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Effect Of Graded Levels Of Aloe Vera (Aloe Barbadensis) Gel In Drinking Water On The Growth Response Of Broiler Chickens

Tshabalala, M., Oluremi*, O.I.A. And Molefe, T.M.
Department Of Animal Science, Faculty Of Agriculture, National University Of Lesotho, Roma, Lesotho

Abstract
The study was carried out to evaluate the effect of graded levels of Aloe vera (Aloe barbadensis) gel orally administered in drinking water on the growth and carcass yield of broiler chickens. 180 day-old cobb 500 unsexed broiler chicks were randomly grouped into four of 45 chicks each. A group each was randomly assigned to one of four different levels of aloe vera treatments 0 ml/L (T1), 2 ml/L (T2), 4 ml/L (T3) and 6 ml/L (T4). and replicated three times. The experiment was a completely randomized design. Aloe vera gel was obtained from freshly harvested aloe leaves, blended and added to water at the rate of 0 ml/L, 2 ml/L, 4 ml/L and 6 ml/L. The result showed that aloe vera gel in water did not significantly P>0.05 impair broiler growth indices; final body weight, body weight gain, feed intake feed conversion efficiency, protein intake and PER across the treatment groups. Aloe vera gel at levels of 0 ml/L to 6 ml/L had significant P<0.05 effect on dressed weight and percent carcass weight of breast, back and neck, drumstick, thigh and wings. Treatments did not affect significantly P>0.05 % LW of visceral organs except spleen P<0.05. Aloe vera gel at levels of 0 ml/L to 6 ml/L did not cause adverse effect on growth of broiler chickens, and at 2 ml/L produced a dressed weight and carcass cuts higher than at 0 ml/L. and can be used as a dietary supplement at 2 ml/L to obtain higher carcass yield.
Keywords: *feed additive, performance, phytogenic, poultry*

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I. Introduction

Unprecedented surge in demand for animal protein, which includes meat, milk, eggs and other animal products for human consumption is inevitable as the world faces the challenge of feeding the world sustainably. Protein is regarded as the costliest element of any diet and a crucial component of a healthy, balanced diet (Schönfeldt and Gibson, 2012). Both plant and animal sources of protein can be used in diet preparation, but the two most significant sources in the globally are meat and cereals. Over the past 50 years, there has been a greater demand for meat globally, and meat production has more than tripled and every year, 340 million tonnes of meat are produced globally (Ritchie *et al.,* 2017). In 2018, an estimated total of 69 billion chickens, 1.5 billion pigs, 656 million turkeys, 574 million sheep, 479 million goats, and 302 million cattle were slaughtered for meat consumption worldwide (Garmyn, 2021). Global meat production is increasing, primarily due to increased poultry production because meat consumption is shifting towards poultry (OECD-FAO, 2021). Poultry, the farm animal of choice to fast-track animal protein production and availability is highly susceptible to disease and requires the use of medications most of which are expensive and sometimes not readily available. Furthermore, application of synthetic or artificial promoters in poultry industry is being discouraged globally because of the residual effect of their active ingredients in poultry meat which poses health risk to consumers. Thus, the need to identify phytogenics suitable as natural feed additive supplements that can be used in poultry to enhance growth rate of chickens as a production strategy to meet animal protein needs without endangering the lives of consumers. Aloe vera, (a thick short-stemmed plant that stores water in its leaves), a succulent evergreen perennial plant species found in many regions of the world, has a number of health benefits such as; wound healing properties (Rajendran *et al.,* 2007), anti-diabetic (Moghaddasi and Verma, 2011; Kumar *et al.,* 2011), anti-inflammatory (Steenkamp and Stewart, 2007), antimicrobial, antibacterial and antitumor benefits (Kumar *et al.,* 2011), and it abounds in Lesotho.

Objective

1. To determine the effect of graded levels of Aloe vera gel in drinking water on the growth performance of broiler chickens.
2. To assess the effect of graded levels of Aloe vera gel in drinking water on the carcass and viscera organs yield of broiler chickens.

