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Impact of ginger lily (*Costus afer*) extract on the growth performance and cost benefit analysis of finisher broiler birds

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ABSTRACT: A total number of one hundred and twenty (120) unsexed four weeks old broiler birds were used to determine the impact of *Costus afer* extract on the growth performance and cost benefit analysis of broiler birds.One week was used for brooding the chicks after which they were randomly distributed into five treatment groups of thirty birds replicated three times with ten birdsper replicate in a completely randomized design (CRD). The homogenous *Costus afer* extract was administered at inclusion levels of 0, 5, 10 and 15 mls per litre of drinking water corresponding to treatments 1, 2, 3 and 4 respectively. Feed and water were given *ad-libitum* and recorded throughout the experimental period which lasted for five weeks. The proximate analysis of *Costus afer* leaves and stem extract indicates lower values in CP (2.50%), NFE (0.22%) and ME (0.10 kcal/kg). Data obtained showed that the growth performance parameters were significantly ($p<0.05$) influenced across the treatment group. Birds in treatment 4 (15 ml) had the highest ($p<0.05$) values of 3620.00 g/b, 102.38 g/b and 1.34 for final body weight, daily weight gain and feed conversion ratio respectively. The cost benefit analysis table displaced a net profit and cost benefit ratio of superiority ($p<0.05$) for birds placed in treatment 4 (15 ml) with values obtained as #2934.00/b and 1.22/b, while the lowest values for net profit and cost benefit ratio were reported in treatment 1 with #616.40/b and 6.01/b respectively. Based on the facts reported in the present research work, it can be concluded that *Costus afer* leaves and stem extract can be administered to broiler birds up to 15 ml/litre of drinking water without any decline or negative impact on the performance and invariably yields a better profit. Thus, best possible result was recorded in treatment 4 (15 ml/l).

Keywords: Cost benefits analysis, *Costus afer* extract, finisher birds, growth performance, impact.

INTRODUCTION

The growth of the poultry industry in developing countries especially Nigeria, has been very rapid during the past decades. Broiler production is an important and promising sector of the poultry industry in Nigeria. It is known to be a fast means of providing animal protein in developing countries like Nigeria due to its short generation interval, rapid weight gain and efficient feed utilization (Jiwuba *et al*., 2016). Consumption of chicken meat, like all other types of meat, has progressively increased from the past century to today and has remained stable over the past years. Poultry meat has been reported to contain about 21 - 30% protein as against 20 – 22% and 18% reported for rabbit and beef meat, respectively (Jiwuba *et al*., 2016). Poultry nutritionists have over the years expounded various strategies aimed at cost effective broiler production and improved quality of poultry products. One of the strategies employed to reduce feed cost and improve feed utilization in broiler production is supplementation with exogenous enzymes (Ravindran, 2013).

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 antibiotic has been banned completely from use as additive in livestock feeds since 2006, because of

suspected risk of generating microbiota with increased resistance to the antibiotic used for therapy in human and animals. Phytogenics are a class of non-antibiotic growth promoters derived from herbs, spices, and other plants that are utilized as feed additives (Murugesan *et al.,* 2015*).*

Ginger lily (*Costus afer*) is from the Zingiberaceae family, it is a tall perennial herbaceous, unbranched creeping plant (up to 4 m) commonly found in West African countries like Nigeria, Ghana, and Cameroun. It is primarily known as 'ginger lily' or 'bush cane', '*Okpete'* by Igbos, *'Kakizawa'* by Hausas, *'Tete-egun'* by Yorubas and *'Mberitem'* in Efik (Anaga *et al*, 2004). *C. afer* is mostly used indigenously, because of its nutrient and therapeutic constituents. This entails the use of some of the plant parts in food preparation. The chemical composition of various parts of *C. afer* shows the presence of macro- and micronutrients. The leaves and stem are rich in essential nutrients such as carbohydrate, crude protein, fat, ash, moisture, and a good source of fiber. Some other studies have reported the presence of substantial levels of multi vitamins in the leaves (Ekpe *et al*., 2018). The phytochemical examination of some parts of this plant shows the presence of alkaloids, phenols, saponins, triterpenes, tannins, and glycosides in different solvents (Akpan *et al*., 2012). These phytochemicals and nutritional compositions may justify the nutraceutical use of the plant.

