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Growth Response and Gastrointestinal Tract Characteristics of Broiler Chicks offered Additives Extracts of Aspilia africana Leaves

[1]Obasi, I. U., [2]Azodo, L. N., [1]Ukwu, C. P., [1]Ogbuewu, I. P., [1]Okoli, I. C. and [1]Etuk, E. B.

[1]Department of Animal Science and Technology, Federal University of Technology Owerri
[2]Department of Animal Production Technology, Federal College of Agriculture Ishiagu
Corresponding author: *obasiikechu@gmail.com; 08064238820*

Abstract

The effect of additives produced from Aspilia africana leaves using different extraction methods on the seventh day performance of broiler chicken was studied. Fresh A. africana leaves were dried for 48 hours and thereafter, macerated. Extraction of A. africana leaves was performed using six methods; water decoction, methanol, and ethanol extraction, followed by microwave assisted repeats of the three extraction media. The additive production was completed by the addition of sodium benzoate as preservative and Aspartame® as sweetener to each extract. They were designated A. africana water decoct (AAWD); A. africana microwave assisted water decoct (AMWD); A. africana ethanol extract (AAEE); A. africana microwave assisted ethanol extract (AMEE); A. africana methanol extract (AAME); and A. africana microwave assisted methanol extract (AMME). 168-day-old broiler chicks were divided into 7 groups of 24 chicks each. Each group was replicated 4 times in a 2 x 4 factorial in a completely randomized design experiment. The seven additives (treatments) were randomly assigned to the groups as follows: T1 (control- no additive), T2 (AAWD), T3 (AMWD), T4 (AAEE), T5 (AAEE), T6 (AAME) and T7 (AMME). Each replicate group received 2ml of the additive per litre of drinking water daily. Seventh day performance results showed that there were no significant differences ($p>0.05$) among the treatment groups. Gastrointestinal tract (GIT) results showed that crop weight was significantly ($p<0.05$) higher in the control while other GIT parameters measured where similar ($p>0.05$) across treatment groups. In conclusion, inclusion of 2ml each of differently processed A. Africana additive in drinking water of broiler chicks daily did not have any significant effect on growth performance of broilers in the first seven days of age.

Keywords: Aspilia african, Extraction, Broiler, Performance, Gastrointestinal.

Description of Problem

It has also been reported that broiler (meat) has high protein content of 21-30 percent contrasted with rabbit and beef, which contain 20-22 percent and 18 percent protein, respectively (1). The major constraint to improved broiler chicken production in Nigeria is however, the high and rising cost of inputs, especially feed, which accounts for over 60-70% of total cost of production (2). This high cost of feed has been attributed to increase in the prices of feed ingredients (3).

Poultry researchers and nutritionists have over the years expounded various strategies aimed at cost effective broiler production and improved quality of poultry products (4). Some of the strategies employed to reduce the effect of costly feed ingredients and finished feeds in broiler production include supplementation with exogenous enzymes, fermentation and use of agro industrial by-products (5;6;7). Varying levels of successes have been reported with these strategies possibly because of factors such as genotype, diet composition, digestible nutrient content, energy to protein ratio, feed form and feed processing, environment, and disease (4).

To improve the feed conversion efficiency and other production indices of poultry, it has become imperative to boost the quality, and nutrient values of feeds being offered to the animals. Many feed additives have been offered as components of poultry diets in attempts to overcome poor nutrients utilization, and performance challenges (8). In general, additives are products incorporated into the diets or water of often healthy animals for nutritional purposes on a permanent basis (i.e., during the entire production period of the animal), in contrast to medicinal inputs which are applied for prophylaxis and therapy of diagnosed health issues for a limited period of time (8;9). These additives include organic acids, plant extracts, herbs and spices, enzymes, probiotics, prebiotics, and fungi (10). Other additives that have been shown to be beneficial to birds include flavourants, colourants, detoxicants, vitamins, minerals, synthetic and natural amino acids, osmo-regulators, antioxidants, and methyl donors (11;12). The active principles and working mechanisms of these additives however vary widely, while the sources, prescriptions and usage of these feed additives among stakeholders may also result in wide variations in their effects at different production environments (13;14).

