

## Growth performance of broiler chickens administered varying doses of garlic (*Allium sativum*) and Aloe vera (*Aloe barbadensis*) extracts

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### Abstract

The study was designed to evaluate the effects of administering extracts of garlic and Aloe vera in water on the growth performance and apparent nutrient digestibility of broiler chickens. One hundred and fifty, day old, Arbor acre chicks were used, in a completely randomized design, in seven treatments and each with three replicates. The experiment lasted for eight weeks. The garlic and Aloe vera extracts together with the antibiotics control (Sulfaquinoxalina) were administered at different doses via drinking water consecutively for three days and alternately at week 1, 3, 5 and 7, respectively. Treatment 1 received commercial antibiotics (Sulfaquinoxalina) at 2.67 g in 4 litres of water. Treatments 2 and 3 each received 0.40 mL of garlic and Aloe vera extracts in 4 litres of water which translated to 400 ppm. Treatments 4 and 5 each received 0.80 mL of both extracts in 4 litres of water (800 ppm) while treatments 6 and 7 each received 1.20 mL of both extracts in 4 litres of water (1200 ppm), respectively. The parameters measured were mean body weight, mean body weight gain, mean feed intake, mean feed conversion ratio, mean protein and energy efficiency ratio and apparent nutrient digestibility of feed as a result of the various doses of garlic and Aloe vera. Results showed no significant ( $p > 0.05$ ) differences in all the growth performance parameters measured for the first four weeks (starter phase). Feed conversion ratio, protein efficiency and energy efficiency ratio were affected ( $p < 0.05$ ) across the treatment groups at the last four weeks (finisher phase) of the experiment, with broiler chickens administered 400 ppm of garlic extract (T3) showing better performance (2.44, 2.42, 0.14) compared to those fed treatment 6 and 7 (1200 ppm Aloe vera and garlic). The apparent nutrient digestibility of the broiler chickens for all the nutrients were significantly ( $p < 0.05$ ) affected at both the starter and finisher phases of the experiment but no particular trend was observed. The total digestible nutrients were therefore calculated and it showed that birds administered 400 ppm Aloe vera extract (T2) at the starter phase and both 800 ppm of Aloe vera (T4) and garlic (T5) at the finisher phase, had better ( $p < 0.05$ ) total digestible nutrients compared to the control (90.69 vs 88.31; 91.10, 90.60 vs 88.59, respectively). It is concluded that the doses of 400 ppm (garlic) and 800 ppm (Aloe vera) extracts via drinking water improved feed conversion ratio, protein and energy efficiency ratio of broiler chickens at the finisher phase.

**Keywords:** Broiler chickens, Garlic, Aloe vera, extracts, administered.

### Introduction

The rise of commercial poultry production in Nigeria has great potential in improving the animal protein state of the Nigerian population (Adeniji, 2005). This is being threatened by the possible ban on the usage of antibiotics in animal production due to consumer awareness of the negative effect

of antibiotics such as, the development of drug resistance by microbes and tainting of animal products. The use of phytochemicals as animal growth promoters has not been completely elucidated yet, even though, these natural chemicals have been used for a long time as medicines, flavour agents and food

preservatives (Windisch *et al.*, 2008). The investigation of herbal materials as antibiotics therefore holds promise as an alternative in the control of diseases and also as a growth performance enhancer. In addition to possibly lowering the cost of food production in Nigeria, it could create an herbal remedy export market and thereby create job opportunities in the country. The use of herbal extracts may also satisfy the increasing concerns of consumers, on condition that they prove to be both safe and effective (Ola-fadunsin and Ademola, 2013). The use of medicinal plant extracts is becoming popular because it is affordable by farmers in developing countries (Kubkomawa *et al.*, 2013). Ali and Alqurainy (2006) stated that chemicals found in plants (phytochemicals) protect plant cells from environmental hazards such as pollution, drought, stress and pathogenic attack. Although known as plant secondary metabolite, they are of health benefits to man. The active compounds in plant differ generally base on inherent factors such as the plant part used, the harvest season, the geographical origin and external factors such as production technique (Ganguly, 2013). Secondary plant metabolites are tools that enable plants to convey and associate with organisms that co-inhabit the same ecological niche. Some secondary plant metabolites may be involved in the attraction of beneficial organisms while others may inhibit or even kill plant predators or pathogens, and also guard against competitors. In addition to their significance in interactions with the environment, some phytochemicals also have primary functions in plant growth and development. *Aloe vera (Aloe barbadensis)* is a cactus-like plant, without stem and with triangular fleshy leaves ranging in colour from grey-green to bright green and the margins of the leaves have small white 'teeth' (Surjushe *et al.*, 2008; Hashemabadi and Kaviani, 2010). The leaf and juice of

