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Evaluation of *Aloe barbadensis M.* gel supplementation on growth performance, survival rate and carcass characteristics of broiler chickens

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Research Article

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Abstract

ABSTACT

This study evaluated the effect of dietary Aloe vera gel supplementation, administered via drinking water at four levels (0.0, 5.0, 7.5, and 10.0 mL), on performance, survival rate, and carcass characteristics of broiler chickens in a CRD with three replicates per treatment. Growth performance, IBW, FBW, BWG, FI, FCR, and SR showed no statistically significant differences among treatments ($P > 0.05$), although T2 tended toward higher FBW and WG, and T4 recorded the best SR; high within-treatment variability, particularly in FCR, likely limited the detection of these trends. In contrast, Aloe vera gel supplementation significantly affected specific carcass components: shank weight differed highly significantly among treatments ($P < 0.01$), while back, thigh, and leg weights were significantly affected ($P < 0.05$), with the control (T1) consistently producing the heaviest leg-quarter cuts and higher inclusion levels (T3, T4) yielding progressively lower values. Live weight, dressed weight, breast, wing, head, neck, drumstick, and giblet weights were unaffected by treatment. These findings indicate that while Aloe vera gel supplementation at the tested levels did not enhance overall growth performance or survival, inclusion above 5.0 mL was associated with a selective reduction in leg-quarter cut weights, without corresponding effects on total carcass yield.

Introduction

Poultry producers have been using growth promoters to raise birds for healthy production and profitability. Which resulted to the use of antibiotics that can alter the intestinal microbiota and eliminate harmful bacteria which in turn improves their production (Quaye et al., 2023). Antibiotics as growth promoters have been very useful in improving poultry performance, and feed conversion ratio (FCR), but the constant application of antibiotic in the treatment of poultry has resulted in residual deposit in poultry products and bacterial resistance against treatment in humans (Mohamed et al.,2017). Despite all the necessary measures used to prevent residual effect of antibiotic in food, a lot of drugs residues are consumed by human and lead to increased antibiotic resistance (Ayoola et al., 2020). As a result of its detrimental effect to human health, there exists a global calls and concerns over the use of antibiotics for growth promotion or therapeutic purposes. Therefore, EU (European Union) have banned the application of antibiotics in animal feed (Chiesa et al., 2017). Herbs and many other plant extracts and essential oils are now being used as an alternative to antibiotics (Abd El-Hack et al., 2020, 2022; Diaz-Sanchez et al., 2015). Herbs, as a new class of additives to poultry feeds, have beneficial properties such as anti-oxidant, anti-microbial, and anti-fungal (Babak and Samuel, 2014) as well as immunomodulatory and anticoccidial effects, which resulted to the increased use of herbs as feed additives in poultry.

The active compounds of herbs can be found in the form of glycosides, alkaloids, volatile oils, enzymes, organic acids and more importantly polysaccharides (Li, 2000). *Aloe barbadensis* gel (ABG) contains compounds with proven antibacterial, antiviral, antifungal, antioxidant, anti-inflammatory, antidiabetic, immunomodulatory and wound-healing properties (Quaye et al., 2023). It's also contains a primary

polysaccharide known as acemannan (Boudreau and Beland 2006; Hamman, 2008), which has the ability to affect the humoral immune response and cellular immunity (Du et al., 2011).

A well-known herb that has received particular attention from researchers is ABG. The most important part of ABG is its leaf which is composed of two main sections: latex and gel (Quaye et al., 2023). The gel contained in ABG leaves is composed of about 98.5% to 99.5% water (Femenia et al., 1999), and the remaining dry matter contains more than 75 biologically active ingredients (Boudreau and Beland, 2006) which have medicinal effects that are useful in treating diseases. Major ingredients of ABG include anthraquinones, saccharides, vitamins, enzymes, and low-molecular-weight compounds (Quaye et al., 2023) which give ABG its anti-inflammatory, immunomodulatory, wound-healing, anti-viral, anti-fungal, anti-tumor, anti-diabetic, and anti-oxidant effects (Christaki and Florou-Paneri, 2010).