II. Materials And Methods

Study site

The research was carried out in the Teaching and Research Farm, the National University of Lesotho, Roma. The Roma valley enjoys two distinct seasons, winter (May, June, and July) and summer (November, December and January) and two transitional seasons; autumn (February, March and April) and spring (August, September, and October). Winters are cold and humid and temperatures can be as low as -1 °C, while summers are hot and dry, and temperatures can go as high as 28 °C (RCRC, 2021). Roma is situated in the lowlands within the latitudes 28° S and 31° S, and longitudes 27° E and 30° E with average annual precipitation of about 720 mm, of which 85% falls between October and April (LMS, 2021).

Preparation of aloe vera gel and drinking water treatments

Aloe vera (*Aloe barbadensis*) leaves were harvested from Hata-butle in Roma, Lesotho. The leaves were cut at the base of the stem with a clean sharp knife. The leaves were placed up-right in a plastic bucket to drain out aloin, the bitter taste in aloe vera. Thereafter, the leaves were washed, placed on a clean flat surface, sliced off the serrated edges, and then cut through the medial area. The semi-solid gel on the cut surface was scooped with a table spoon into a beaker and then washed with clean warm water to remove the greenish yellowish bitter toxic sap that leaks from the cut on leaf. Thereafter, the semi-fluid gel was blended and added to drinking water at the rate of 0 ml/L (0%), 2 ml/L (0.2%), 4 ml/L (0.4%) and 6 ml/L (0.6%) to give experimental treatments T1, T2, T3 and T4, respectively.

Experimental animal management and design

A total of 180-day-old Cobb 500 broiler chicks in a deep litter in an environmentally controlled Poultry house partitioned into two sides, each of 12 pens of 1 m x 1.5 m dimension per pen were used. The experimental chicks were randomly divided to four groups of 45 each, with similar weight. A group each was randomly assigned to one four different levels of aloe vera treatments 0 ml/L (T1), 2 ml/L (T2), 4 ml/L (T3) and 6 ml/L (T4). Each treatment was replicated three times. Wood shaving was used as litter material and the chickens were raised under the same management conditions and practices namely; brooding, illumination, feeding, watering and hygiene. Antibiotic (Fosbac Plus T), antistress (Natuvite) and coccidiostat (Esb_3) were orally administered in water to broiler chicks at the recommended dosage for 5 days after arrival. All the chicks, irrespective of treatment groups were fed uniform commercial broiler starter diet (day-old to 14-day old), broiler grower diet (15 to 28-day old) and broiler finisher diet (29 to 42-day old). Aloe vera gel was administered through drinking water bi-weekly, corresponding to the first day of the week and mid-week throughout a forty-two day feeding period. Feed and portable water were provided *ad libitum* throughout a 42-day feeding trial. The experiment was a completely randomized design (CRD).

Chemical analyses of experimental diets and Aloe vera gel

The nutrient composition of starter crumbs, grower pellets and finisher pellets was done using SupNIR-2700 (Near Infra- Red Analyser-2700 Series), while the proximate nutrients in the aloe vera gel were determined using the standard methods (AOAC, 2012). The Ca, P and metabolisable energy content in the aloe vera gel and experimental diets were determined using the procedures of David (1960), Bhargava and Raghuphathi (2005) and Pauzenga (1985), respectively.

Experimental data collection;

a. The growth performance indices were:
i. Initial and final body weight per bird were determined using an electronic multi-function scale Model B09XHSKSJF, while the body weight gain (BWG) was determined by difference.
ii. Feed intake (FI) per bird which was obtained by difference between feed supplied and supplied.
iii. Feed conversion ratio (FCR) = FI / BWG.
iv. Protein intake (PI) = FI x % Crude protein in the experimental diet
v. Protein efficiency ratio (PER) = BWG / PI.
vi. Mortality rate expressed as a percentage of number of mortality to number of birds stocked
b. Carcass indices;

At the end of the 42-day feeding trial, two birds with average live body weight similar to the treatment average weight were selected from each pen (n=24) for carcass yield evaluation. The birds were deprived of feed for 18 hours, and slaughtered between 09.00 to 10.00 hours at the jaw base. The slaughtered chickens were processed using the procedures recommended by World Bank Group (2007). Slaughtered chickens were dipped in hot water (60 °C) for about 10 seconds, the feathers were removed manually and weighed, and thereafter eviscerated and weighed. Carcass was cut into parts; breast, thighs, drumsticks, back and neck, and their weights expressed as percent of dressed weight, while abdominal fat, head, shank were expressed as percent of the fasted

live body weight at slaughter. The visceral organs were weighed and expressed as percentage of fasted live weight.