*Aloe vera* have been used both internally and externally in animals. It is known to possess pharmacological effect (wound healing, anti-inflammatory, anti-arthritic, anti-oxidative, anti-diabetic, and anti-tumorigenic), anti-bacterial properties, anti-venin and immunological properties (Hashemabadi and Kaviani, 2008). Garlic (*Allium sativum*) belongs to the same group as the onion with close relatives such as onion, shallot, leek, chive and Chinese onion; garlic yield the sulphur compounds: allicin, ajoene, diallyl polysulfides, vinylthiins, S-allylcysteine and enzymes, saponins, flavonoids and maillard reaction products which are not Sulphur containing compounds (McGee, 2004). Ahsan *et al.* (1999) reported that feed added garlic can upgrade immune performance against Infectious Bursal Disease (IBD) and Newcastle Disease (ND) in poultry. Garlic infusion plays a vital role in the weight gaining efficiency of broilers (Shahriyar and Durraini, 2006). The proposed mechanism of action for a particular phytochemical depends largely on its structure, dosage and pharmacokinetics, as well as the animal species, productive stage and administration period. On the other hand, the observed growth promoting effect may be due to admixture of several mechanisms, as a result of the various biological activities of the phytochemicals. The proposed modes of actions may include the following: improving the feed antioxidant status, decreasing the antimicrobial colonization of the gut, and increasing the stimulation of appetite. Some phytochemicals can excite the olfactory nerves and taste buds (Muanda *et al.*, 2011; Velasco and Williams, 2011). All of these effects can cause positive results such as higher feed consumption and weight gain (Franz *et al.*, 2010; Kanduri *et al.*, 2013; Alipour *et al.*, 2015). Also, in terms of nutrient digestion and absorption, they exhibit various biological activities that are

related to the functions of the intestinal tract, such as digestive secretions and nutrient absorption (Dhama *et al.*, 2014). Over the years, results of the use of phytochemicals from *Aloe vera* and garlic on growth performance of broiler chickens have been conflicting. Fallah (2015) reported no significant ( $p>0.05$ ) difference in final body weight, feed intake and lowest feed conversion ratio in broiler chickens fed with 3 % *Aloe vera* gel in drinking water, 3 % garlic powder in diet and 1.5 % *Aloe vera* gel + 1.5 % garlic powder in diet, respectively. Issa and Omar (2012) showed also that supplementation of garlic powder at 0.2 % and 0.4 % in diets of broilers had no significant ( $p>0.05$ ) effect on feed intake, weight gain and feed conversion ratio of broiler chickens. Examining the effects of basal diets supplementation with 0.1 and 2.0 % *Aloe vera* on Fayoumi chickens, Khan *et al.* (2014) reported an improved ( $p<0.05$ ) feed intake, body weight gain and an insignificantly ( $p>0.05$ ) higher feed conversion ratio. Due to this fact, the need to further test the performance of broiler chickens administered varying doses of garlic and *Aloe vera* extracts, and the possibility of obtaining an optimum level of both herbs that will support growth and well-being of the chickens is a justification for the current study. The study will shed more light on what the performance of broiler birds will be if given higher than 300 ppm of single doses of both herbs via drinking water.

## **Materials and methods**

### ***Experimental site***

The experiment was carried out at the poultry unit of the Teaching and Research farm of the Department of Animal Production, located at the Gidan Kwano campus of the Federal University of Technology, Minna, Niger State. According to the Federal University of Technology Minna Student's Handbook (FUTMSH,

2019), Gidan Kwano is situated at latitude  $9.61^{\circ}$  N and longitude  $6.26^{\circ}$  E, with an average rainfall of 1300 mm and a mean annual temperature of  $40^{\circ}$  C.