MATERIALS AND METHODS

Study area

The study was carried out at the Teaching and Research Farm of the Department of Animal Science, Faculty of Agriculture, Chukwuemeka Odumegwu Ojukwu University, Igbariam, Anambra State of Nigeria.

Sources and preparation of *Costus afer*

The *Costus afer* (bush cane) leaves and stem were sourced from Amuwo, Amesi, Aguata Local Government Area in Anambra State. The fresh leaves and stem were washed to remove debris, spread out on a mat for 4 hours in order to drain properly under room temperature. The leaves and stem 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 hammer mill. An extract was thereafter made from the ground leaves and stems by hand squeezing with cloth.

Experimental animal management and design

The extract was administered at the rate of 0, 5, 10 and 15 mls/litre corresponding to treatments 1, 2, 3 and 4 respectively in a completely randomized design (CRD). A total of one hundred and twenty (120), four weeks old unsexed broiler birds were used for the research work. The birds were randomly distributedinto four treatment groups of thirty birds each replicated three times with ten birds per replicate. Feed and water were given *ad-libitum* and vaccinations were given as at when due. The research work lasted for four weeks.

Table 1. Proximate analysis of *Costus afer* extract.

Parameters	Percentage (%)
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 EnergyKcal/kg	0.10

Data collection and analysis

The initial weights of the birds were obtained at the beginning of the experiment and subsequently on a weekly basis. 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 ratio was obtained as the ratio of feed intake divided by the body weight gain. Data collected were subjected to analysis of variance (ANOVA), while significant different means were separated according to the method of Duncan Multiple range test as described by Obi (2002). Proximate analysis of *Costus afer* leaves and stem extract was carried out using the standard procedure of AOAC (2015) (Table 1). The cost implication analysis was also carried out according to the formula outlined by Olabode *et al*. (2022) as follows;

*__Cost of bird__ = Amount used in purchasing the bird

*__Cost per kg of feed__ = Cost of feed/25kg

*__Cost of feed consumed__ = Total feed intake x cost per kg of feed/1000

*__Management cost__ = These include transportation, cost of vaccine, drugs, litter materials, source of light etc

*__Total cost of production__ = Cost of bird + cost of feed consumed + management cost

*__Revenue__ = Average final weight of bird x cost per kg of the current market price of 1 kg meat of broiler/1000

*__Benefit or profit__ = Revenue – cost of production

*__Cost benefit ratio__ = Cost of production/benefit

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

Table 3. Growth performance of finisher broiler birds administered with *Costus afer* extract.

Parameters	Treatments				SEM
	T1	T2	T3	T4	
Initial body weight (g)	620.00	642.67	679.33	753.33	-
Final body weight (g)	2400.00^{d}	2800.00^{c}	3250.00^{b}	3620.00^{a}	98.15
Body weight gain (g)	1780.00^{c}	2157.33^{b}	2570.67^{a}	2866.67^{a}	79.43
Daily weight gain (g)	63.57^{c}	77.05^{b}	91.81^{b}	102.38^{a}	21.60
Total feed intake (g)	4230.00^{a}	3980.00^{ab}	3960.00^{b}	3850.00^{b}	80.75
Daily feed intake (g)	151.07^{a}	142.14^{b}	141.43^{b}	137.50^{b}	17.21
Feed conversion ratio	2.38^{a}	1.85^{ab}	1.54^{b}	1.34^{b}	0.46

