	Vitamins
Day 21	Second Gumboro vaccine (i/o or oral)
Day 22 to 24	Ordinary water
Day 25 to 27	Vitamins
Day 28	Second lasota
Day 29 to 33	Anticoccidia drug and vitamin (minus vitamin B1 (thiamine))

Other cost or managerial cost: Cost expended on transportation, litter materials, vaccines, drugs etc

Total cost of production: Cost of bird + cost of feed consumed + managerial cost

Revenue: Average final Weight of birds x cost per kg of current market price of 1kg meat of broiler/1000

Benefit/Profit: Revenue – cost of production

Cost benefit ratio: Cost of production/Benefit

Statistical collection

Values obtained in the course of the experiment were subjected to Analysis of Variance (ANOVA) according to AOAC (2015), and significant means were compared using Duncan's Multiple Range Test at a 5% significance level.

Ethical approval

The research work was not a threat to the life of the animal or humans involved, as necessary steps were taken to ensure the safety of life; as such it was ethically sound and safe both professionally and locally at all points of the research.

RESULTS AND DISCUSSION

Impact of broiler birds administered with three different leaf meal extracts was presented in Table 4. Results for final body weight were highest ($p<0.05$) for birds in treatment 4 with 3357.45 g and were significantly ($p<0.05$) different from the value of 3150.32 g recorded in treatment 3. Birds in treatment 1 had the least value of 2896.50g for final body weight, which was similar to that of 2960.10 g seen in treatment 2. From the results recorded, values for final body weight increased among the groups from treatment 1 to 4, as the rate of the leaf meal extract increased in the diets of the groups. This suggested that the birds were able to access necessary bio-nutrients from test ingredients, and the active substances in these extracts were able to enhance and speed up the growth of the birds in these treatments. The result obtained in this study tallies with the work carried out by Azodo *et al*. (2023), where they reported better final weight when *Costus afer* extract was administered to broiler birds. El-Husseiny *et al*. (2008) observed increased growth performance in the treatments where herbs were used to replace synthetic growth promoters and medicinal herbs in broiler birds. Also, Oloruntola *et al*. (2018), working on the effect of neem, pawpaw and bamboo leaf and meal on broiler chickens, reported better and higher final body weight of the birds placed on the diet containing higher levels of the leaf meal, respectively. Body weight gain was superior ($P<0.05$) in treatment 4 with 3178.35 g, which was closely followed by 2969.82g observed in treatment 3. The least value of 2716.00g was seen in treatment 1, which did not vary from the value of 2779.85g in treatment 2. Data reported for feed intake were higher ($p<0.05$) in treatment 1 with 5286.50 g, which was similar to the value of 5178.98 g seen in treatment 2. The lowest value of 5005.31 g was observed in treatment 4, which did not differ from the value of 5094.98 g observed in treatment 3. Values obtained for daily feed intake showed the highest ($p<0.05$) in treatment 1 with 107.89 g, which varied from the value of 105.69g obtained in treatment 2. Daily f eed intake was lowest in

Table 4. Growth performance and cost benefit analysis of broiler chickens.

Parameters	Treatments				SEM
	T1	T2	T3	T4	
Initial body weight (g)	180.50	180.25	180.50	179.10	-
Final body weight (g)	2896.50^{c}	2960.10^{c}	3150.32^{b}	3357.45^{a}	42.75
Body weight gain (g)	2716.00^{c}	2779.85^{c}	2969.82^{b}	3178.35^{a}	18.22
Feed intake (g)	5286.50^{a}	5178.98^{a}	5094.98^{b}	5005.31^{b}	56.40
Daily feed intake (g)	107.89^{a}	105.69^{b}	103.98^{c}	102.15^{d}	19.31
Daily weight gain (g)	55.43^{c}	56.73^{c}	60.61^{b}	64.86^{a}	10.75
Feed conversion ratio	1.95^{a}	1.86^{b}	1.72^{c}	1.58^{d}	0.88
Cost of bird at day old	1400.00	1400.00	1400.00	1400.00	-
Cost of kg of feed	980.00	980.00	980.00	980.00	-
Cost of feed consumed	5180.77^{a}	5075.40^{b}	4993.08^{c}	4905.20^{d}	48.12
Managerial cost	1200.00	1200.00	1200.00	1200.00	-
Total cost of production	7780.77^{a}	7675.40^{b}	7593.08^{c}	7505.20^{d}	71.93
Revenue	11006.70^{d}	11248.38^{c}	11971.22^{b}	12758.31^{a}	76.79
Benefit/Net profit	3225.93^{d}	3572.98^{c}	4378.14^{b}	5253.11^{a}	61.14
Cost benefit ratio	2.41^{a}	2.15^{b}	1.73^{c}	1.43^{d}	0.92