### ***Source of experimental birds and plant materials***

One hundred and fifty-day old Arbor acre broiler chicks purchased from Bounty Harvest agro services, Ibadan, Oyo State, Nigeria were used for the study. A commercial pelletized feed was used for both the starter (21 % CP, 3100 Kcal/kg ME) and finisher (17 % CP, 3000 Kcal/Kg ME) phases of the experiment. Fresh garlic was bought from Kure Ultra-modern market, while *Aloe vera* was obtained from the garden of a friend's home. The samples were transported in polythene bags to the laboratory of the Department of Animal Production situated at the Gidan Kwano campus for further processing.

### ***Preparation of aqueous plant extracts***

A thermostatic water bath was used for the extraction of the extracts at the temperature of  $98^{\circ}$  C for both plant materials (garlic and *Aloe vera*). Water bath was used because hot steam produced was used to evaporate water from the extracts without denaturing phytochemicals in the extracts. The *Aloe vera* was washed and cut into bits while the garlic was peeled and the bulbs removed. Using an electronic weighing balance (model: Wt6002kf, Life Assistance Scientific Company, UK), their total weight was measured to be 5 and 2 kg, respectively. They were then blended separately. The products obtained were turned into separate containers, and diluted with two litres of water each. They were then placed in the water bath using separate beakers for extraction. After extraction, they were packaged into small air-tight containers, labelled and stored at refrigeration temperature of  $4^{\circ}$  C.

### ***Management practices and experimental design***

Two weeks before the arrival of the chicks,

*Broiler chickens administered varying doses of garlic (Allium sativum) and Aloe vera (Aloe barbadensis) extracts*

the pens were washed with detergent, disinfected using Izal® and allowed to dry. Openings in the pens were thoroughly cemented and repairs were carried out on the various cages with damages by replacing torn nets and realigning broken woods. The pens were disinfected the second time two days before the arrival of the chicks, after which wood shavings were spread on the floor as litter material. Feeders, drinkers and earthenware pots were placed in their proper locations for the provision of feed, water and heat, respectively. The poultry house was properly covered with sacks to conserve heat and provide a secure environment for the chicks. On arrival of the chicks, glucose and multivitamins were administered to them to serve as source of energy and anti-stress. The initial body weight of the chicks was taken and recorded as they were assigned to seven treatment groups (T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub>, T<sub>4</sub>, T<sub>5</sub>, T<sub>6</sub> and T<sub>7</sub>) earmarked for the experiment in a completely randomized design. Each treatment group had three replicates with 7 chicks per replicate. As the chicks age, the sacks used to cover the poultry house were slightly opened during the day to allow for cross-ventilation and release of excess heat. During the course of the experiment, clean water and measured quantities of feed were given to the chicks daily free choice. Other routine daily operations were observed. Vaccines (Lasota and Gumboro) were administered to the chicks at 7 days old and at 2 weeks old respectively. A repeat dose of Lasota at 3 weeks old and finally another Gumboro dose at 4 weeks of age were also administered. Before the vaccination of the chicks, they were denied water for at 12 hours which made them thirsty.

**Administration of the extracts**

The extracts of garlic and Aloe vera together with the commercial anti-coccidia (given to the control) were administered via drinking water consecutively for 3 days and

alternately at week 1, 3, 5 and 7, respectively. Treatment one was treated with commercial anti-coccidia (Sulfaquinoxalina®) at 2.67 g in 4 liters of water according to the manufacturer's recommendation. Treatments 2 and 3 each received 0.40 mL of garlic and Aloe vera (400 ppm), treatments 4 and 5 each received 0.80 mL of garlic and Aloe vera (800 ppm) while treatments 6 and 7 each received 1.20 mL of garlic and Aloe vera (1200 ppm), respectively all in 4 litres of water.