ABG can withstand high acidity in the intestines of birds, ensuring its potency and impact (Darabighane & Nahashon, 2014). ABG has an antibacterial activity, allowing helpful microorganisms to exhibit their effect on nutrient digestion at the expense of pathogenic bacteria activity in the gastrointestinal tract (Shokri et al., 2017). Additionally, ABG is high in polyphenols and natural antioxidants, which help to prevent free radical overproduction, which causes lipid peroxidation and immune cell damage (Sharma et al., 2018).

Numerous studies suggest that many benefits of ABG are attributable to polysaccharides contained in ABG gel, which compose a large part of dry matter in this gel (Hamman, 2008). In other words, almost 60% of dry matter of ABG gel is composed of polysaccharides (McAnal ley, 1989). A compound often analyzed by researchers is the polysaccharide acemannan which has immunomodulatory, anti-microbial, and anti-tumor effects (Choi and Chung, 2003).

Materials and Methods

The experiment was conducted at the Poultry Unit of Professor Lawal Abdu Saulawa Livestock Teaching and Research Farm, Department of Animal Science, Federal University, Dutsin-Ma, Katsina State, Nigeria. Dutsin-Ma is a Local Government Area in Katsina State, North-western Nigeria. It lies on Latitude 12.27 °’18’N, Longitude 07.29°’29'E, with onset of rainfall starting from May and ending by October. The average annual rainfall is about 553mm with annual temperature ranges from 29°C – 45°C (Nimet, 2024).

Experimental Animals

A total of 120-day-old broiler chicks were procured from a reputable commercial hatchery. The chicks were randomly allocated to 4 dietary treatment groups, with three replications, each containing 10 birds per replicates. The pens were of equal size, equipped with feeders and drinkers, and located in a well-ventilated poultry house. The birds were raised on a deep litter system, and brooding was conducted under standard conditions for the first 14 days (2 weeks).

Experimental Design and Treatments

The study utilized a Completely Randomized Design (CRD). The birds were assigned to four (4) dietary treatment groups, with three replicate pens per treatment. The treatments (T1 – T4) were described as T1 (control) 0.0mL ABG/L of water, T2 5.0mL ABG/L of water, T3 7.5mL ABG/L of water and T4 10mL ABG/L of water.

Preparation of the Aloe barbadensis M.

Fresh *Aloe barbadensis M* was collected from the Dutsin-Ma Wednesday Market. The leaves were cleaned with water and the ABG was extracted from the leaf by peeling off the leaves following Shokraneh et al., (2016) procedure. The latex of the leaves was removed, and the gel was collected and blend using an electric blender (Binatone BLG-595; 400 W, 1.5 L glass jar; Binatone Industries Ltd., Lagos, Nigeria), stocked in a clean container and store in a refrigerator, in line with the stabilization guideline of Ramachandra and Srinivasa Rao (2008). Aloe vera gel was added to plain water following the levels specific in each treatment from the commencement of experiment to 42-day, birds in the control group were provided with commercial feed. Water consumption was recorded (Pesti et al., 1985).

Data Collection

Growth Performance; the following parameters were measured and recorded to determine the growth performance characteristics

Body weight and body weight gain:

The body weight of the chickens were taken at the beginning of the study and fortnightly. Initial and final weights and total body weight gain was determined and recorded.

BWG = Final body weight – Initial body weight

Feed intake

A measured quantity of feed was allocated on weekly basis to each of group of chickens and fed on a daily basis. Feed left over was weighed to determine weekly feed intake and daily feed intake.

Feed given (g) – left-over (g)

Feed conversion ratio

Feed conversion ratio was determined by calculating the ratio of feed intake to weight gain.

$$\text{Feed conversion ratio (g/g)} = \frac{\text{Feed intake (g)}}{}$$

Body weight gain (g)

Survival rate

Survival rate was determined by multiplying the initial number of chickens by 100 and divide by the final number of chickens; as described below:

$$\text{Survival} = \frac{N_t \times 100}{N}$$

Where N_t and N_0 are the initial and final numbers of chickens respectively

Carcass measurements

Three chickens from each treatment were randomly selected at 6 weeks of age. The chickens were fasted for 10 hours, however, with access to drinking water. Before slaughtering, live weight (LW) was recorded. The carcasses were then scalded in hot water for about 2 minutes to facilitate manual plucking. The following parameters were then measured and recorded; dressed weight (DW), wing weight (WW), back weight (BW), breast weight (BRW), thigh weigh (TW), shank weight (SW), neck weight (NW) and head weight (HW) Internal organs (edible and non-edible) was removed and weighed.