A range of phytogenic additives have been studied in poultry production with the aim of enhancing feed utilization, growth performance and meat quality. (15) Observed that dressed weight and abdominal fat values were better in broiler chicken fed diets containing bitter leaf, ginger and mixtures of two other herbs than the control. (16) Investigated the effect of milled ginger and garlic on the growth performance, carcass quality, and economics of broiler production and reported a significant increase in daily weight gain and dressing percentage attributable to improved utilization by the birds on test additives. *Aspilia africana* which is abundant in compound bushes and farms in southeastern Nigeria and exploited locally as fodder for small ruminants (17), contains high protein value which suggests its potential use as a feed ingredient in animal production (18). However, amino acids are usually imbalanced in leaf meal protein, especially in the ratio of essential amino acids required by the animals making the use of leave extract a veritable alternative. Studies in laying quails (19;20) demonstrated that *Aspilia africana* leaf extract has the potential to boost growth performance, egg production and improve internal egg quality with positive impacts on egg composition and yolk colour. A slight improvement in the digestibility of nutrients because of the extract supplementation has also been reported (21). Nevertheless, leaf current extraction procedures are manual, laborious and often inefficient and superior extraction technology are sometimes time consuming or too expensive. In addition,

fresh leaf extracts have very poor keeping quality, making production daily affair and sometimes less palatable (22)

For broiler chickens particularly those grown to 42 days, the first seven days represents almost 17% of the total growing cycle – making it a crucial period; therefore, the importance of the first seven days in the life of the broiler chick cannot be over-emphasized, as this week sets the foundation for the lifetime performance of the broiler(23). Stimulating feed and water consumption during their first seven days will maximise gut development and give chicks the best start (23). Furthermore, it is important to maintain a healthy gut through good diet and appropriate nutritional intervention. The objective of this study, therefore, was to determine the effect of additives produced from leave extracts of *Aspilia africana* using different methods on the seventh day performance and gastrointestinal characteristics of broiler chickens.

Materials and Method

Experimental location

Production of phytogenic additives produced from leaf extracts of *Aspilia africana* as well as broiler chicken trials was carried out at the Teaching and Research Farms of the School of Agriculture and Agricultural Technology, Federal University of Technology, Owerri (FUTO).

Development of additive from *Aspilia africana* leaves extract

The freshly harvested *Aspilia africana* is gotten from Umudike in Ikwuano Local Government Area (LGA) of Abia State during the rainy season used for this study was weighed and washed in water to remove sand and debris, shade dried for 48 hours to reduce the moisture content and then macerated using Mastercheff® blender (Model Mc-211). The macerated leaves were extracted in three media; water, methanol, and ethanol, each in non-microwave assisted and microwave assisted.

Extraction procedures

Water decoction (WD): Water was boiled for 15- 20 minutes until the water volume is halved. Preparation ofthe macerated plant material (AA) was soaked in each amount of water in an earthenware container, 500 milliliters of water was used for every 300gramsof chopped plant material. The container was covered and boiled for 10-20 minutes, until water volume is halved; then strained, cooled, and refrigerated. Water decoctions usually keep for 2-3 days (24).

Microwave assisted water decoction (MW): Three hundred (300) grams of the macerated plant materials (AA) was transferred to a 500ml conical flask and 400ml of boiled water added. The mixture was shaken thoroughly and kept for 45 minutes so that the absorption of water by plant material will properly take place. The flask was kept in the microwave oven and treated for microwave process. The microwave extraction was done 5 minutes with irradiation power set at 480 W. After the extraction, the conical flask was taken out from the microwave oven and the content filtered with Whatman paper No. 4. Concentration of extract was carried out in a water bath and calculated percentage yield of extract (%w/w) was determined (25).

Methanol Extraction (ME): Three hundred grams (300g) of the macerated plant

materials (AA) each was measured separately into different containers and soaked with 400ml of methanol. The mixtures was allowed to stand for 72 hours with intermittent shaking and then filtered with muslin cloths as described by (26).

Microwave assisted methanol extraction (MM): Three hundred (300) grams of the macerated plant materials (AA) was transferred to a 500ml conical flask and 400ml of methanol added. The setup was thoroughly mixed and kept for 45 minutes so that the absorption can properly take place. The flask was transferred to the microwave oven. The extraction time in the microwave oven was set at 5 minutes and irradiation power set at 480W. After the extraction, the conical flask was taken out from the microwave oven and filtered with Whatman paper No. 4 (27).