$$\text{Dressing percent} = \frac{\text{Dressed weight}}{\text{Fasted live weight}} \times 100$$

Data analysis

Data collected were analyzed (SPSS, 2011) version 20 using one-way analysis of variance (ANOVA) to determine significant difference among treatment groups, and significant means were separated by LSD at 5% level of probability.

III. Results

Composition of Aloe vera gel

The nutrient composition of aloe vera gel on dry matter basis is presented in Table 1. Aloe vera had 91.26% DM, 76.92% carbohydrates which represented a major portion of the nutrient in aloe vera, 68.18% nitrogen free extract, ash 13.37%, crude fibre 6.95%, crude protein 2.39%, and crude fat 0.37%. Calcium and phosphorus were 0.50% and 0.24%, respectively.

Nutrient composition of experimental diets

The nutrient composition of the experimental diets fed to the chickens at starter (0-14 days), grower (15-28 days) and finisher (29-42 days) are presented in Table 2.

Effect of graded levels of Aloe vera gel in drinking water on the growth performance of broiler chickens

The growth performance of broiler chickens is presented in Table 3. With the exception of mortality which was affected significantly $P<0.05$ by different levels of aloe vera gel, the other performance indices; body weight gain, feed intake, FCR, protein intake and PER did not differ significantly $P>0.05$ among the dietary treatments. The effect of oral administration of aloe vera gel on the weekly body weight and feed intake pattern is presented in Fig. 1 and Fig. 2, respectively.

Effect of graded levels of Aloe vera gel in drinking water on carcass yield and cut of broiler Chickens

The effect of aloe vera gel in drinking water on carcass yield of broiler chickens presented in Table 4 revealed that dressed weight, and the weights of breast, back and neck, drumstick thigh and wing of broiler chickens were affected significantly $P<0.05$.

Effect of graded levels of Aloe vera gel in drinking water on the viscera organs of Broiler chickens

The effect of experimental treatments on the viscera organs weight of broiler chickens is in Table 5. The percent live weight of kidney, caeca, proventriculus, heart, small intestine, large intestine, empty gizzard and gastrointestinal tract length did not vary significantly $P > 0.05$, except the spleen $P < 0.05$.

IV. Discussion

The highest component of aloe vera was carbohydrates (CHO) 76.92%, which is comparable to 73.07% (Adesuyi *et al*., 2012) and 78.88% (Usman *et al.,* 2020). This amount indicated that aloe vera is a rich source of carbohydrates. Carbohydrates provide crucial functions in the body as structural components and energy sources (Voet *et al*., 2008), regulate nerve tissue and offer easily accessible fuel for physical activity (Whitney and Rolfes, 2005). Crude fibre of 6.95% in the Aloe vera is between 6.00% reported by Usman *et al.* (2020) and 7.84% reported by Adesuyi *et al*. (2012). The amount of fibre in feedstuffs affect how well monogastric animals and particularly chickens digest their food. According to De Vries (2015), low to moderate dietary intakes of fibre (50 g/kg or 5%) may be advantageous for gastrointestinal growth, function, and health, improving nutrient absorption and growth efficiency in chickens. Crude protein of 2.39% in aloe vera is slightly above 2% reported by Luta *et al.* (2009), however, lower than 7% reported by Lawless and Allen (2000). This observed differences may be due different agro- ecological zones, method of processing, season of harvest or age of aloe vera leaves. It is well known that as plants mature, protein content decreases and fibre increases. Aloe vera fat content of 0.37% obtained is low compared to most of the nutrients.

