RJMP Research Journal of Medicinal Plants

OPEN ACCESS

# Effect of Phytobiotic Extract on the Growth Performance and Cost Benefit Analysis of Broiler Birds

[1]Azodo Lilian, [1]Olabode Adeyemi David, [1]Uzoma Chinenye, [1]Ebiaku Victor and [2]Amos Mishael
[1]Department of Animal Production Technology, Federal college of Agriculture, Ishiagu, Ebonyi, Nigeria
[2]Department of Agricultural Technology, Federal College of Agriculture, Ishiagu, Ebonyi, Nigeria

## ABSTRACT

**Background and Objective:** The use of extract has successfully replaced the use of synthetic feed additives which tends to create an enabling environment for mutation and resistance development by negative microbes in poultry birds. The main objective of the study is to determine the effect of phytobiotic (*Costus afer*) extract on the growth performance and cost-benefit analysis of broiler birds. **Materials and Methods:** As 120 day-old broiler chicks were used for the experiment. The chicks were brooded for a week and thereafter distributed to four pens which were replicated thrice with ten birds per pen. *Costus afer* extract was given at 0, 5, 10 and 15 mL/L of drinking water in treatments 1, 2, 3 and 4, respectively. The experiment lasted for 49 days. **Results:** Dietary effect on parameters obtained showed that results for growth performance were significantly ($p<0.05$) affected across the treatment group. Birds in treatment 4 (15 mL) had superior ($p<0.05$) values of 3620.00, 3349.85 and 1.19 g for final body weight, body weight gain and feed conversion ratio. While cost-benefit analysis table showed a higher value in treatment 4 for net profit and cost-benefit ratio with 3626.00 and 0.80, while the lowest values for net profit and cost-benefit ratio were obtained in treatment 1 with 1285.60 and 2.36, respectively. **Conclusion:** It is concluded that *Costus afer* extracts can be administered in broiler birds to the tune of 15 mL/L of drinking water without declining effects on the performance of the birds and eventually leading to a better profit.

## KEYWORDS

*Costus afer*, phytobiotics, growth analysis, broiler birds, body weight, feed conversion ratio



## INTRODUCTION

The current global restriction on the use of antibiotic growth promoters in animal production has stimulated interest in animal nutritionists on the use of other alternatives such as phytochemical feed additives, phytobiotics, phytogenic feed additives among others as growth promoters[1]. Phytogenic feed additives are plant derived products (e.g., extracts, dried plant materials, essential oil, pure isolated compounds) containing plant metabolites as active principles[2]. Most of this active secondary plant metabolite belongs to classes of flavonoids, isoprene derivatives and glucosinolates; a large number of which have been suggested to act as antioxidants and antibiotics[3].

ISSN: 2151-7924 (Online)
ISSN: 1819-3455 (Print)
https://doi.org/10.17311/rjmp.2024.7.12

Received: 15 Jan. 2024
Accepted: 04 Apr. 2024
Published: 08 Apr. 2024

Phytogenic feed additives have attracted increasing interest as an alternative feeding strategy to replace antibiotic and or inorganic growth promoters. This has occurred especially in the European Union, where antibiotics have been banned completely from use as additives in livestock feeds since 2006, because of suspected risk of generating microbiota with increased resistance to the antibiotic used for therapy in humans and animals. Phytogenic materials belong to the group of non-antibiotic growth promoters mainly obtained from plant materials such as herbs, spices, extract, oil etc. which are usually referred to as natural plant feed additives[4].

Ginger lily is a tall perennial herbaceous, non-divided creeping plant commonly found in West African countries like Nigeria, Ghana, Cameroun etc. It is also known as 'bush cane[5]. The plant is mainly used locally, in that it contains a high amount of bioactive substances which can be used both for nutrients in animals and therapeutic purposes. In this case it involves the use of some of the plant parts in various functions, one of which includes food preparation. The chemical composition of various parts of *Costus afer* revealed the presence of macro- and micronutrients.

The leaves and stems are rich in essential nutrients such as carbohydrates, crude protein, fat, ash, moisture and a good source of fiber. Some other studies have reported the presence of substantial levels of multivitamins in the leaves[6]. Phytochemical constituents of the plant showed the presence of alkaloids, phenols, saponins, triterpenes, tannins and glycosides in different liquid forms[7]. The use of these related plant material sources may be a great source of alternative to the use of synthetic feed additives in broiler production. Thus, the research work aimed at determining the effect of *Costus afer* extract on the growth performance and cost benefit analysis of broiler birds.

