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Influence of Aloe Vera Powder on the Growth Performance and Cost Benefit Analysis of Starter Broiler Birds

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ABSTRACT

Background and Objective: Synthetic feed additives usually come along with numerous side effects and zoonotic impacts on the end consumers. This can be corrected by the use of natural plants which have properties similar to the work done by the synthetic substances in these animals. The research work was carried out to determine the influence of Aloe vera powder on the growth performance and cost-benefit analysis of starter broiler birds. **Materials and Methods:** The 96 day old 'Rose 308' strains of broilers were used for the research work. The day-old chicks were brooded for a week and thereafter selected into four treatment groups of twenty-four each and replicated three times with eight birds per replicate in a Completely Randomized Design (CRD). Four different diets were compounded such that Aloe vera powder was included at the rate of 0, 0.50, 1.00 and 1.50% corresponding to treatments 1, 2, 3 and 4, respectively. Feed and water were given *ad-libitum* throughout the experimental period of 21 days. **Results:** Proximate analysis of Aloe vera powder showed that it has a dry matter content of 93.58 and 6.42% moisture, 10.42% crude protein, 6.45% crude fiber, 2.03% ether extract, 18.77% ash and 55.915% carbohydrates. Birds on control diets were superior to the birds in other treatments in terms of final body weight, body weight gain, feed intake and feed conversion ratio. Birds in treatment 1 (0% avp) had better results in terms of performance when compared to the treatment groups fortified with Aloe vera. The result of the cost-benefit analysis showed that the bird in treatment 4 had a superior ($p<0.05$) benefit/profit of 471.99 when compared to the control with a value of 440.47. **Conclusion:** It can be concluded that the inclusion of Aloe vera powder in the diet of broiler birds at the starter phase is viable up to a level of 1.50% with the best performance observed in treatment 1 (control).

KEYWORDS

Growth performance, starter broilers, cost benefit analysis, Aloe vera powder, proximate analysis

INTRODUCTION

Synthetic feed additives usually come along with numerous side effects and zoonotic impacts on the end consumers. As such numerous negative trends such as mutation and development of microbial resistance in the animals could in the long run lead to high levels of morbidity and mortality which usually arise in

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the production of animals, especially poultry birds[1]. Thus, the provision of feed has been reported to account for about 60-80% of the total cost of livestock production in most developing countries[2]. In view of this, there has been increased interest by most poultry farmers in the search for non-conventional feed ingredients that could be cheaper such as leaf and seed meals of ethno-medicinal plants[3]. One way is to look for possible alternative sources of feed supplements that are not only cheap and could boost the growth of chickens but are also readily available. Recently, phytogenic feed additives have gained attention and importance due to the restriction on the usage of antibiotics as growth promotants by the European Union, even though mostly their mode of operation has not been fully known or exploited[4]. It has been reported by different authors that these natural products of plant origin are natural, less toxic, residue-free and ideal feed additives for animals when compared to synthetic ones or inorganic chemicals. Antimicrobial and antifungal properties of these phytogenic substances and their anti-parasitic effects have also been observed[5]. Although, phytogenic herbal extracts received considerable attention in the poultry industry, especially the broiler aspect as a friendly alternative to synthetic antibiotics, in that they can also be included in the feed or drinking water to enhance the bird's growth and development.

The plant Aloe vera (*Aloe barbadensis*) has a spiky, succulent and perennial nature. It is rich in vitamins and minerals. Specific vitamins in the Aloe vera include; vitamin A (beta-carotene), vitamin B1 (thiamine), vitamin B2 (riboflavin), vitamin B3 (niacin), vitamin B5, vitamin B6, vitamin B12, vitamin C, vitamin E, choline and folic acid[6]. The antioxidant activity in Aloe vera is related to the presence of vitamin A, C and E, respectively. Vitamin B and choline are involved in amino acid metabolism while vitamin B12 is needed for the maintenance and production of blood cells. Other vital minerals found in Aloe vera are calcium, chromium, copper, iron, magnesium, manganese, potassium, phosphorus, sodium and zinc[2]. These minerals are essential for overall good health and are known to work in synergistic combinations with each other, with vitamins and other trace elements. Aside from vitamins and minerals, Aloe vera is also rich in enzymes, hormones, sugars, anthraquinones or phenolic compounds, lignin, saponins, sterols, amino acids and salicylic acid[7]. Thus, the purpose of this study is geared towards looking for alternatives to synthetic growth promotant in poultry production, especially in broiler birds.