Fat is usually a stored form of energy in living organisms (Haque *et al*., 2014) and is required as a major structural component of biological membranes in the form of phospholipids and sterols (Nelson and Cox, 2008). Ale vera ash content was 13.37%. Ash shows the quantitative presence of minerals, and minerals play roles in the body as secondary messengers in biochemical cascades pathways and, are also essential for proper functioning of tissues (Antia *et al*., 2006). The ash level in the aloe vera is close to 14.65±0.03 reported by Khan

et al. (2014). Phosphorus content of 0.24% in Aloe vera is lower than 0.57% (Usman *et al.,* 2020), however aloe vera could still serve as a supplemental source of phosphorus. Calcium of 0.50% obtained in the study showed that aloe vera is rich in this mineral and can also serve as a supplemental source. Metabolizable energy of 2539.09 kcal/kg in aloe vera is substantially high and may serve as an immediate energy source to broiler chickens through drinking water, in addition to the dietary energy source. The birds may utilize the energy from aloe vera more efficiently and potentially leading to better feed conversion rate.

Nutrient composition of experimental diets

The crude protein of 22.17% in starter diet is comparable to the requirements recommended by Poultry Hub (2023) and Fowler (2022) for broilers in starter phase. Crude fibre of 5.88% was slightly higher than 5.00% maximum requirement (BIS, 2007). The amount of fibre in feedstuffs affects how well chickens digest their food, and the higher the dietary fibre, the poorer the quality of diet. Fat content of 2.51% was lower than 3.00% recommended by BIS (2007)]. This may be partly responsible for the deficit in the dietary metabolizable energy of 2689.14 Kcal/kg relative to 3000.00 Kcal/kg recommended by BIS (2007). Calcium of 1.38% was higher than 1.00% recommended by NRC (1994) and Poultry Hub (2023), while phosphorus of 0.49% was comparable to requirements of 0.45% recommended by NRC (1994) for starter broilers. Methionine of 0.51% was comparable to 0.52% recommended by ICAR (2013) for broilers from 0-14 days of age while lysine of 1.38% was within 1.30% recommended by Fowler (2022) and 1.44% recommended by Poultry Hub (2023). Total DM was low and can encourage a short shelf-life of feed due to possible growth of mould. The crude protein of 18.67% in grower diet was lower than 20% recommended by Fowler (2022) for broilers from 22-42 days of age. Low protein intake can slow down growth rate, limit muscle development and overall weight gain of broiler chickens. Fat content of 2.43% was lower than the minimum requirement of 3.5% stated by BIS (2007) for broi**lers of 8-21 days of age, while** crude fibre content of 6.96% was higher than the maximum requirement of 5% recommended for broilers of the same age. Fat is a dense source of energy **for broiler chickens therefore and low dietary fat than required can contribute to the reduction in** dietary energy **level**. Dietary metabolizable energy of 2854.26 Kcal/kg **is** lower than 3050.00 Kcal/kg recommended by ICAR (2013) for broilers from 14-21 days of age. Low levels of ME can result in increased feed intake. However, dietary methionine of 0.51%, lysine of 1.22% and calcium of 1.24% were comparable to the minimum requirements recommended by BIS (2007) for broilers from 8-21 days of age. Phosphorus of 0.40% was lower than 0.45 % minimum level recommended, and this may affect the calcium: phosphorus required in the diet for proper bone development. The finisher phase is a critical phase **i**n broiler production when birds are prepared for market. The crude protein of 18.23% was lower than 19-21% crude protein recommended by Poultry Hub (2023) for broilers from 25 days of age to market. Low protein intake at this stage may lead to slow growth rate and birds may not reach desired market weight early due to reduced muscle development and lower meat yield which will affect the quality and quantity of the final product. Nevertheless, the growth rate of the chickens in this study was high across the treatments indicating that the disparity between the recommended and dietary crude protein did not show much adverse effect on the finisher birds. Fat content of 2.02% is lower than 4% minimum requirement recommended by BIS (2007) for broilers of 22 days of age to market. Lowered dietary fat could impact meat quality because the meat may have reduced juiciness, flavour, and tenderness, making it less desirable for consumers. Crude fibre content of 5.81% was higher than the 5% maximum requirement recommended by BIS (2007) for broilers of 22 days of age to market. Excessive fibre in the diet of meat type chickens can interfere with the digestibility of essential nutrients, proteins inclusive. This may lead to reduced efficiency of energy utilization and some behavioural problems. The metabolizable energy of 2847.98 Kcal ME/kg was lower than 3100.00 Kcal ME/kg recommended by ICAR (2013) for broilers of 21-42 days of ag**e.** The practical implication is that the chickens will have to consume more feed to satisfy the energy and protein requirements. However, lysine of 1.47% and methionine of 0.48% were higher than the minimum requirements of 1.00% and 0.45%, respectively (BIS, 2007) for broilers from 22 days of age to market. This may constitute economic waste in view of their costs and the need to reduce feed cost which accounts for about 70% of the total cost of raising broiler chickens. Calcium of 0.60% is lower than 0.85% stated by ICAR (2013) for broilers from 21-42 days of age, while phosphorus of 0.37% is comparable to 0.38% recommended. Low levels of calcium have the potential to affect calcium: phosphorus in the diet, which subsequently affects the overall performance of the birds.