Ethanol Extraction (EE): The ethanolic extraction of macerated AA was prepared as outlined by (28). Three hundred grams (300g) of each of the test material (AA) was soaked in 400ml of 80% ethanol in a container, thoroughly mixed and left to stand for 72hours. Thereafter, it was filtered with Whatman paper No. 4.

Microwave Assisted Ethanol Extraction (ME): Three hundred grams (300g) of each of the macerated test materials was placed in a 500ml conical flask, 400ml of 80% ethanol poured into each of the flask and left for 45 minutes for proper absorption. Thereafter, it was transferred to the microwave oven and treated for microwave process. The extraction time was set at 5 minutes and irradiation power set at 480W. After the extraction process, the conical flask will be taken out from the oven, and each filtered with Whatman paper No. 4.

Procedure for addition of chemical preservatives and sweetener

To preserve the extract, 0.05g each of sodium benzoate was dissolved in 3ml of distilled water and shaken thoroughly inside a beaker; 150ml of the solution was then be added to 1 litre of each of the extract sample (29). To sweeten and mask the bitterness usually associated with phytogenics, Aspartame® which served as an artificial sweetener was added to the extracts at 20mg/liter. The extracts were stored at room temperature in properly labeled sample bottles for easy identification. The products were labelled as follows, *A. africana* water decoct (AAWD); *A. africana* microwave assisted water decoct (AMWD); *A. africana* ethanol extract (AAEE); *A. africana* microwave assisted ethanol extract (AMEE); *A. africana* methanol extract (AAME); and *A. africana* microwave assisted methanol extract (AMME). They were stored in capped plastic bottles at room temperature.

Experimental birds and management

One hundred and sixty-eight (168) day-old, Arbor Acre broiler chicks procured from Amo Farm Sieberer Hatchery, Owerri, Imo State were used for this study. The chicks were divided into 7 groups of 24 chicks each on weight equalization basis. Each group was replicated 4 times resulting to 6 chicks per replicate. The 7 experimental groups were randomly assigned to the 7 treatments as described: T_1 (control- no additive), T_2 (AAWD), T_3 (AMWD), T_4 (AAEE), T_5 (AAEE), T_6 (AAME) and T_7 (AMME) in a 2 x 4 factorial arrangement of the completely randomized design (CRD) experiment. Each

experimental group received 2ml of the additive per litre of water per day. Feed and water were offered *ad libitum* and other management practices were observed. The birds were on deep litter with 20w electric bulbs and kerosine stoves as source of heat for brooding. This experiment lasted for 7 days. Experimental starter broiler chicken diets is produced as shown in Table 1

Table 1: Gross Composition of experimental starter broiler chicken diets

Ingredients	Starter
Maize	50.00
Soya bean meal	30.00
Wheat offal	6.00
Palm kernel cake (PKC)	6.00
Fish meal	4.00
Bone meal	2.00
Oyster shell	1.00
Vitamin/Mineral premix*	0.25
Common salt	0.25
Lysine	0.25
Methionine	0.25
Total (kg)	100.00
Metabolisable Energy (Kcal/kg)	2873.45
Crude protein	23.00
Ether extract	3.68
Crude fibre	4.15
Lysine	1.60
Methionine	0.62
Calcium	1.60
Phosphorus	0.67

* To provide the following per kg feed vitamin A15,000iu, vitamin D313000iu, thiamine 2.0mg, riboflavin 6.0mg, pyridoxine 4.0mg, cobalamine 0.05mg, biotine 0.08mg, pantothemic acid 5.0mg, folic acid 0.5mg, choline chloride 0.05g, manganese 0.096g, zinc 0.06g. copper 0.006g, iodine 0.0014g, selenium 0.24g, cobalt 0.25g and antioxidant 0.125g

Data Collection

Body weight gain, feed intake and feed conversion ratio (FCR) were recorded and used to determine performance response of the chicks on the seventh day. Gastro intestinal tract (GIT) characteristics were determined using the methods described by (30). In the morning of the seventh day of feeding, one bird was selected from each replicate, weighed with electronic balance (Model-SF400), slaughtered, and weighed again. The whole GIT was removed and weighed, while the remaining body weight was determined by difference. Thereafter, the different GIT segments (crop, proventriculus, gizzard, small intestine, and large intestine) were tied off with thread to avoid mixing of their contents. The segments were separated at these tied points, and their contents expressed into clean test tube and labeled properly. The GIT segments were then weighed, and their weights expressed as percentages of the live weight of the birds.