**Data collection**

Feed intake and weight gain were determined on weekly basis. These were used to calculate feed conversion ratio. Protein and energy efficiency ratio were also calculated from protein, energy intake and body weight gain. The data were obtained as follows:

Weekly average feed intake/bird (g)

$$= \frac{\text{Total feed intake (g)}}{\text{Number of birds per replicate}}$$

Weekly body weight gain/bird (g)

$$= \text{Current body weight (g)} - \text{Previous body weight (g)}$$

Feed conversion ratio =

$$\frac{\text{Feed intake (g)}}{\text{Body weight gain (g)}}$$

Protein efficiency ratio =

$$\frac{\text{Body weight gain (g)}}{\text{Protein intake (g)}}$$

Energy efficiency ratio =

$$\frac{\text{Body weight gain (g)}}{\text{Energy intake (g)}}$$

Energy intake (g)

**Apparent nutrient digestibility**

This was conducted using digestibility cages supplied with drinkers and feeders. The cages and all the materials needed were washed and cleansed before the placement of the broiler chickens. At the 3<sup>rd</sup> and 7<sup>th</sup> week, respectively, a total of fourteen broiler chickens (two per treatment) were randomly selected, their body weights taken after which they were placed in their respective cages. The chickens were provided an adjustment period of four days.

Daily feed intake was recorded throughout the duration of the trial. Flat sacks were placed beneath the cages for easy collection of the droppings (total collection method) which was done for a period of three consecutive days. The droppings were weighed, oven-dried to a constant weight using a hot air oven and ground for analysis. A sub sample of this was taken and used for proximate analysis for dry matter, crude protein, crude fibre, ether extract, ash and nitrogen free extract. Apparent nutrient digestibility was evaluated using the formula;

$$\text{Apparent nutrient digestibility (\%)} = \frac{\text{NI} - \text{NE}}{\text{NE}} \times 100$$

NI

Where NI = nutrient intake and NE = nutrient excreted.

**Data analysis**

The data collected were entered into Excel sheets and analyzed using Statistical Package for Social Scientists version 16.0 (SPSS, 2007). The data was subjected to one-way analysis of variance at 95 % confidence level. Treatment means were separated using Duncan multiple range test.

**Results**

The growth performance of broiler chickens administered varying doses of garlic and Aloe vera extracts in drinking water at the starter phase is presented in Table 1. The results obtained showed no significant ( $p > 0.05$ ) differences in all of the growth performances parameters measured across the treatment groups. Table 2 shows the results of the growth performance of broiler chickens administered varying doses of garlic and Aloe vera extracts in drinking water at the finisher phase. The result showed that feed conversion ratio, protein efficiency ratio and energy efficiency were influenced ( $p < 0.05$ ) by the administration of both extracts of garlic and Aloe vera. The results of the feed conversion ratio, protein and energy efficiency ratios indicated that chickens administered treatment 3 (400 ppm garlic) had better results compared to those administered treatment 6 (1200 ppm Aloe vera) and treatment 7 (1200 ppm garlic). However, the average feed intake, average body weight, and average body weight gain were not significantly ( $p > 0.05$ ) influenced.

**Table 1: Growth performance of broiler chickens administered garlic and Aloe vera extracts at starter phase (1-4 weeks)**

Parameter	T <sub>1</sub> (0AG)	T <sub>2</sub> (400A)	T <sub>3</sub> (400G)	T <sub>4</sub> (800A)	T <sub>5</sub> (800G)	T <sub>6</sub> (1200A)	T <sub>7</sub> (1200G)	SEM	LS
Initial weight (g/bird)	55.30	55.47	55.13	55.10	55.57	55.33	55.57	0.68	NS
Final weight (g/bird)	888.91	856.19	808.05	844.72	842.87	946.06	897.18	16.40	NS
Body weight gain (g/bird)	833.61	800.72	752.92	789.62	787.30	890.72	841.62	16.42	NS
Weekly weight gain (g/bird)	208.40	200.18	188.23	197.40	196.83	222.68	210.49	4.10	NS
Weekly feed intake (g/bird)	412.08	391.80	390.27	390.36	378.35	457.30	402.73	9.90	NS
FCR (g/bird)	1.98	1.96	2.10	1.98	1.92	2.04	1.91	0.03	NS
PER	2.41	2.43	2.30	2.41	2.48	2.35	2.49	0.03	NS
EER	0.16	0.16	0.15	0.16	0.17	0.16	0.17	0.00	NS

T<sub>1</sub> = 0 aloe vera and garlic, T<sub>2</sub> = 400 ppm Aloe vera, T<sub>3</sub> = 400 ppm garlic, T<sub>4</sub> = 800 ppm Aloe vera, T<sub>5</sub> = 800 ppm garlic, T<sub>6</sub> = 1200 ppm Aloe vera, T<sub>7</sub> = 1200 ppm garlic, SEM = standard error of mean, LS = level of significance, NS = not significant ( $p > 0.05$ ), FCR = feed conversion ratio, PER = protein efficiency ratio, EER = energy efficiency ratio.