## MATERIALS AND METHODS

**Experimental site:** This research work was conducted at the Teaching and Research farm of Animal Science Department, Faculty of Agriculture, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State, Nigeria. The research work lasted from April 2022 to June, 2022

**Source and processing of black plum leaf:** The *Costus afer* leaves and stem (5 kg each) were sourced from Amuwo, Amesi, Aguata Local Government Area in Anambra State. The fresh leaves and stems were washed to remove debris and spread out on a mat for 4 hrs to drain properly at room temperature. The leaves and stems were air-dried in a well-ventilated and clean room; this was to avoid the loss of some important components when exposed to sunlight especially vitamin C. Thereafter, they were ground into fine particles using a hammer mill. An extract was thereafter made from the ground leaves and stems by hand squeezing with cloth. The extract was administered at the rate of 0 mL, 5 mL, 10 mL and 15 mL/L corresponding to treatments 1, 2, 3 and 4, respectively in a Completely Randomized Design (CRD).

**Experimental design and management of birds:** A total of 120 day-old unsexed broiler chicks (Ross 308 strain) obtained from Enugu state were used for the research work. The birds were randomly distributed into four treatment groups of thirty birds each replicated three times with ten birds per replicate. Feed and water were given *ad-libitum* and vaccination schedules were adhered to as strictly as possible.

**Ethical consideration:** There was no bleach of human rights or animal rights in the course of the research work, as there was total compliance with rules guiding the use of products relating to animals and avoidance of any zoonotic transfer.

**Data collection and statistical analysis:** The initial weight of the birds was obtained at the beginning of the experiment and subsequently weekly. Feed intake was also recorded as the difference between the quantity of feed given the previous day and the quantity that was left the next day. The feed conversion

Table 1: Proximate analysis of *Costus afer* extract

| Parameter (%) | |
|---|---|
| Dry matter | 2.84 |
| Moisture | 97.16 |
| Ash | 0.12 |
| Crude protein | 2.50 |
| Ether extract | 0.00 |
| Crude fibre | 0.00 |
| Nitrogen free extract | 0.22 |
| Metabolizable energy kcal/kg | 0.10 |

Table 2: Nutrient profile of starter and finisher

| Content | Starter | Finisher |
|---|---|---|
| Crude protein (%) | 24.00 | 22.00 |
| Fiber (%) | 3.00 | 5.10 |
| Fat (%) | 5.00 | 8.00 |
| Calcium (%) | 1.00 | 1.00 |
| Phosphorus (%) | 0.50 | 0.50 |
| Lysine (%) | 1.20 | 1.20 |
| Methionine+cystine (%) | 0.75 | 0.75 |
| Metabolizable energy (kcal/kg) | 2900.00 | 3200.00 |

ratio was obtained as the ratio of feed intake divided by the body weight gain. Data collected were subjected to Analysis of Variance (ANOVA), at a 5% level while significantly different means were separated according to the method of Duncan multiple range test. Proximate analysis of *Costus afer* leaves and stem extract (Table 1) was carried out. The formula postulated by Olabode *et al*.[8] was used to calculate the cost-benefit analysis:

$$\text{Cost of bird} = \text{Amount used in purchasing the bird}$$

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

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

$$\text{Management cost} = \text{These include transportation, cost of vaccine, drugs, litter materials, source of light etc}$$

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

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

$$\text{Benefit or profit} = \text{Revenue-cost of production}$$

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

Nutrient profile of commercial feeds for starter and finisher broiler chicken procured from FAME feed used for the experiment is given in Table 2.

## RESULTS AND DISCUSSION

Table 3 displayed the growth performance of broiler birds administered with *Costus afer* leaves and stem extract. Final body weight revealed superiority ($p<0.05$) with a value of 3620 g which was significantly ($p<0.05$) different from the result observed in treatment 3 with 3250 g. The lowest value of 2400 g was

Table 3: Growth performance of broilers administered with *Costus afer* extract

| | Treatments | | | | |
|---|---|---|---|---|---|
| Parameter | T1 | T2 | T3 | T4 | SEM |
| Initial body weight (g) | 275.00 | 270.60 | 274.30 | 270.15 | - |
| Final body weight (g) | 2400.00$^{d}$ | 2800.00$^{c}$ | 3250.00$^{b}$ | 3620.00$^{a}$ | 79.52 |
| Body weight gain (g) | 2125.00$^{c}$ | 2529.40$^{b}$ | 2975.70$^{a}$ | 3349.85$^{a}$ | 61.96 |
| Daily weight gain (g) | 43.37$^{c}$ | 51.62$^{b}$ | 60.73$^{b}$ | 68.36$^{a}$ | 16.44 |
| Total feed intake (g) | 4380.00$^{a}$ | 4130.00$^{ab}$ | 4110.00$^{b}$ | 4000.00$^{b}$ | 88.05 |
| Daily feed intake (g) | 89.39$^{a}$ | 84.29$^{b}$ | 83.88$^{b}$ | 81.63$^{b}$ | 13.29 |
| Feed conversion ratio | 2.06$^{a}$ | 1.63$^{b}$ | 1.38$^{c}$ | 1.19$^{d}$ | 0.88 |