The pH of the content of each GIT segment was determined with the aid of a pH meter as outlined by (30). A measured quantity of the sample was weighed into a glass beaker, and an equal amount of distilled water added to the sample. The content of the beaker was stirred to obtain a slurry solution, and then covered with watch glass. The solution was allowed to stand for an hour, with intermittent stirring every 10 to 15 minutes, to allow the pH of the GIT content slurry to stabilize. The pH electrode was now placed into each of the slurry solution. After 30 seconds, the pH meter was read, and the value was recorded.

Statistical Analysis

Data collected were subjected to analysis of variance (ANOVA) and means separated where significant treatment existed using (31) application.

Results and Discussion

Growth performance

The seventh day parameters considered were final weight, weight gain, feed intake, and FCR (Table 2). Chicks on AMME additives recorded the highest final body weight and body weight gain, however, the observed difference was not significant ($p>0.05$). Results showed that the final body weight, body weight gain, feed intake and FCR were similar ($p>0.05$) between microwave and non-microwave extraction methods. The seventh day body weight in this study nevertheless ranged from 128.83g for those on AMWD additives to 132.78g for those on AMME additives for microwave extraction method while chicks on non-microwave extraction ranged from 121.70g in AAWD additive to 132.10g for chicks on the control. Feed intake was similar ($p>0.05$) among the treatment groups and ranged from 125.30g in AMWD to 130.28g in AMEE for microwave method of extraction and 125.53g on the control to 139.63g for AAME in non-microwave extraction method. Feed conversion ratio showed that best FCR was recorded amongst birds in AAME followed by AMWD which was numerically higher than the control. This could indicate a more efficient feed utilization. Chicks offered additives produced with microwave extraction method performed better than those on non-microwave extraction method.

Seventh day growth performance of broiler chicks offered additives produced in different media from *Aspilia africana* leaves shows that there was no significant ($p>0.05$) difference in final body weight but birds on methanol medium recorded the highest result

followed by ethanol medium, The body weight followed similar trend. There was no significant ($p>0.05$) difference recorded in body weight gain and feed intake and FCR, however, birds in the methanol medium recorded the highest body weight gain, highest feed intake and best FCR. Seventh day growth performance of broiler chicken offered additives produced by different extraction methods from *Aspilia africana* leaves is presented results showed that the final body weight gain, body weight gain, and feed intake were similar ($p>0.05$) for control, microwave and non-microwave extraction methods. FCR values were also similar ($p>0.05$) in microwave and non-microwave extraction method. Chicks offered additives produced with microwave extraction method performed better than those on non-microwave extraction method.

Effect of extraction method were similar ($p>0.05$) in all the parameters except FCR but effect of extraction media were similar ($p>0.05$) in the parameters. Interaction between extraction method and extraction media were similar ($p>0.05$) all the parameters.

Factors that could influence lower than standard body weight of chicks includes brooding management and nutrition (32). The potential 7th day body weight of the modern broiler chick is usually ±180 g (32), although the recommended weight for the Arbor acre strain used in this experiment is 150 g (33). Generally, a weight achievement of about 160 g or more which approximates to 4.5 - 5 times the day-old chick body weights is an indication of a good start (32). Results from this study agrees with (34) and (35) who reported that microwave assisted extraction methods had earlier shown a higher yield of bioactive compounds from phytogenic materials which could have positively influenced nutrient utilization. Although several study reports have suggested that aqueous extract and leave meal of phytogenic plants could effectively improve broiler performance (36), most of these reports are based on results derived from the finishing stages of these birds (15;37). Again, the high body weight gain of chicken on additives extracted with methanol tend to align with the improved concentration of bioactive substances which could have influenced metabolic efficiency.

Gastro-intestinal tract and organ weight

Tables 3 shows that chicks on AMWD and AAWD additive recorded similar ($p>0.05$) weight of crop compared with others in both microwave and non-microwave method while the control were significantly ($p<0.05$) in both methods. Chicks on the control had similar ($p>0.05$) proventriculus, gizzard, small intestine and large weight with other groups. The large and small intestinal values were numerically higher in AAME.