Effect of graded levels of Aloe vera gel in drinking water on the growth performance of broiler chickens

The growth performance indices were not impaired. The result is in line with the result of Bernard *et al.* (2016) and Quaye *et al*. (2023) that feed intake, BWG, and FCR did not vary significantly when broilers were supplemented with aloe vera leaves and gel extract. The weekly live weight of broiler chickens in Figure 1 showed a comparable steady increase in the live weight of broiler chickens irrespective of the treatment group. Also, the weekly feed intake trend in Figure 2 showed a steady increase irrespective of the treatments with no

disparity in feed consumption, which is in agreement with the observation of Nasary and Waziri (2019). Enhanced feed intake of birds in aloe vera gel treatments could be associated with stimulated feed taste and appetite (Khan *et al.,* 2014), and that phytogenic substances are reported to improve the flavour and palatability of diet (Darabighane *et al.,* 2011). Higher body weight and lower FCR, which are indicators of good growth performance were observed in broilers supplemented with 2 ml/L of aloe vera gel, while increase from 2 ml/L to 6 ml/L resulted in reduced body weight and poorer FCR. The ratio of feed intake to body weight is crucial in livestock and poultry production, particularly broiler chickens. Protein efficiency ratio partly agrees with the findings of Yadav *et al.* (2017) who observed no significant variation when broilers were supplemented with aloe vera extracts for five weeks, while significant variation occurred only in sixth week of age unlike in this study. The mortality rate of 1.19% was significantly $P<0.05$ higher in the control treatment compared to 0.68%, 0.51% and 0.51% in T2, T3 and T4, respectively. Significantly higher mortality recorded in control group compared to the other treatments is an important observation, and consistent with the findings of Quaye *et al.* (2023) who reported significantly higher mortality in control compared to aloe vera treatments. According to Shokri *et al.* (2017), lower mortality in aloe vera treatment groups is due to the antibacterial, antioxidant and antifungal, anti-inflammatory, and anti-viral (Yadav *et al.*, 2017) properties of aloe vera gel extracts. These properties of aloe vera would have helped the birds in aloe vera groups to fight against disease infection. Aloe vera is capable of boosting the bird's immune system (Yadav *et al.*, 2017). Darabighane and Nahashon (2014) observed that the broilers treated with aloe vera gel showed relatively higher white blood cell counts compared to control group. White blood cells help animals in battling infection, which may explain the reduced mortality in birds treated with aloe vera gel in the study.

Effect of graded levels of Aloe vera gel in drinking water on carcass yield and cut of broiler chickens

The highest dressed weight of 1.83 kg was obtained in T2 which was not significantly $P>0.05$ different from 1.76 kg (T3) and 1.80 kg (T4) but significantly higher than 1.71 kg in the control group (T1). The sequence of significant $P<0.05$ effect on the carcass cuts was not in a particular order. The highest breast weight of 32.20 % DW was obtained in T4, while the highest back and neck % DW of 33.59 was obtained in T2. Significantly $P<0.05$ higher drumstick weight of 13.39% DW was obtained in T2, and similarly, significantly higher thigh weight of 16.67% DW was obtained in T2 compared to 14.14% DW in control. Wing weight of 13.41% DW in T2 was significantly $P<0.05$ higher compared to 10.27% DW, 10.64% DW and 11.20% DW obtained in T1, T3 and T4, respectively The result of dressing percentage supports the finding of Jamir *et al*. (2019) who reported no significant variation between birds supplemented with different amounts of aloe vera powder and control. It has been reported that supplementation of fresh aloe vera gel (0.25 g/kg or 0.025%) and dry aloe vera gel (0.25 and 1.0 g/kg or 0.025 and 0.1%) for five weeks showed no significant impact on carcass yield (Sinurat *et al*., 2002). The high shank weight 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. The result of abdominal fat is in line with Islam *et al.* (2017) who reported insignificant values of abdominal fat when broiler chickens were supplemented with aloe vera gel at 0, 5, 10, 15 and 20 ml/L.