*Broiler chickens administered varying doses of garlic (Allium sativum) and Aloe vera (Aloe barbadensis) extracts*

**Table 2: Growth performance of broiler chickens administered garlic and Aloe vera extracts at finisher phase (5-8 weeks)**

Parameter	T <sub>1</sub> (0AG)	T <sub>2</sub> (400A)	T <sub>3</sub> (400G)	T <sub>4</sub> (800A)	T <sub>5</sub> (800G)	T <sub>6</sub> (1200A)	T <sub>7</sub> (1200G)	SEM	LS
Initial weight (g/bird)	888.91	856.19	808.05	844.72	842.87	946.06	897.18	16.40	NS
Final weight (g/bird)	2198.54	2094.60	2118.87	2029.08	2155.55	2210.64	2044.48	27.70	NS
Body weight gain (g/bird)	1309.64	1238.41	1310.82	1184.36	1312.67	1264.58	1147.30	22.67	NS
Weekly weight gain (g/bird)	327.41	309.60	327.70	296.09	328.17	316.15	286.82	5.67	NS
Weekly feed intake (g/bird)	819.62	786.55	797.56	808.28	829.28	964.31	835.83	21.37	NS
FCR (g/bird)	2.50 <sup>ab</sup>	2.54 <sup>ab</sup>	2.44 <sup>a</sup>	2.74 <sup>abc</sup>	2.52 <sup>ab</sup>	3.05 <sup>c</sup>	2.92 <sup>bc</sup>	0.07	*
PER	2.35 <sup>ab</sup>	2.32 <sup>ab</sup>	2.42 <sup>a</sup>	2.16 <sup>abc</sup>	2.33 <sup>ab</sup>	1.96 <sup>c</sup>	2.03 <sup>bc</sup>	0.05	*
EER	0.13 <sup>ab</sup>	0.13 <sup>abc</sup>	0.14 <sup>a</sup>	0.12 <sup>abc</sup>	0.13 <sup>ab</sup>	0.11 <sup>c</sup>	0.12 <sup>bc</sup>	0.00	*

T<sub>1</sub> = 0 aloe vera and garlic, T<sub>2</sub> = 400 ppm Aloe vera, T<sub>3</sub> = 400 ppm garlic, T<sub>4</sub> = 800 ppm Aloe vera, T<sub>5</sub> = 800 ppm garlic, T<sub>6</sub> = 1200 ppm Aloe vera, T<sub>7</sub> = 1200 ppm garlic, SEM = standard error of mean, LS = level of significance, NS = not significant (p>0.05), FCR = feed conversion ratio, PER = protein efficiency ratio, EER = energy efficiency ratio.

Tables 3 and 4 show the results of the apparent nutrient digestibility of broiler chickens administered varying doses of garlic and Aloe vera extracts in drinking water at the starter and finisher phases, respectively. The apparent nutrient digestibility of the chickens for all the nutrients were significantly (p<0.05) affected at both phases of the experiment.

However, no particular trend was observed in the apparent nutrient digestibility leading to calculation of the total digestible nutrients. This showed that chickens administered 400 ppm of Aloe vera extract (T<sub>2</sub>) at the starter phase, and both 800 ppm of Aloe vera (T<sub>4</sub>) and garlic (T<sub>5</sub>) extracts at the finisher phase, had better (p<0.05) total digestible nutrients compared to the control.

**Table 3: Apparent nutrient digestibility of broiler chickens administered garlic and Aloe vera extracts at starter phase (1-4 weeks)**