MATERIALS AND METHODS

Experimental site: The experiment was carried out at the Poultry Unit of the Animal Production Department, Ishiagu, Ebonyi State, Nigeria from June to July, 2023.

Source and processing of Aloe vera leaf: The Aloe vera leaves (6 kg) that were used for the experiment were sourced from Ishiagu Town and environment, all within Ebonyi State. The Aloe vera leaves were obtained fresh. Washed, sliced into thinner/smaller parts and then sun-dried to get a crispy-like leafy material. The crispy leaves were then turned to powder using grinding and then incorporated into the diets of the birds at the level of 0, 0.50, 1.00 and 1.50%, respectively (Table 1).

Experimental design and management of birds: A total number of ninety-six day-old Ross 308 strains of broiler chicks were used for the experiment. The chicks were brooded for a week after which they were randomly distributed into four treatment groups and replicated three times with eight birds in a Completely Randomized Design (CRD). Feed and water were given *ad-libitum* and vaccination was given as at when due according to standard practices. The initial weight of the birds was taken at the beginning of the study and then 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. Feed conversion ratio was obtained as the ratio of feed intake divided by the body weight gain. Four experimental diets were formulated such that diet 1 contained 0% Aloe vera powder, while diets 2, 3 and 4 had Aloe vera powder at the levels of 0.50, 1.00 and 1.50%, respectively. Proximate analysis of Aloe vera

powder (Table 2) was also carried out using the standard procedure of AOAC[8]. Cost-benefit was calculated using the formula given by Olabode *et al.*[9] as follows:

- Cost of bird = Amount expended or spent on purchase of bird
- Cost per kg of feed = Cost of feed/25 kg
- Cost of feed consumed = Total feed intake×cost per kg of feed/1000
- Managerial cost
- Total cost of production
- Revenue = Average final weight of birds×cost per kg of current market price of 1 kg meat of broiler/1000
- Profit/benefit = Revenue-cost of production
- Cost benefit ration

Statistical analysis: Data collected were subjected to Analysis of Variance (ANOVA) and significantly different means were separated according to the method of Duncan's multiple range test at 5% significant level.

Ethical consideration: The research posed no risk or injury to the birds as there were no zoonotic occurrences throughout the research work and the level of morbidity was at its minimum.

Table 1: Experimental diet for broiler starter chickens fed graded levels of Aloe vera powder (avp)

Ingredients	T1	T2	T3	T4
Maize	52.00	52.00	52.00	52.00
Wheat offal	7.25	7.00	6.90	6.70
Soybean meal	6.60	6.50	6.40	6.30
Full fat soya	5.00	5.00	4.80	4.70
Groundnut cake	17.50	17.35	17.25	17.15
Fish meal	3.50	3.50	3.50	3.50
Blood meal	3.50	3.50	3.50	3.50
Aloe vera powder	0	0.50	1.00	1.50
Limestone	1.50	1.50	1.50	1.50
Bone meal	2.00	2.00	2.00	2.00
Methionine	0.35	0.35	0.35	0.35
Lysine	0.20	0.20	0.20	0.20
Starter premix	0.35	0.35	0.35	0.35
Salt	0.25	0.25	0.25	0.25
Total	100	100	100	100
Crude protein (%)	23.50	23.42	23.29	23.18
Metabolizable energy (Kcal/kg)	2872.50	2873.30	2872.50	2873.29
Crude fiber (%)	3.47	3.46	3.47	3.46
Ether extract (%)	4.55	4.52	4.50	4.48
Calcium (%)	1.25	1.29	1.30	1.30
Phosphorus (%)	048	0.48	0.48	0.48
Methionine (%)	0.72	0.72	0.72	0.72
Lysine (%)	1.30	1.30	1.30	1.30

Table 2: Proximate composition of Aloe vera powder

Components	Composition (%)
Dry matter	93.58
Moisture	6.42
Crude protein	10.42
Crude fiber	6.45
Ether extract	2.03
Ash	18.77
Carbohydrate	55.91
Metabolizable energy	2494.10

RESULTS AND DISCUSSION

The results obtained for growth performance and cost benefit analysis are displayed in Table 3. The results showed that birds in treatment 1 had a superior ($p<0.05$) final body weight of 725 g which was significantly ($p<0.05$) higher than those obtained in treatments 4 and 3 with values of 708.33 and 700.00 g, respectively.