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

Table 4: Cost benefit analysis of broilers administered with *Costus afer* extract

| | Treatments | | | | |
|---|---|---|---|---|---|
| Parameter | T1 | T2 | T3 | T4 | SEM |
| Live weight (g) | 2400.00$^{d}$ | 2800.00$^{c}$ | 3250.00$^{b}$ | 3620.00$^{a}$ | 79.52 |
| Total feed intake (g) | 4380.00$^{a}$ | 4130.00$^{ab}$ | 4110.00$^{b}$ | 4000.00$^{b}$ | 88.05 |
| Cost of chick at day old (₦) | 620.00 | 620.00 | 620.00 | 620.00 | - |
| Cost of kg of feed (₦) | 380.00 | 380.00 | 380.00 | 380.00 | - |
| Cost of feed consumed (₦) | 1664.40$^{a}$ | 1569.40$^{b}$ | 1561.80$^{b}$ | 1520.00$^{c}$ | 38.71 |
| Management cost (₦) | 750.00 | 750.00 | 750.00 | 750.00 | - |
| Total cost of production (₦) | 3034.40$^{a}$ | 2939.40$^{b}$ | 2931.80$^{b}$ | 2890.00$^{c}$ | 92.50 |
| Revenue (₦) | 4320.00$^{d}$ | 5040.00$^{c}$ | 5850.00$^{b}$ | 6516.00$^{a}$ | 121.69 |
| Benefit/net profit (₦) | 1285.60$^{d}$ | 2100.60$^{c}$ | 2918.20$^{b}$ | 3626.00$^{a}$ | 81.70 |
| Cost benefit ratio | 2.36$^{a}$ | 1.40$^{b}$ | 1.01$^{c}$ | 0.80$^{d}$ | 0.03 |

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

obtained in treatment 1 (control) which was significantly ($p<0.05$) different from the value of 2800 g obtained in treatment 2. This suggests that the birds administered with *Costus afer* extract were able to utilize the abundance of minerals and vitamin[6] in the *Costus afer* leaves and stems in liquid form (extract). Also, the active substances in the *Costus afer* leaves and stem[9] were able to stimulate positive microbes in the gut of the birds which invariably led to the addition of weight to the birds. These findings agreed with the report of Peng *et al.*[10] who suggested that the presence of a large number of pharmacologically active compounds and essential nutrients including vitamins and minerals found in *Costus afer* extracts could be responsible for the increase in body weight of the birds.

Dietary effect on feed intake was higher for birds in treatment 1 (4380 g), while the least value of 4000 g was observed for birds in treatment 4, which did not differ ($p>0.05$) from the value of 4110 g reported for birds in treatment 3. Birds in treatment 2 had a value of 4130 g respectively. The declining value obtained in the feed intake could be due to the antinutritional factor in the plant-based treatments[11]. The results obtained in the present study were in agreement with those reported by Onyimonyi *et al.*[12] who stated that there was a decrease in feed consumed as the level of neem leaf meal increased in the diet of the birds. Data from feed conversion ratio showed significant ($p<0.05$) impart in the treatment groups. A superior ($p<0.05$) value in terms of best performance was observed in treatment 4 (1.19), while the least value in terms of performance was seen in treatment 1 (2.06), which suggested that the inclusion of *Costus afer* leaves and stem extract was able to support and sustain an increase in weight in relation to the quantity and quality of feed consumed by the birds.

Also, the result for cost-benefit analysis (Table 4) showed treatment 4 with a higher ($p<0.05$) revenue base of #6516.00 which differs from the lowest value of #4320.00 observed in treatment 1. Similar trend played out for net profit where treatment 4 was observed to be highest ($p<0.05$) with a value of #3626.00 which differs from the lowest value of #1285.60 obtained in treatment 1. This was similar to the results reported by Anyasor *et al.*[9] where they observed higher revenue and net profit when plant-based materials were added to the diet given to broiler birds.