Data analysis

The data of growth performance, carcass characteristics and visceral organs generated were analyzed as a Completely Randomized Design (CRD) using one-way Analysis of Variance (ANOVA), with four treatments (T1-T4) and three replicates per treatment (N = 12). Statistical significance were set at $P < 0.05$. Where treatment effects were significant, means were separated using Duncan's Multiple Range Test (DMRT). Significance were further classified as: * = significant ($P < 0.05$), ** = highly significant ($P < 0.01$), NS = not significant ($P \geq 0.05$).

Results and Discussion

Results

The effect of *Aloe barbadensis M.* Gel Supplementation on Growth Performance and Survival Rate of Broiler Chickens were presented on Table 1. The results indicated that none of the growth performance parameters such as initial body weight (IBW), final body weight (FBW), body weight gain (BWG), feed intake (FI), feed conversion ratio (FCR), or survival rate showed statistically significant differences across all the treatments ($P > 0.05$). Although descriptive variations were visible (T2 tended to have higher FBW and BWG, and T4 the best survival rate), the high within-treatment variability (particularly in FCR) resulted in non-significant F-values.

Table 1
Effect of *Aloe barbadensis M.* Gel Supplementation on Growth Performance and Survival Rate of Broiler Chickens.

Parameter	T1	T2	T3	T4	SEM	F-value	P-value	Remark
IBW /kg	5.033	5.533	5.633	5.767	0.354	0.820	0.519	NS
FBW / kg	13.267	14.933	13.100	14.767	0.766	1.590	0.266	NS
BWG /kg	8.233	9.400	7.467	9.000	0.837	1.040	0.424	NS
TFI /kg	2.657	2.767	2.640	2.867	0.170	0.390	0.766	NS
FCR	1.211	1.172	1.352	1.200	0.128	0.400	0.760	NS
SR%	86.667	96.667	90.000	100.000	3.727	2.670	0.119	NS

$^{a-b}$ means within rows bearing different superscripts differs significantly at p > 0.05; SEM: pooled standard error of means, IBW: initial body weight, FBW: final body weight, BWG: body weight gain, TFI: total feed intake, FCR: feed conversion ratio, and SR: survival rate.

The non-significant variations observed among the treatments on performance indices revealed that the dietary supplementation of *Aloe barbadensis M*. gel at 0.0ml, 5.0ml, 7.5ml and 10.0ml levels respectively applied, did not produce differential growth responses under the conditions of this experiment. This may also reflect the limited statistical power associated with n = 3 replicates per treatment, which reduces the ability to detect moderate effect sizes.

Effect of *Aloe barbadensis M.* Gel on carcass characteristics of Broiler Chickens as presented on Table 2; revealed that shank weight was the only parameter with highly significant value among all the treatments ($P < 0.01$), with T1 and T2 having markedly heavier shanks than T3 and T4, while T3 recording the lowest value. Back, thigh, and leg weights were all significantly affected by the supplementation of ABG in their drinking water ($P < 0.05$); in each case T1 produced the heaviest cuts, while T3 and T4 were generally lower and not significantly different from each other. Live weight, dressed weight, breast weight, head weight, wing weight, neck weight, drumstick weight and all other giblets weights (gizzard, heart, liver, proventriculus, intestines, lungs) showed no significant differences among treatments ($P > 0.05$), indicating that inclusion of ABG did not influence these parameters under the conditions of this study.