Parameter	T <sub>1</sub> (0AG)	T <sub>2</sub> (400A)	T <sub>3</sub> (400G)	T <sub>4</sub> (800A)	T <sub>5</sub> (800G)	T <sub>6</sub> (1200A)	T <sub>7</sub> (1200G)	SEM	LS
DM	85.92 <sup>a</sup>	83.88 <sup>ab</sup>	80.61 <sup>c</sup>	75.65 <sup>d</sup>	80.83 <sup>c</sup>	80.70 <sup>c</sup>	83.04 <sup>bc</sup>	0.73	*
CP	65.75 <sup>bc</sup>	72.70 <sup>a</sup>	63.15 <sup>cd</sup>	59.77 <sup>d</sup>	72.35 <sup>a</sup>	68.63 <sup>ab</sup>	72.26 <sup>a</sup>	1.19	*
CF	43.30 <sup>de</sup>	51.81 <sup>c</sup>	48.49 <sup>cd</sup>	38.50 <sup>e</sup>	55.29 <sup>bc</sup>	58.97 <sup>ab</sup>	62.60 <sup>a</sup>	1.90	*
EE	88.60 <sup>bc</sup>	92.92 <sup>a</sup>	86.75 <sup>c</sup>	83.69 <sup>d</sup>	92.90 <sup>a</sup>	94.29 <sup>a</sup>	89.92 <sup>b</sup>	0.82	*
Ash	59.79 <sup>ab</sup>	63.85 <sup>a</sup>	56.06 <sup>bc</sup>	55.19 <sup>bc</sup>	51.58 <sup>c</sup>	53.83 <sup>c</sup>	61.76 <sup>a</sup>	1.05	*
NFE	99.76 <sup>a</sup>	97.14 <sup>b</sup>	99.50 <sup>a</sup>	94.67 <sup>c</sup>	91.09 <sup>c</sup>	90.45 <sup>c</sup>	92.45 <sup>d</sup>	0.80	*
TDN	88.31 <sup>b</sup>	90.69 <sup>a</sup>	86.83 <sup>b</sup>	82.89 <sup>c</sup>	88.14 <sup>b</sup>	88.41 <sup>b</sup>	88.25 <sup>b</sup>	0.54	*

<sup>abcde</sup> = Means in the same row with different subscripts are significantly different (p<0.05), T<sub>1</sub> = 0 aloe vera and garlic, T<sub>2</sub> = 400 ppm Aloe vera, T<sub>3</sub> = 400 ppm garlic, T<sub>4</sub> = 800 ppm Aloe vera, T<sub>5</sub> = 800 ppm garlic, T<sub>6</sub> = 1200 ppm Aloe vera, T<sub>7</sub> = 1200 ppm garlic, SEM = standard error of mean, LS = level of significance, NS = not significant (p>0.05), DM = dry matter, CP = crude protein, CF = crude fibre, EE = ether extract, NFE = nitrogen free extract.

**Table 4:** Apparent nutrient digestibility of broiler chickens administered garlic and Aloe vera extracts at finisher phase (5-8 weeks)

Parameter	T <sub>1</sub> (0AG)	T <sub>2</sub> (400A)	T <sub>3</sub> (400G)	T <sub>4</sub> (800A)	T <sub>5</sub> (800G)	T <sub>6</sub> (1200A)	T <sub>7</sub> (1200G)	SEM	LS
DM	85.25 <sup>c</sup>	86.00 <sup>bc</sup>	86.08 <sup>bc</sup>	86.61 <sup>abc</sup>	87.88 <sup>ab</sup>	85.41 <sup>c</sup>	88.58 <sup>a</sup>	0.35	*
CP	89.41 <sup>a</sup>	86.60 <sup>b</sup>	86.34 <sup>b</sup>	81.04 <sup>b</sup>	85.53 <sup>c</sup>	90.72 <sup>a</sup>	83.80 <sup>c</sup>	0.53	*
CF	68.26 <sup>bc</sup>	75.95 <sup>b</sup>	85.93 <sup>a</sup>	44.39 <sup>c</sup>	65.91 <sup>c</sup>	68.24 <sup>c</sup>	57.97 <sup>d</sup>	2.83	*
EE	85.06 <sup>d</sup>	92.07 <sup>a</sup>	88.38 <sup>c</sup>	90.04 <sup>bc</sup>	91.06 <sup>ab</sup>	86.37 <sup>d</sup>	90.06 <sup>bc</sup>	0.55	*
Ash	66.02 <sup>ab</sup>	62.57 <sup>ab</sup>	54.15 <sup>cd</sup>	60.03 <sup>bc</sup>	66.99 <sup>a</sup>	51.32 <sup>d</sup>	66.01 <sup>d</sup>	1.44	*
NFE	89.89 <sup>c</sup>	90.39 <sup>c</sup>	92.09 <sup>b</sup>	95.10 <sup>a</sup>	94.70 <sup>a</sup>	94.34 <sup>b</sup>	94.31 <sup>a</sup>	0.44	*
TDN	88.59 <sup>b</sup>	89.97 <sup>ab</sup>	90.19 <sup>ab</sup>	90.60 <sup>a</sup>	91.10 <sup>a</sup>	90.41 <sup>ab</sup>	89.69 <sup>ab</sup>	0.25	*