^{abcd}Means on the same row with different superscripts are significantly (P<0.05) different. SEM = Standard Error of Mean.

treatment 4 with 102.15 g, which was significantly (p<0.05) different from the value of 103.98 g observed in treatment 3. The decrease in feed intake across the treatment group can be due to the level of fibre and anti-nutritional factors in the extracts. This agrees with the assertion of Oloruntola *et al*. (2018) and Azodo *et al*. (2023), who reported that high fibre in the diet of broiler birds usually leads to a decline in their feed intake. Data obtained for daily weight gain followed a similar pattern to body weight gain, with a superior (p<0.05) value of 64.86g in treatment 4, while the least value of 55.43 g was recorded in treatment 1, which did not differ from the value of 56.73g observed in treatment 2, but varied from that of 60.61 g observed in treatment 3. Feed conversion ratio was highest (p<0.05) in treatment 1 with 1.95 (a reflection of the least performance in the group), while the lowest value of 1.58 (a better performance) was revealed in treatment 4. Feed conversion ratio of 1.86 and 1.72 was reported in treatments 2 and 3, respectively.

Results of cost benefit analysis were displayed in Table 4. Data for the cost of a bird at day old and the cost of kg of feed had the same value of ₦1400 and ₦980 among the groups studied. Values obtained for the cost of feed consumed had a superior (p<0.05) value of ₦5180.77 in treatment 1, which was significantly (p<0.05) different from the value of ₦5075.40 observed in treatment 2. Treatment 4 had the least value of ₦4905.20, which varied (p<0.05) from the value of ₦4993.08 observed in treatment 3. Managerial cost had the same value of ₦1200 for all treatments. Values reported for total cost of production had a superior (p<0.05) value of ₦7780.77 in treatment 1, while the lowest value of ₦7505.20 was noted in treatment 4. ₦7675.40 and ₦7593.08 were recorded for total cost of production in treatment 2 and 3, respectively. Data reported for revenue obtained from the sales of the birds was higher (p<0.05) in treatment 4 with ₦12758.31, which was followed by those in treatment 3 with ₦11971.22. The lowest was obtained in treatment 1with ₦11006.70, which differed (p<0.05) from those of ₦11248.38 observed in treatment 2. Net profit followed the same pattern as revenue, where the superior (p<0.05) value of ₦5253.11 was seen in treatment 4, which was followed by ₦4378.14 in treatment 3. The least value of ₦3225.93 was recorded in treatment 1, which was different (p<0.05) from the value of ₦3572.98 obtained for net profit in treatment 2, respectively. Values obtained for cost benefit ratio had the superior performance in treatment 4 with 1.43, while the least performed treatment was reported in treatment 1 with 2.41. Cost benefit ratio had values of 2.15 and 1.73 in treatment 2 and 3, respectively. The results obtained in the present study agreed with the report of Azodo *et al*. (2023) where they obtained superior (p<0.05) revenue, net profit and cost benefit ratio. Also, Olabode *et al*. (2022) and Amos *et al*. (2024) recorded better cost benefit values when leaf meals were given to broiler birds.

Conclusion

It can be concluded that extracts from neem, moringa and lemongrass leaf meal have a combined rich bio-nutrient and phyto-chemicals which facilitated the growth of the bird. Also, cost benefit (revenue, net profit and cost benefit ratio) was better in the treatment administered with 15 ml/L of the leaf extract. Thus, the administration of leaf meal extracts of neem, moringa and lemongrass is viable up to the rate of 15 ml/L.