Table 2
Effect of *Aloe barbadensis M.* Gel on carcass characteristics of Broiler Chickens

Parameter	T1	T2	T3	T4	SEM	F-value	P-value	Remark
live weight /kg	2.033	2.233	1.700	1.850	0.229	1.02	0.4353	NS
Dressed weight /kg	1.833	1.867	1.333	1.433	0.207	1.74	0.2360	NS
Breast weight /kg	0.417	0.513	0.410	0.457	0.077	0.38	0.7684	NS
Head weight /kg	0.050	0.050	0.050	0.054	0.002	1.33	0.3310	NS
Wing weight /kg	0.110	0.127	0.100	0.097	0.0300	0.21	0.8880	NS
Back weight /kg	0.183^{a}	0.183^{ab}	0.113^{abc}	0.073^{cd}	0.023	5.62	0.0227	*
Neck weight /kg	0.100	0.087	0.085	0.048	0.021	1.17	0.3789	NS
Thigh weight /kg	0.200^{a}	0.136^{ab}	0.042^{bcd}	0.063^{bc}	0.032	5.23	0.0274	*
Leg weight /kg	0.143^{a}	0.050^{bc}	0.047^{bcd}	0.062^{b}	0.019	5.88	0.0202	*
Shank. weight /kg	0.187^{a}	0.170^{ab}	0.011^{cd}	0.058^{c}	0.026	10.51	0.0038	**
Drum stick. weight/kg	0.173	0.203	0.147	0.087	0.078	0.40	0.7554	NS

$^{a–d}$ means within rows bearing different superscripts differs significantly at p > 0.05; SEM: pooled standard error of means

Table 3
Effect of *Aloe barbadensis M.* Gel on visceral organs of Broiler Chickens

Parameter	T1	T2	T3	T4	SEM	F-value	P-value	Remark
Gizzard. weight/kg	0.038	0.035	0.027	0.106	0.036	1.01	0.4377	NS
Heart weight/kg	0.010	0.034	0.027	0.064	0.020	1.31	0.3378	NS
Liver weight/kg	0.025	0.058	0.044	0.047	0.009	2.25	0.1602	NS
Provent. weight/kg	0.015	0.057	0.060	0.055	0.019	1.22	0.3623	NS
Intes. weight/kg	0.122	0.133	0.110	0.117	0.030	0.11	0.9515	NS
lungs weight/kg	0.060	0.030	0.060	0.048	0.019	0.56	0.6549	NS

$^{a-d}$ means within rows bearing different superscripts differs significantly at p > 0.05; SEM: pooled standard error of means, Provent: proventriculus, Intes: intestines

Overall, treatment effects were concentrated in the leg-quarter cuts (back, thigh, leg, shank), all of which were in favored of T1, while carcass yield components and giblet organs weights were not affected by the ABG inclusion.

Discussion

The findings of Quaye et al. (2023) was in accordance with the present study who reported that the growth performance of broiler birds supplemented with Aloe vera extract recorded no significant differences for feed intake, body weight, body weight gain and FCR across all the treatment groups. Similarly, Babak & Samuel (2014), reported that no significant difference was observed between the antibiotic group and the 2% Aloe vera gel group in terms of body weight gain and FCR. In the contrary, Aglipay et al. (2023) reported that final weight of broilers as presented in their study revealed significant increased. Birds given Aloe vera gel at varying levels performed comparably in terms of final weight, significantly heavier than those birds given commercial antibiotics + electrolytes. Additionally, Amber et al. (2021) reported that an enhanced growth rate and FCR in broilers treated with Aloe vera (1.5%) in drinking water at the end of the trial (35days). Similarly, Ayman et al. (2026) illustrated that the impact of varying dietary levels of LAV on FCR, BWG, of broiler chickens showed significant improvement during the periods of 35 days of age in comparison to the control group.

On the contrary, Ayman et al. (2026) study showed that groups fed different levels of Lyophilized Aloe Vera Gel had higher carcass means when compared with the control group. In addition, Olupona et al., (2010); Darabighane et al. (2011) reported that Aloe vera juice treatment in drinking water influenced the percentage of carcasses, breasts and dressings than the control group. Furthermore, Quaye et al. (2023) findings revealed that supplementation of Aloe vera did not influence the carcass traits and the weight of internal organs. This observation supports the results of Shokraneh et al. (2016) who found that carcass

yield and internal organs weights were not significantly affected by Aloe vera gel extracts supplementation. However, Mohamed et al. (2017) reported significant improvement in dress weight and intestinal organs weights of broilers treated with extracts of Aloe vera gel.