<sup>abcde</sup> = Means in the same row with different subscripts are significantly different (p<0.05), T<sub>1</sub> = 0 aloe vera and garlic, T<sub>2</sub> = 400 ppm Aloe vera, T<sub>3</sub> = 400 ppm garlic, T<sub>4</sub> = 800 ppm Aloe vera, T<sub>5</sub> = 800 ppm garlic, T<sub>6</sub> = 1200 ppm Aloe vera, T<sub>7</sub> = 1200 ppm garlic, SEM = standard error of mean, LS = level of significance, NS = not significant (p>0.05), DM = dry matter, CP = crude protein, CF = crude fibre, EE = ether extract, NFE = nitrogen free extract.

### Discussion

The better performance recorded in the feed conversion ratio for birds administered 400 ppm of garlic (T<sub>3</sub>) at the finisher phase of the experiment is in harmony with the reports of El-Katcha *et al.* (2016) who observed that garlic (allicin) supplementation in broiler chicks at 25, 50 and 75 mg/kg, led to improved feed conversion ratio (1.60, 1.52 and 1.56), compared to birds fed the control (1.67) and the 100 mg/kg dietary allicin supplementation (1.73), respectively. El-Katcha *et al.* (2016) were of the view that their results might be due to good health status of the birds brought about by the administration of garlic. Such good results could also be due to the chemical composition of garlic as posited by Reuter (1995). The insignificant results observed for body weight is at variance with the reports of El-Banna *et al.* (2013). They observed significant differences in the body weight of broiler chickens with better body weight observed in chickens fed 50 ppm garlic + 50 ppm Aloe vera (2260 g) compared to the controls (infected non treated-1690 g, non infected non treated-1940 g), 25 ppm Toltrazuril (2130 g), 100 ppm aqueous garlic and Aloe vera (2160 g and 2120 g, respectively). Konjufca *et al.*

(1997) had reported that feeding garlic powder at different levels improved birds' performance even though insignificantly making their reports similar to what was obtained in the current study. The nature of the results at both the starter and finisher phases, suggests that there is opportunity to administer higher doses of both extracts. Such higher doses might take advantage of the antibacterial properties of the supplements, which have been reported to lead to better absorption of nutrients present in the gut leading to improvement in feed conversion ratio (Meraj, 1998), thereby positively impacting on body weight gain. Although the apparent nutrient digestibility showed significant differences at both the starter and finisher phases of the experiment, no particular trend was observed leading to the need to calculate the total digestible nutrients. Chickens administered the plant extracts (400 ppm Aloe vera) at the starter phase and both 800 ppm Aloe vera (T<sub>4</sub>) and 800 ppm garlic (T<sub>5</sub>) at the finisher phase, had better total digestible nutrients compared to chickens in the control group. These findings are in agreement with the observations of Hernandez *et al.* (2004) who showed that plant extracts improved the whole tract digestibility of nutrients. The positive

influence of these extracts on the total digestible nutrients at both the starter and finisher phases of the experiment is also in line with the findings of Gardzielewska *et al.* (2003) and Yadav *et al.* (2017) who reported that garlic enhances digestion due to its rich aromatic oil content, and that the anti-bacterial properties of Aloe vera helps in maintaining and improving intestinal micro-flora in chickens, improves feed utilization, facilitate better nutrient absorption, strengthen the immune system of broiler chickens and, also reduces the cost of production.

### **Conclusion**

The study showed that administration of doses of 400 ppm (garlic) and 800 ppm (Aloe vera) extracts via drinking water improved feed conversion ratio, protein and energy efficiency ratio of broiler chickens at the finisher phase of the experiment.

### **Recommendation**

It is recommended that higher doses of both extracts should be tried on broiler chickens to help further elucidate their impact on growth performance.

### **References**

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*Received: 10<sup>th</sup> June, 2020*

*Accepted: 27<sup>th</sup> September, 2020*