Gastrointestinal trait and organ weight of broiler chicken offered additives produced by different extraction methods from *Aspilia africana* leaves extract results shows that chicks on additives produced by both extraction method produced similar ($p>0.05$) crop weight. Proventriculus, gizzard, small intestine, large intestine, and liver weights were similar ($p>0.05$) for chicks in both groups with non-microwave method producing superior values except for proventriculus.

Gastrointestinal tract and internal organ weight of broiler chicken offered additives produced by different media from *Aspilia africana* leaves extract results showed that there was no significant ($p<0.05$) difference

Table 2: Seventh day growth performance of broiler chicken offered additives produced from *Aspilia Africana* leaves

Factors		Performance parameters				
		Initial body weight (g)	Final body weight (g)	Body weight gain (g)	Feed intake (g)	Feed conversion Ratio
Extraction Method	**Extraction Media**					
Microwave	Control	41.53	132.10	90.58	125.53	1.44
	Water (AMWD)	41.76	128.83	87.23	125.30	1.43
	Ethanol (AMEE)	41.80	132.78	91.03	130.28	1.50
	Methanol (AMME)	41.59	134.28	92.68	125.20	1.41
	SEM	0.05	2.17	2.17	2.71	0.04
Non-microwave	Control	41.53	132.10	90.58	125.53	1.44
	Water (AAWD)	41.73	121.70	79.85	128.78	1.62
	Ethanol (AAEE)	41.65	129.98	84.40	131.15	1.56
	Methanol (AAME)	41.58	126.05	88.40	139.63	1.59
	SEM	0.05	2.88	2.90	2.54	0.05
Main Effects						
Extraction Method	Microwave	41.72	131.96	90.31	130.70	1.45
	Non – Microwave	41.65	125.91	84.22	133.18	1.59
	SEM	0.04	1.69	1.70	2.19	0.03
Extraction Media	Water	41.75	125.26	83.54	126.99	1.52
	Ethanol	41.73	129.41	87.71	133.89	1.53
	Methanol	41.58	132.13	90.54	134.95	1.50
	SEM	0.04	1.69	1.70	2.19	0.03
Effects	Extraction Method	0.42^{ns}	0.08^{ns}	0.08^{ns}	0.57^{ns}	0.01

^{ns} Means not significantly different ($p>0.05$)
AMWD = *Aspilia africana* microwave assisted water decoct
AMEE = *Aspilia africana* microwave assisted ethanol extract
AMME = *Aspilia africana* microwave assisted methanol extract
AAWD = *Aspilia africana* water decoct
AAEE = *Aspilia africana* ethanol extract
AAME = *Aspilia africana* methanol extract

in crop weight between the chicks in water medium and those on additives from other extraction media. Although there were no significant differences ($p>0.05$) between chicks on the extraction media, chicks on water medium had a superior percentage crop weight than others. Other parameters examined showed that there were non-significant difference ($p>0.05$) among groups.

Effect of extraction method and extraction media as well as the interaction between extraction method and extraction media showed no significance ($p>0.05$) in all the treatment groups

The crop and small intestinal value may indicate efforts by these birds to maximize the functions carried out by these organs which may include feed conditioning by the crop to suit the digestive environment of the GIT. The range of percentage weight of components of GIT tracts and internal organs

in this study are 0.75% crop in AAEE additive to 9.08% small intestine in AAME additive. This indicates that AAWD enhanced GIT development in the chicken. These results are consistent with those observed by (38), who did not find differences among the control and those containing antibiotic or mixtures of plant extracts for organ weight of broiler chicken at 42-days of age.

Table 3: Gastrointestinal tract (GIT) and internal organ weight of broiler chicken offered additives produced from A. africana leaves