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

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

Dietary effect on growth performance of broiler finisher birds administered with *Costus afer* extract was presented in Table 3. Result obtained for final body weight showed that birds in treatment 4 had the highest ($p<0.05$) value of 3620 g, which was closely followed by those in treatment 3 (3250 g). The lowest value of 2400 g was observed in treatment 1 (control) which also differ ($p<0.05$) from those obtained in treatment 2 with 2800 g. This suggest that the birds administered with *Costus afer* extract were able to access and utilize the abundance of mineral and vitamin (Ekpe *et al*., 2018) in the *Costus afer* leaves and stem in liquid form (extract). Also, the bioactive substance embedded in the *Costus afer* leaves and stem (Anyasor *et al*., 2014) were able to stimulate positive microbes in the gut of the birds which invariably led to addition of weight to the birds. This result was similar to the report of Peng *et al*. (2016) who suggested that the presence of large number of pharmacological active compounds and essential nutrients including vitamins and minerals found in phytogenic extracts were responsible for increase in growth in broiler birds. Effect of diet on feed intake was superior ($p<0.05$) in treatment 1 (4230 g) followed by those in treatment 2 with 3980 g. While the least value of 3850 g was reported for birds in treatment 4, which did not differ ($p>0.05$) from the value of 3960 g reported for birds in treatment 3 respectively. The decrease in the value of feed consumed from treatment 1 to treatment 4 could be due to the presence of bitter and unpalatable substances in the *Costus afer* leaves and stem which imparted into the extract administered to the birds. Also, anti-nutritional composition of the leaves and stem could be another important factor leading to decrease in the feed consumption by the birds (Chuku and Chuku, 2018). This was similar to the report of Onyimonyi *et al*. (2009) who reported decreased in feed consumed as the level of neem leaf meal increased in the diet of the birds. Result obtained for feed conversion ratio showed significant ($p<0.05$) effect across the treatments. Superior ($p<0.05$) value in terms of best performance was observed in treatment 4 (1.34), while the least value in terms of performance was seen in treatment 1 (2.38). This suggested that the inclusion of *Costus afer* extract were able to support and sustain an increase in weight in relation to the quantity and quality of feed consumed. Result for cost benefit analysis (Table 4) showed that treatment 4 had a superior ($p<0.05$) revenue value of #6516.00, while the least value of #4320.00 was observed in treatment 1. Similar trend played out for net profit where treatment 4 had the highest ($p<0.05$) value of #2934.00 which differ from the lowest value of #616.40

Table 4. Cost benefit analysis of finisher broiler birds administered with *Costus afer* extract.

Parameters	Treatments				SEM
	T1	T2	T3	T4	
Live weight (g)	2400.00^{d}	2800.00^{c}	3250.00^{b}	3620.00^{a}	98.15
Total feed intake (g)	4230.00^{a}	3980.00^{ab}	3960.00^{b}	3850.00^{b}	80.75
Cost of birds at 4wks old (₦)	1700.00	1700.00	1700.00	1700.00	-
Cost of kg of feed (₦)	320.00	320.00	320.00	320.00	-
Cost of feed consumed (₦)	1353.60^{a}	1273.60^{b}	1267.20^{b}	1232.00^{c}	54.11
Management cost (₦)	650.00	650.00	650.00	650.00	-
Total cost of production (₦)	3703.60^{a}	3623.60^{b}	3617.20^{b}	3582.00^{c}	79.20
Revenue (₦)	4320.00^{d}	5040.00^{c}	5850.00^{b}	6516.00^{a}	112.46
Benefit/Net profit (₦)	616.40^{d}	1416.40^{c}	2232.80^{b}	2934.00^{a}	74.10
Cost benefit ratio	6.01^{a}	2.56^{b}	1.62^{c}	1.22^{d}	0.06

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

seen in treatment 1. This result agrees with the report of Onyimonyi *et al*. (2009) and Olabode *et al*. (2022) where they observed better revenue and net profit when phytogenic materials were used to fortify diet given to broiler birds at finisher stage.

Conclusion

It can be concluded that:

1. *Costus afer* extract are very rich in essential nutrients and could be of great value in improving feed utilization in broiler birds.
2. The administration of *Costus afer* extract to broiler chickens up to 15 mls/litre of water at finisher phases significantly improved growth performance.
3. Better revenue and net profit could be achieved when *Costus afer* extract are administered to broiler birds especially at finishing phase up to 15 mls/liter.

CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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