This shows that *Costus afer* extracts obtained from stem and leaves can be administered to broiler birds up to the level of 15 mL leading to a better growth performance and invariably higher profit in return. Based on the results obtained in this study, a higher rate of the extract is recommended to see its impact on the growth performance and fermentation effect to ascertain its implication on the birds and the use of other parts of the *Costus afer*. The limitation observed in the course of the research has to do with the accuracy in getting the normal concentration needed for diluting the water of the birds.

## CONCLUSION

It can be concluded that *Costus afer* extract contains substances which has the ability to serve as natural feed promotant in poultry birds. *Costus afer* extract can be administered up to 15 mL in broiler production. The best performance was obtained in treatment 4 with 15 mL of *Costus afer* extract with a better cost-benefit ratio. Therefore, it is recommended that higher rate of the extract be used to see its impact on the growth performance. Also, it is recommended fermentation effect to ascertain its implication on the birds and the use of other parts of the *Costus afer* in the feeding of poultry birds, like the leaves, flowers, etc.

## SIGNIFICANCE STATEMENT

The study aimed at using *Costus afer* extract to increase growth performance and reduce the cost of production in broiler birds. It showed the advantage of combining both the stem and leaf of the plant in an extract form, thus optimizing the bioactive substances in the plant in those areas. It also showed that the extract of *Costus afer* can be effective as a natural growth additive in broiler birds leading to better growth performance and profit both in the short and long run. It further showed the possibility of using the extract in other poultry species, since the digestive systems of the birds are similar in function, there is a possibility of similar or still better performance in other species of poultry birds.

## REFERENCES

1. Subha, G., 2013. Herbal and plant derived natural products as growth promoting nutritional supplements for poultry birds: A review. J. Pharm. Sci. Innovation, 2: 12-13.
2. Akbarian, A., J. Michiels, J. Degroote, M. Majdeddin, A. Golian and S. de Smet, 2016. Association between heat stress and oxidative stress in poultry; mitochondrial dysfunction and dietary interventions with phytochemicals. J. Anim. Sci. Biotechnol., Vol. 7. 10.1186/s40104-016-0097-5.
3. Suganya, T., S. Senthilkumar, K. Deepa, J. Muralidharan, G. Gomathi and S. Gobiraju, 2016. Herbal feed additives in poultry. Int. J. Sci. Environ. Technol., 5: 1137-1145.
4. Murugesan, G.R., B. Syed, S. Haldar and C. Pender, 2015. Phytogenic feed additives as an alternative to antibiotic growth promoters in broiler chickens. Front. Vet. Sci., Vol. 2. 10.3389/fvets.2015.00021.
5. Anaga, A.O., C.J. Njoku, E.S. Ekejiuba, M.N. Esiaka and I.U. Asuzu, 2004. Investigations of the methanolic leaf extract of *Costus afer*. Ker for pharmacological activities *in vitro* and *in vivo*. Phytomedicine, 11: 242-248.
6. Ekpe, I.P., E.O. Udosen and D. Amaechi, 2018. Evaluation of some vitamins and macro-nutrients composition of ethanolic extract of *Tecoma stans* and *Costus afer* leaves. Int. J. Biochem. Res. Rev., Vol. 23. 10.9734/IJBCRR/2018/44554.
7. Akpan, M.M., C.S. Odeomena, C.N. Nwachukwu and B. Danladi, 2012. Antimicrobial assessment of ethanolic extract of *Costus afer* leaves. Asian J. Plant Sci. Res., 2: 335-341.
8. Olabode, A.D., L. Azodo, O.E. Okelola, N.A. Olorunfumilola and P. Onyishi, 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). Int. J. Environ. Agric. Res., 8: 38-41.
9. Anyasor, G.N., F.D. Onajobi, O. Osilesi and O. Adebawo, 2014. Proximate composition, mineral content and *in vitro* antioxidant activity of leaf and stem of *Costus afer* (ginger lily). J. Intercult. Ethnopharmacol., 3: 128-134.

10. Peng, Q.Y., J.D. Li, Z. Li, Z.Y. Duan and Y.P. Wu, 2016. Effects of dietary supplementation with oregano essential oil on growth performance, carcass traits and jejunal morphology in broiler chickens. Anim. Feed Sci. Technol., 214: 148-153.
11. Woyengo, T.A., E. Beltranena and R.T. Zijlstra, 2017. Effect of anti-nutritional factors of oilseed co-products on feed intake of pigs and poultry. Anim. Feed Sci. Technol., 233: 76-86.
12. Onyimonyi, A.E., A. Olabode and G.C. Okeke, 2009. Performance and economic characteristics of broilers fed varying dietary levels of neem leaf meal (*Azadirachta indica*). Int. J. Poult. Sci., 8: 256-259.