Factors		Parameters (%live weight)					
		Crop	Proventriculus	Gizzard	Small intestine	Large intestine	Liver
Extraction Method	**Extraction Media**						
Microwave	Control	1.42[a]	1.40	5.18	8.16	1.66	4.67
	Water (AMWD)	0.96[b]	1.51	4.17	8.46	1.81	4.31
	Ethanol (AMEE)	0.81[b]	1.42	4.23	8.04	1.62	4.25
	Methanol (AMME)	1.20[b]	1.41	4.19	7.72	1.28	4.13
	SEM	0.13	0.07	0.21	0.39	0.09	0.16
Non-microwave	Control	1.42[a]	1.40	5.18	8.16	8.16	4.67
	Water (AAWD)	1.05[b]	1.57	5.40	8.09	8.09	4.19
	Ethanol (AAEE)	0.75[b]	1.46	4.00	8.51	8.51	4.37
	Methanol (AAME)	0.75[b]	0.98	4.14	9.08	9.08	4.26
	SEM	0.12	0.12	0.25	0.29	0.06	0.12
Main Effects							
AAME Extraction Method	Microwave	0.99	1.44	4.20	8.07	1.57	4.23
	Non -Microwave	0.85	1.33	4.51	8.56	1.65	4.27
	SEM	0.07	0.08	0.17	0.31	0.07	0.13
Extraction Media	Water	1.01	1.54	4.79	8.27	1.80	4.25
	Ethanol	0.78	1.44	4.11	8.27	1.53	4.26
	Methanol	0.98	120.00	4.16	8.40	1.49	4.25
	SEM	0.07	0.08	0.17	0.31	0.07	0.13
Effects	Extraction Method	0.31[ns]	0.47[ns]	0.31[ns]	0.47[ns]	0.57[ns]	0.87[ns]
	Extraction Media	0.34[ns]	0.19[ns]	0.15[ns]	0.98[ns]	0.18[ns]	0.99[ns]
Interaction	Extraction Method X Extraction Media	0.26[ns]	0.33[ns]	0.13[ns]	0.58[ns]	0.23[ns]	0.87[ns]

abMeans in the same column with different superscripts are significantly different ($p<0.05$)
ns Means not significantly different ($p>0.05$)
AMWD=Aspilia africana microwave assisted water decoct
AMEE=Aspilia africana microwave assisted ethanol extract
AMME=Aspilia africana microwave assisted methanol extract
AAWD=Aspilia africana water decoct
AAEE=Aspilia africana ethanol extract
AAME=Aspilia africana methanol extract

pH values of gastrointestinal components of broilers

Table 4 presents the pH values of GIT components of the experimental chicks after seven days of age. Microwave extraction methods results showed that similar ($p< 0.05$) pH value of crop were recorded for chicks on the control and AMWD while AMEE and AMME additives were significantly ($p>0.05$) higher (5.25 and 6.25) than the other groups (4.75). Proventriculus and Gizzard pH values ranged from 4.25-5.75 respectively. Small intestine values were similar ($p< 0.05$) across treatments groups while large intestine values which ranged from 4.75 – 6.25 recorded similar ($p<0.05$) values AMWD and AMME while birds on the control, AMEE as well as AMME recorded significantly ($p>0.05$) higher pH values.

Non microwave extraction methods results showed that similar ($p< 0.05$) pH value of crop were recorded for chicks on the control, AAWD and AAEE while AMME additives were significantly ($p< 0.05$) higher (4.75 - 5.25) than the other groups (6.75). Proventriculus, small and large intestine pH values ranged from 4.75 – 5.75, 5.75 – 7.00 and 5.50 – 6.25 respectively and were similar ($p<0.05$) across treatment groups with the control. Gizzard pH values were similar ($p<0.05$) across treatments groups with AAWD (5.99) recording highest value.

pH values of gastrointestinal tract of broiler chicken offered additives produced by different method and media from *Aspilia africana* leaves extract pH values of crop, proventriculus gizzard, small and large intestine were similar ($p>0.05$) for all the groups. However, birds on microwave method recorded more acidic pH compared to non-microwave method. Small intestine pH for chicks on additives tended towards neutral for microwave method. Large intestine was more acidic than small intestine.

Effect of extraction method was similar ($p>0.05$) in all the parameters but effect of extraction media was similar ($p>0.05$) in the parameters except crop. Interaction between extraction method and extraction media were significant ($p<0.05$) in all the parameters.

Although the crop content for all the groups were moderately acidic, it has been reported that as the bird matures, the crop microflora becomes predominantly acidogenic with lactobacilli becoming the most common bacterial species. The increase in lactobacilli population results in a decrease in the pH of the digesta in the crop (39). Results here agree with (40) who reported a crop ph of 4.39 to 6.80 for broiler on probiotics supplement in the first seven days.