The observed higher abdominal fat weight in aloe vera groups may be associated with the high metabolizable energy in aloe vera which in drinking water, becomes directly metabolized and stored in the fat tissue. The weight of back and neck, drumstick, thigh and wing of broilers in birds on 2 ml/L aloe vera gel treatment, and the weight of breast of broilers under treatment of 6 ml/L of aloe vera gel in drinking water were significantly higher than those of broilers in the control. The higher weight of the carcass cuts in the aloe vera treatments may be due to the better absorption and utilization of nutrients from the gut. Heavier breast and thigh weights have also been found in broilers fed aloe vera powder combined with clove or yeast dried products (Tariq *et al.,* 2015).

Effect of graded levels of Aloe vera gel in drinking water on the viscera organs of Broiler chickens

The significant $P<0.05$ variation in spleen had no sequence even though highest in T2 (0.19% LW, and significantly $P<0.05$ different from T3 (0.17% LW) but not significantly $P>0.05$ different from T1 (0.18% LW) and T4 (0.18% LW). The result obtained is partly in line with the findings of Fallah (2015) of no significant variation with 0%, 3% aloe vera gel included in water, 3% garlic powder fed with basal diet, and both 1.5% aloe vera gel and 1.5% garlic powder fed with feed. Quaye *et al.* (2023) also reported no significant variation in the weight of heart, empty gizzard, and empty intestine as percent live weight in broilers supplemented with aloe vera extracts at 0.5% and 1% compared to control. Furthermore, Mohamed *et al.* (2017) reported no significant variation in the weight of intestine, heart, gizzard and spleen for broilers supplemented with aloe vera leaf powder at the rate of 0, 1.5, 2.0, and 2.5%. The observed significant variation in the weight of spleen in the current study did not follow any specific order and possibly may not be associated to the aloe vera treatment. There is a very limited literature on the impact and the effect of aloe vera on the intestinal lengths of broiler chickens. The result on GIT morphometry revealed no significant variation in GIT length and marginal variation

was observed across the treatments. The tract is essential for nutrient digestion and absorption, and the final growth pattern in all livestock and poultry. The order of live weight and body weight gain in the study is comparable, thus the similarity in the morphometry of the GIT.

V. Conclusion

Aloe vera gel is high in total carbohydrates, metabolizable energy, ash, fairly high in crude fibre, low in crude protein, crude fat, moderate in calcium and phosphorus and can serve as broiler chicken natural dietary supplement. The utilisation of aloe vera gel as a dietary supplement for broiler chicken at levels of 0 mg/l, 2 mg/l, 4 mg/l and 6 mg/l in drinking water did not have adverse effect on growth response, and 2 mg/l gave higher dressed weight, and % DW of breast, back and neck, drumstick, thigh and wing than the control. Aloe vera gel can be used as a dietary supplement at a level of 2 ml/L in drinking water of broiler chickens to obtain higher carcass yield.

VI. Recommendation

Aloe vera supplement is recommended at a level of 2 ml/L in drinking water of broiler chickens to obtain higher carcass yield.