While the least value of 667.86 g was observed in treatment 2. The lower weight of birds fed the test diets compared to those fed the control diet can be attributed to the inability of the birds at this phase of growth to utilize the bio-nutrient available in the Aloe vera, which ultimately led to the reduction in weight of birds in these treatments. This result differs from those reported by Mishael *et al.*[10], who observed higher final body weights and body weight gains in broiler birds fed supplemental levels of black plum leaf meal. Similar results were obtained by Sinurat *et al.*[11] where they obtained better performance in broilers treated with 0.75 and 1.00% Aloe vera powder compared to the 0.50% Aloe vera powder group.

Daily feed intake value was also higher ($p<0.05$) in treatment 1 (59.52 g) which was followed closely by those in treatment 3 (59.13 g) and 2 (58.92 g), while birds in treatment 4 had a value of 58.69 g. This could suggest that Aloe vera had substances within that repel the intake of feed and thus make it unpalatable to an extent to the birds. Also, it could suggest that the taste and smell of Aloe vera imparted on the feed consumed by the birds in the diets fortified with it. This was similar to the observation of Eevuri and Putturu[12] who observed that Aloe vera supplementation in broiler ration decreased the feed intake. Results obtained for feed conversion ratio showed that birds in treatment 1 had the lowest value of 2.32, which is a reflection of the best performed treatment in the group. The highest value of 2.57 was obtained in treatment 2 which was significantly ($p<0.05$) different from those obtained in treatment 3 and 4 with values of 2.42 and 2.36, which were by themselves similar statistically. This finding was similar to those reported by Agu *et al.*[13], who observed a significant ($p<0.05$) difference in feed conversion ratio between groups treated with supplemental levels of turmeric meal. Results from cost-benefit analysis showed that as the level of Aloe vera powder increased across the treatment, the benefit also increased. The highest ($p<0.05$) profit was obtained in treatment 4 with a value of 471.99 which differs from those in treatments 3, 2 and 1 with values of 460.68, 452.92 and 440.47, respectively. This was similar to the work carried out by David *et al.*[14], where they observed better cost benefits in treatments fortified with lemon grass leaf and black plum leaf meal in broiler chickens.

Table 3: Growth performance and cost-benefit analysis of starter broiler birds fed supplemental levels of Aloe vera powder

	Treatment				
Parameter	T1	T2	T3	T4	SEM
Initial body weight (g)	186.67	186.25	186.67	185.00	-
Final body weight (g)	725.00^{a}	667.86^{c}	700.00^{b}	708.33^{b}	12.55
Body weight gain (g)	538.33^{a}	481.61^{d}	513.33^{c}	523.33^{b}	6.36
Daily body weight gain (g)	25.64^{a}	22.93^{b}	24.44^{a}	24.92^{a}	0.38
Daily feed intake (g)	59.52	58.92	59.13	58.69	0.20
Feed conversion ratio	2.32^{b}	2.57^{a}	2.42^{b}	2.36^{b}	0.03
Cost of day old chick	560	560	560	560	-
Cost of kg of feed	279.62^{a}	272.43^{b}	265.22^{c}	258.02^{d}	2.47
Cost of feed consumed	349.53	337.08	329.32	318.01	-
Managerial cost	300.00	300.00	300.00	300.00	-
Total cost	1209.53	1197.08	1189.32	1178.01	-
Revenue	1650.00	1650.00	1650.00	1650.00	-
Benefit/profit	440.47	452.92	460.68	471.99	-
Cost benefit ratio	2.75	2.64	2.58	2.50	-

^{abcd}Means on the same row with different superscripts are significantly ($p<0.05$) different

CONCLUSION AND RECOMMENDATION

It can be concluded that the inclusion of Aloe vera powder in the diet of broiler starter birds up to the level of 1.50% can be tolerated by the birds. Thus, this was established from the fact that there was no morbidity and mortality observed especially in the treatments fortified with the Aloe vera powder. Therefore, the study recommended that Aloe vera powder should be used in the diets of other poultry birds like layers, turkeys, ducks, geese, quail, etc. to determine the impact and effect on other birds. Also, other methods of processing should be adopted.

SIGNIFICANCE STATEMENT

The purpose of the study is geared towards finding an alternative to synthetic feed additives and promotant which have over the years been a concern due to mutation and microbial resistance factors and at the same time reduce the cost of production via using natural, available phytogenic plant materials. It can be gathered from the research work that Aloe vera powder can serve as a potent natural feed additive, especially at the starter phase in broiler birds.

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