The pH of the GIT components reported in this study were relatively high in the crop, proventriculus, small and large intestine dropped in the gizzard. This is probably because the gizzard content is a product of the effects of the true stomach (proventriculus) of the chicks on the digesta. The monogastric stomach produces higher concentrations of inorganic acids through its gastric glands to change the digesta to a lower pH status in the gizzard. The gizzard pH in this study is higher than the values published by (39) who reported a pH value of 3.24 and 3.27 at 6 and 15 days of age, respectively in broiler chicken. Small intestine pH values were near neutral in all the groups except AAME, these results were within the range of 5.7 to 6.1 reported by (41) for all the segments of small intestine of broiler chicken fed diet supplemented with *Moringa oleifera* leaf meal at 35 days. The pH values recorded

in the large intestine were however lower than the range of 6.52 – 6.54 reported by (30) after 7 days of feeding palm kernel ash supplemented diets. The increased acidity in microwave method of maybe resulting from temperature elevation due to irradiation time during the time of extraction of the test material (42). The acidity increase was also observed in microwave radiation power in oils extracted from castor bean (43).Gizzard of broiler chicken on different extraction media had more acidic values. A low gizzard pH has been reported improved pepsin activity, nitrogen retention and solubility of the mineral fraction of the feed (44), which in turn might favour its absorption. The result obtained in this study agrees with (45) who reported a negative relationship between gizzard pH and small intestine pH. pH values of chicks on additives in water medium showed that crop and large intestine components of the experimental chicks were generally more acidic, followed by ethanol and methanol media, respectively.

Table 4: pH values of gastrointestinal tract (GIT) and internal organ weight of broiler chicken offered additives produced from *Aspilia Africana* leaves

Factors		Parameters				
		Crop	Proventriculus	Gizzard	Small intestine	Large intestine
Extraction Method	**Extraction Media**					
Microwave	Control	4.75^{b}	5.75^{a}	5.75^{a}	7.00	6.25^{a}
	Water (AMWD)	4.75^{b}	5.00^{ab}	5.00^{ab}	6.50	4.75^{b}
	Ethanol (AMEE)	5.25^{ab}	5.50^{a}	5.50^{a}	6.75	6.25^{a}
	Methanol (AMME)	6.25^{a}	4.25^{b}	4.25^{b}	6.75	6.00^{ab}
	SEM	0.23	0.20	0.15	0.11	0.24
Non-microwave	Control	4.75^{b}	5.75	4.25^{ab}	7.00	6.25
	Water (AAWD)	5.25^{b}	4.75	5.99^{a}	6.25	5.75
	Ethanol (AAEE)	5.25^{b}	5.25	3.25^{b}	6.25	5.25
	Methanol (AAME)	6.75^{a}	5.25	3.75^{ab}	5.75	5.50
	SEM	0.22	0.17	0.26	0.21	0.25
Main Effects Extraction Method	Microwave	5.42	4.92	3.75	6.67	5.67
	Non –Microwave	5.75	5.83	4.00	6.08	5.50
	SEM	0.19	0.15	0.19	0.16	0.22
Extraction Media	Water	5.00^{b}	4.88	4.38	6.38	5.25
	Ethanol	5.25^{b}	5.38	3.75	6.50	5.75
	Methanol	6.50^{a}	4.75	3.50	6.25	5.75
	SEM	0.19	0.15	0.19	0.16	0.22
Effects	Extraction Method	0.25^{ns}	0.54^{ns}	0.45^{ns}	0.08^{ns}	0.70^{ns}
	Extraction Media	0.00	0.16^{ns}	0.11^{ns}	0.81^{ns}	0.55^{ns}
Interaction	Extraction Method X	0.71^{ns}	0.12^{ns}	0.03	0.62^{ns}	0.17^{ns}

[a] Means in the same column with different superscripts are significantly different ($p<0.05$)
[ns] Means not significantly different ($p>0.05$)
AMWD=*Aspilia africana* microwave assisted water decoct
AMEE=*Aspilia africana* microwave assisted ethanol extract
AMME=*Aspilia africana* microwave assisted methanol extract
AAWD=*Aspilia africana* water decoct
AAEE=*Aspilia africana* ethanol extract
AAME=*Aspilia africana* methanol extract

Conclusion

Following the results of this experiment,

1. It had been demonstrated that additives produced from *Aspilia africana* leaves extract could potentially be used as growth promoting additive in broiler chicken especially the microwave-assisted extraction in ethanol and methanol media.
2. Gastrointestinal trait and organ weight of broiler chicken offered additives produced by different extraction methods from *Aspilia africana* leaves extract results shows that chicks on additives produced by both extraction method produced similar results.

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