CONFLICT OF INTEREST

Throughout the experiment, there was no conflict of interest or issue of concern in the experimental work.

REFERENCES

Agu, C. I., Uzoma, C., Okelola, O. E., Olabode, A. D., & Ebiaku, V. (2021). Influence of supplemental levels of turmeric meal (*Curcuma longa*) on the growth performance and serum biochemistry indices of finisher broiler birds (A case study in Ishiagu, Ivo, Lga of Ebonyi State, Nigeria). *International Journal of Agriculture and Bioscience*, *10*, 229-232.

Ahsan, U., Cengiz, Ö., Raza, I., Kuter, E., Chacher, M. F. A., Iqbal, Z., Umar, S., & Çakir, S. (2016). Sodium butyrate in chicken nutrition: the dynamics of performance, gut microbiota, gut morphology, and immunity. *World's Poultry Science Journal*, *72*(2), 265-275.

Akpan, M. M., Odeomen, C. S., & Nwachukwu, C. N. (2011). Antimicrobial assessment of ethanolic extract of *Costus afer* leaves. *Asian Journal of Plant Science and Research*, *2*(3), 335-341.

Alagbe, J. O. (2017). Effect of dietary inclusion of Polyalthia longifolia leaf meal as phytobiotic compared with antibiotics on performance, carcass characteristics and haematology of broiler chicken. *Scholarly Journal of Agricultural Science*, *7*(3), 68-74.

Amos, M., Olabode, A. D., Nduka, C., & Olorunfumilola, N. (2024). Effect of black plum leaf meal on the growth performance characteristics, cost benefit evaluation and serum biochemical indices of finisher broiler birds. *Current Research in Poultry Science,* 14(1), 10-15.

AOAC (2015). Official Methods of Analysis, 20th Edition. *Association of Official Analytical Chemists.* Rockville, MD, USA.

Aroche, R., Martínez, Y., Ruan, Z., Guan, G., Waititu, S., Nyachoti, C. M., Más, D., & Lan, S. (2018). Dietary inclusion of a mixed powder of medicinal plant leaves enhances the feed efficiency and immune function in broiler chickens. *Journal of Chemistry*, *2018*(1), 4073068.

Azodo, L., Bamidele, A.J., Irelen, T. U., Uzoma, C., Olabode, A. D., & Aniebo, A. O. (2023). Impact of ginger lily (*Costus afer*) extract on the growth performance and cost benefit analysis of finisher broiler birds. *Journal of Animal Science and Veterinary Medicine*. 8(3): 364-372.

Cross, D. E., McDevitt, R. M., Hillman, K., & Acamovic, T. (2007). The effect of herbs and their associated essential oils on performance, dietary digestibility and gut microflora in chickens from 7 to 28 days of age. *British Poultry Science*, *48*(4), 496-506.

El-Husseiny, O. M., Abdallah, A. G., & Abdel-Latif, K. O. (2008). The influence of biological feed additives on broiler performance. *International Journal of Poultry Science*, *7*(9), 862-871.

Fascina, V. B., Sartori, J. R., Gonzales, E., Carvalho, F. B. D., Souza, I. M. G. P. D., Polycarpo, G. D. V., Stradiotti, A. C., & Pelícia, V. C. (2012). Phytogenic additives and organic acids in broiler chicken diets. *Revista Brasileira de Zootecnia*, *41*(10), 2189-2197.

Hafeez, A., Männer, K., Schieder, C., & Zentek, J. (2016). Effect of supplementation of phytogenic feed additives (powdered vs. encapsulated) on performance and nutrient digestibility in broiler chickens. *Poultry Science*, *95*(3), 622-629.

Hong, J. C., Steiner, T., Aufy, A., & Lien, T. F. (2012). Effects of supplemental essential oil on growth performance, lipid metabolites and immunity, intestinal characteristics, microbiota and carcass traits in broilers. *Livestock Science, 144*(3), 253-262.