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Table 1: Chemical Composition of Aloe vera gel

Nutrient	% Dry matter	% Dry matter
Dry matter (powder)		91.26
Crude protein		2.39
Crude fibre		6.95
Crude fat		0.37
Ash		13.37
Nitrogen free extract		68.18
Total carbohydrates		76.92
Metabolizable energy (Kcal/kg)		2539.09
Calcium		0.50
Phosphorus		0.24

% Total carbohydrates = 100- (Crude protein + % Crude fat + % Crude fibre + % ash)
ME (Kcal /kg) = 37 (% CP) + 81.8 (% Crude fat) + 35.5 (% NFE) ……. (Pauzenga, 1985)

Table 2: Nutrient Composition of the Experimental Diets

Nutrients (%)	Starter crumbs		Grower pellets		Finisher pellets	
	Laboratory analysis	Feed tag[1]	Laboratory analysis	Feed tag[2]	Laboratory analysis	Feed tag[3]
Total dry matter	85.30	-	88.12	-	88.25	-
Crude protein	22.17	22.00	18.67	16.00	18.23	18.00
Crude fat	2.51	3.00	2.43	7.00	2.02	3.00
Crude fibre	5.88	5.00	6.96	3.50	5.81	7.00
Ash	7.88	-	6.03	-	5.62	-
Nitrogen free extract	46.86	-	54.03	-	56.57	-
Total carbohydrates	61.56	-	65.91	-	68.32	-
Table salt	0.40	-	0.46	-	0.44	-
Metabolizable energy[4] (kcal /kg)	2689.14	-	2854.26	-	2847.98	-
Methionine	0.51	-	0.51	-	0.48	-
Lysine	1.38	1.10	1.22	1.1	1.47	0.9
Phosphorus	0.49	0.60	0.40	0.60	0.37	0.70
Calcium	1.38	1.20	1.24	0.8	0.60	1.20

[1,2,3]showed the nutrients printed on the feed tags of the commercial broiler diets fed., [4]Metabolizable energy (Pauzenga, 1985).

Table 3: Effect of graded levels of Aloe vera gel on the growth performance of broiler chickens

Performance Indices	Experimental Treatments				SEM
	T1	T2	T3	T4	
Initial body weight (kg/bird)	0.384	0.404	0.393	0.389	
Final body weight (*kg*/bird)	2.24	2.35	2.24	2.19	0.05
Total body weight gain (kg/bird)	2.20	2.31	2.20	2.15	0.05
Body weight gain (*g*/bird/day)	52.33	54.98	52.49	51.14	0.00
Feed intake (*g*/day/bird)	87.67	92.50	92.40	88.53	0.00
Feed conversion ratio (bird/day)	1.68	1.68	1.77	1.73	0.02
Protein intake (g/bird)	17.26	18.21	18.19	17.43	0.00
Protein efficiency ratio(bird/day)	3.03	3.02	2.89	2.94	0.00
Mortality rate (%)	1.19^{a}	0.68^{b}	0.51^{b}	0.51^{b}	0.03

[a,b]Means with different subscripts in the same row are significantly different P<0.05. SEM = Standard Error of Mean.
T1 = Control (0 ml/L), T2 = Water containing 2 ml/L Aloe vera gel T3 = Water containing 4 ml/L Aloe vera gel T4 = Water containing 6 ml/L Aloe vera gel

Table 4: Effect of graded levels of aloe vera gel in drinking water on the carcass yield of broiler chickens

Carcass yield	Experimental Treatments				SEM
	T1	T2	T3	T4	
Fasted live weight (kg)	2.21^{b}	2.37^{a}	2.29^{ab}	2.28^{b}	0.02
Dressed weight (kg)	1.71^{b}	1.83^{a}	1.76^{ab}	1.80^{a}	0.02
Dressing percentage (%)	77.11	77.08	77.03	79.16	2.93
Shank (%LW)	3.24	3.77	3.73	3.63	0.12
Abdominal fat (%LW)	1.75	2.45	2.21	2.34	0.15
Breast (% DW)	27.86^{bc}	30.46^{ab}	26.93^{c}	32.20^{a}	0.70
Back and neck (% DW)	29.73^{b}	33.59^{a}	32.10^{ab}	28.79^{b}	0.78
Drumsticks (% DW)	11.14^{b}	13.39^{a}	12.24^{ab}	13.00^{ab}	0.38
Thighs (% DW)	14.14^{b}	16.67^{a}	14.91^{b}	15.43^{ab}	0.30
Wings (% DW)	10.27^{b}	13.41^{a}	10.64^{b}	11.20^{b}	0.41