The giblets organs investigated in this study revealed that, liver, gizzard, and heart (%) in all supplemented groups did not show any statistically significant differences when compared to the control group. Similarly, Durrani et al. (2008) observed other parameters, such as liver, heart, and gizzard weight, were not altered by the supplementation of Aloe vera gel.

The results of the present study was not in accordance with Mohamed et al. (2017), who found a substantial improvement in the digestive organ weights of broilers treated with Aloe vera gel extracts. They further stressed that the disparities could be attributed to the level of the Aloe vera extract used and the mode of inclusion rate.

Similarly, the findings of Tshabalala et al (2025) reported a significantly higher thigh weight in T2 compared to the control group. Wing weight of T2 was significantly higher compared to what was obtained in T1, T3 and T4, respectively. However, their report was in accordance with the present study, where highly significant shank weight was obtained and is possibly related to the live body weight of the chickens. Higher shank mass will be required to support and carry the weight of heavier chickens.

Conclusion

It could be concluded that dietary *Aloe barbadensis* gel (ABG) supplementation had no effect on broiler growth performance or survival ($P > 0.05$), but it did significantly reduce leg-quarter cuts, shank, back, thigh, and leg, at higher inclusion levels (7.5–10.0 mL), while leaving overall carcass yield and giblets unaffected. In short: ABG neither helped nor hurt growth, but doses above 5.0 mL appear to selectively shrink leg-quarter weights without any compensating performance benefit, a real, localized effect despite the study's limited replication.

Abbreviations

M. Miller

CRD. Completely Randomize Designs

IBW. Initial Body Weight

FBW. Final Body Weight

BWG. Body Weight Gain

FI. Feed Intake

FCR. Feed Conversion Ration

SR. Survival Rate

WG. Weight Gain

ABG. Aloe Barbadensis Gel

Nimet. Nigerian Meteorological Agency

LW. Live Weight

DW. Dressed Weight

WW. Wing Weight

BW. Back Weight

BRW. Breast Weight

TW. Thigh Weigh

SW. Shank Weight

NW. Neck Weight

HW. Head Weight

DMRT. Duncan's Multiple Range Test

ANOVA. Analysis of Variance

NS. Not Significant and

T1 – T4. Treatment1 – Treatment5

Declarations

Competing Interests

The authors have no relevant financial or non-financial interests to disclose.

Author contributions;

Aliyu Suleiman: Conceptualization, Design, Methodology, Validation, Acquisition of data; Termidayo Ojo Stephen: Drafting the introduction article; Maryam Idris Abdullahi: writing and editing of abstract. All authors have read and agreed to the published version of the manuscript.

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Recommendation

1. **Inclusion level:** Based on the observed trend of reduced leg-quarter weights at 7.5–10.0 mL with no compensating performance gain, ABG supplementation should not be recommended above 5.0 mL under conditions similar to this study; if adopted commercially, lower inclusion levels are preferable.
2. **Increase replication:** Future trials should use a larger number of replicates per treatment (e.g., n ≥ 5–6) to improve statistical power and more reliably detect moderate effects on growth performance traits that may have been masked here by within-treatment variability.
3. **Investigate mechanism:** Given the significant, dose-related effect on shank, back, thigh, and leg weights specifically, follow-up work should examine possible mechanisms — such as effects on bone mineralization, muscle fiber development, or localized blood flow/nutrient partitioning to the leg region — through histological or biochemical analysis.
4. **Broaden outcome measures:** Since ABG is reported in the literature to have immunomodulatory and gut-health benefits beyond direct growth promotion, future studies should extend beyond performance and carcass traits to include gut morphology, immune response, and haematological/serum biochemical indices, which may better capture ABG's functional value.
5. **Economic evaluation:** Before recommending on-farm adoption, a cost-benefit analysis comparing ABG supplementation to conventional feed additives or growth promoters should be conducted, given the absence of a clear performance advantage in this study.

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