Jiwuba, P. C., Dauda, E., Onyekwere, M. U., Okechukwu, S. O., & Ubogu, V. R. (2016). Responses of Broiler Finisher Birds Fed Diets Sweet Potato (*Ipomoea batata*) Root Meal. *Asian Research Journal of Agriculture*, *1*(4), 1-7.

Lippens, M., Huyghebaert, G., & Cerchiari, E. (2005). Effect of the use of coated plant extracts and organic acids as alternatives for antimicrobial growth promoters on the performance of broiler chickens. *European Poultry Science*, *69*(6), 261-266.

Lutful Kabir, S. M. (2009). The role of probiotics in the poultry industry. *International journal of molecular sciences*, *10*(8), 3531-3546.

Mashayekhi, H., Mazhari, M., & Esmaeilipour, O. (2018). Eucalyptus leaves powder, antibiotic and probiotic addition to broiler diets: effect on growth performance, immune response, blood components and carcass traits. *Animal*, *12*(10), 2049-2055.

Oke, O. E., Emeshili, U. K., Iyasere, O. S., Abioja, M. O., Daramola, J. O., Ladokun, A. O., Abiona, J. A., Williams, T. J., Rahman, S. A., Rotimi, S. O., & Adejuyigbe, A. E. (2017). Physiological responses and performance of broiler chickens offered olive leaf extract under a hot humid tropical climate. *Journal of Applied Poultry Research*, *26*(3), 376-382.

Olabode, A. D., Amos, M., & Nduka, C. E. (2023). Impact of phytobiotics on growth performance and cost analysis of starter broiler birds. *Acta Scientific Veterinary Sciences, 5*(9), 100-103.

Olabode, A. D., Azodo, L., Okelola, O. E., Olorunfumilola, N. A., & Onyishi, P. (2022). Growth response and cost benefit analysis of starter broiler birds fed supplemental levels of black plum leaf meal (A case study in Ishiagu, Ivo Local Government Area of Ebonyi State). *International Journal of Environmental and Agricultural Research*, *8*, 38-41.

Olabode, A. D., Nduka, C., Okelola, O. E., Olorunfunmilola, N., & Agu, C. (2024). Growth performance and haematological profile of broiler chickens fed graded levels of lemon grass leaf meal. *Current Research in Poultry Science* 14(1), 21-26.

Oloruntola, O. D., Agbede, J. O., Ayodele, S. O., & Oloruntola, D. A. (2018). Neem, pawpaw and bamboo leaf meal dietary supplementation in broiler chickens: Effect on performance and health status. *Journal of Food Biochemistry*, *43*(2), e12723.

Onyimonyi, A. E., & Ernest, O. (2009). An assessment of pawpaw leaf meal as protein ingredient for finishing broiler. *International Journal of Poultry Science*, *8*(10), 995-998.

Sariozkan, S., Konca, Y., Kocaoglu, B., Aktug, M. K., Ozkan, S., & Tugrul, S. (2016). The effect of dietary supplementation of lemon grass (*Cymbopogon citratus*) on performance, carcass quality, and marketing of quail (*Coturnixcoturnix Japonica*). *Journal of Scientific Works and Veterinary Medicine, 63*(1), 98-103.

Tesfaye, E., Animut, G., Urge, M., & Dessie, T. (2013). *Moringa oleifera* leaf meal as an alternative protein feed ingredient in broiler ration. *International Journal of Poultry Science,* 12, 289-297.

Windisch, W. M., Schedle, K., Plitzner, C., & Kroismayr, A. (2008). Use of phytogenic products as feed additives for swine and poultry. *Journal of Animal Science, 86*(14 Suppl.), E140-E148.

Zhang, Y. N., Wang, J., Qi, J., Wu, S. G., Chen, H. R., Luo, H. Y., Yin, D. J., Lü F. J., Zhang, H. J., & Qi, G. H. (2017). Evaluation of mango saponin in broilers: effects on growth performance, carcass characteristics, meat quality and plasma biochemical indices. *Asian-Australasian Journal of Animal Science*, *30*(8), 1143-1149.