[a,b,c]Means with different subscripts in the same row are significantly different P<0.05. SEM = Standard Error of Mean, % LW = Percentage Live Weight, % DW = Percentage Dressed Weight
T1 = Control (0 ml/L), T2 = Water containing 2 ml/L aloe vera gel T3 = Water containing 4 ml/L aloe vera gel T4 = Water containing 6 ml/L
aloe vera gel

Table 5: Effect of graded levels of Aloe vera gel in drinking water on the visceral organs of Broiler Chickens (% LW)

Organs	Experimental Treatments				SEM
	T1	T2	T3	T4	
Spleen	0.18^{ab}	0.19^{a}	0.17^{b}	0.18^{ab}	0.08
Small intestines	2.12	2.67	2.45	2.36	0.07
Large intestines	0.48	0.65	0.57	0.55	0.03
GIT_L (m)	2.07	1.99	2.06	2.03	0.08
Kidney	0.02	0.02	0.02	0.02	0.00
Caeca	0.72	0.72	0.62	0.91	0.06
Proventriculus	0.45	0.66	0.63	0.65	0.05
Heart	0.57	0.80	0.62	0.66	0.05
Empty Gizzard	1.75	1.96	2.15	1.91	0.12

^{a,b}Means with different subscripts in the same row are significantly different P<0.05. SEM = Standard Error of Mean, GIT_L = Length of gastrointestinal tract
T1 = Control (0 ml/L), T2 = Water containing 2 ml/L aloe vera gel T3 = Water containing 4 ml/L aloe vera gel T4 = Water containing 6 ml/L
aloe vera gel.

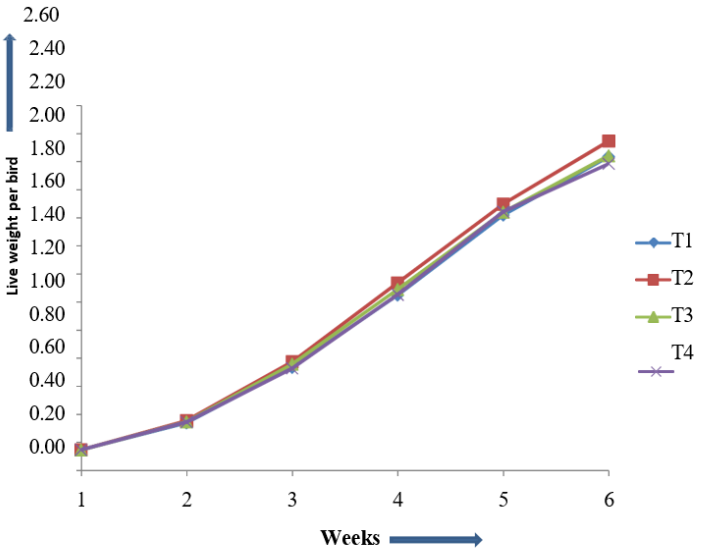

Figure 1: Mean Weekly Live body weight of Broiler Chickens on Aloe vera gel in Drinking water

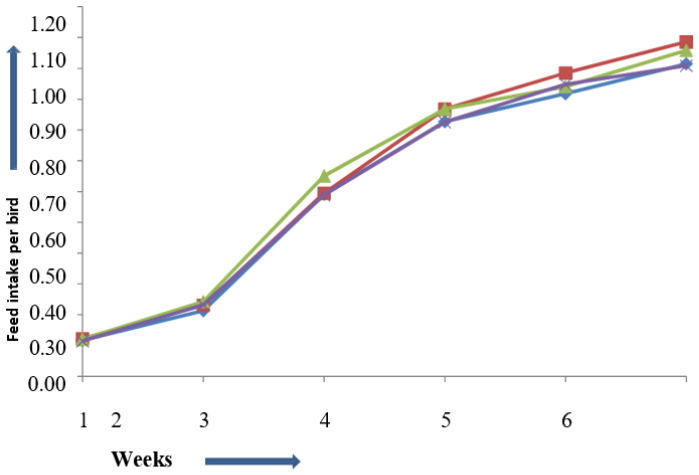

Figure 2: Mean Weekly Feed intake of Broiler Chickens on Aloe vera gel in Drinking water