RESPONSES OF BROILER CHICKENS TO DIFFERENT LEVELS OF QUEOUS EXTRACTS FROM *Moringaoleifera* LEAVES AND GUM ARABIC IN COMPARISON WITH ANTIBIOTIC

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Abstract

The search for safe and natural alternative to reduce over-dependence on antibiotics in poultry has led to the evaluation of aqueous extracts from Moringaoleifera leaves and Gum Arabic. One hundred and twenty (120) day-old Abor-acre broilers were procured from a commercial hatchery in Nigeria and brooded together for the first one week of age to acclimatise, On day 7, the birds were randomly distributed into group A, B and C (10 *chicks each) in duplicates, Group A comprised of chicks administered orally with different levels of Moringa leaf extract, B * Gum Arabic and* C "• *antibiotic only as control for comparison at2, 4 and 6 weeks of age. All the chicks in all the groups were fed ad libitum with broiler starter diet (22%* CP *and2800 Kcaj/kgME)from 1-4 weeks of age, and finisher (20%* CP *and 2649 KcaVkg ME) was given from 5-8 weeks. Feed intake and body weight (gain) were reported cm weekly basis, Phytochemical and mineral analysis and haematology were taken. The results of phytochemical analysis showed that Moringa leaves and Gum Arabic contained high levels of tannins. The proximate study showed that Moringa leaves contained appreciable amounts of crude protein (17.01% ±0,1), carbohydrate (63.11 % ±0,09), energy (1440.11kcal/kg), crude fat (2.11 % ±0.11) and fatty acid (1.69% ±0.09). Gum Arabic also contained crude protein (15,38% ±0.3), carbohydrate (62.26% ±0.50), energy (138759 ±0.11), crude fat (1.83% ±0.06) and fatty acid (1.46% ±0.05). The minerals in Moringa leaves (magnesium - 0.38% ±0.01, potassium* - 0.97% ±0.01 *(ppm), sodium* -192.95 ±4.5 *(ppm), iron* -107.48 *±8.8 (ppm), zinc* - 60.06 ±0.3 *(ppm), manganese* » 81.65 ±2.31 *ppm) and Gum Arabic (magnesium - 0.42% ±0.01, potassium* -1.30% ±0.04, *sodium* - 259.85 ±1.78 *(ppm), iron <* 98,42 ±1.55 (ppm), zinc* - 47.77 ±1.06 *(ppm) and manganese* - 58.83 ±0.54 *ppm) were significant (P<0.05). All the broilers that were administered with different levels of aqueous extracts from Moringa leaves and Gum Arabic were not significantly affected (P>0.05). However, there was slight reduction in feed intake in group A and B at high concentration (10 and 20% w/o). This significantly reduced the weight gain (P<0.05) of broilers in group A, possibly due to the high levels of tannins in Moringa leaves. Generally, the carcass and organ weights and haematological parameters of the birds did not show any appreciable variations. In conclusion, it was recommended that Moringaoleifera leaves and Gum Arabic could be utilized as a useful source of plant phytobiotic to promote health and growth performance of broilers if they are adequately processed.*

Key words: Medicinal plants, alternative antibiotic, drugresidues, broiler chickens.

INTRODUCTION

Poultry (birds) like other farm animals are exposed to pathogens in their environment, air, food and drinking water. Antibiotics are drugs that are administered in the poultry drinking water or food for prevention and control of bacterial problems and as growth promoters. It is a common practice in the management of broilers to administer antibiotics via drinking water (Murwani and Bayuardhi, 2007). The benefits of such practice is to maintain good health and to suppress mortality of birds, and to support maximal growth via improved utilization of nutrients and hence to improve profit (Murwani and Murtini, 2009). The action of antibiotics helps to decrease the number of competitive pathogenic bacteria in the gut (of birds) and therefore reducing bacterial load in the gut (Dibner and Richards, 2005).

However, the negative impact of antibiotics such as emergence of antibiotic-resistant pathogens, drugs toxicity and residues has raised serious concern, leading to the ban on antibiotics in food animals and poultry since 2006 by the European Union. In attempt to reduce or eliminate antibiotic medication, certain local feed ingredients are now utilised for improvement of growth and immune response due to the presence of naturally occurring phytonutrients in the feed ingredients (Murwani, 2008; Murwani and Murtini, 2009). Phytonutrients or secondary metabolites of plants (such as saponins, tannins, oxalates, phytates, trypsin inhibitors and cyanogenic glycosides) may be applied in nutrition and as pharmacologically-active agents (Soetan and Oyewole, 2009). The use of medicinal plants as possible therapeutic measures has become a subject of active scientific

investigation (Patwardhan*et al,* 2004; Sudha*et al,* 2010). Some medicinal plants (products) are believed to enhance the natural resistance of the body to infection due to the presence of bioactive chemical substances such as polysaccharides and saponins (Atal*et al.*, 1986).

Plants also contain minerals and fatty acids which are beneficial in promoting health (Ogbe and John, 2011). *Moringa old/era* (and other plant products) were reported to have antibacterial properties and conclusion was made to investigate the plants as phytotherapeutic agent to combat infectious agents (Patel, 2011). They were also reported to be non-toxic and recommended for use in developing countries (Mangale*et al.,* 2012). Today, most of the drugs used as medicines have their origin from plants. Some plants products such as Acacia gum or gum arabic, which is a hardened sap or secondary metabolite (a mixture of saccharine and glycoprotein) that oozes out from acacia trees in Africa (particularly Senegal, Sudan and Nigeria) are also utilized in the preparation of medicines to alleviate cough and diarrhea by traditional herbalists. Commercially, gum arabic is used as an additive in foods and as a thickener in soft drinks and manufacture of pharmaceutical capsules, lotions, cosmetics and to coat pills. Supplementation with gum arabic was said to significantly increase beneficial bacterial flora, *Bifidobacteria*and *Lactobacilli* in healthy human volunteers in a dose-dependent manner (Calame*et* al.,2008).

Majority of the earth's inhabitants rely on traditional medicine for their primary health care needs and most of these therapies involved the use of plant extracts or their active components (Somaieh*et al.,* 2011). Plants extracts are known to have antiseptic properties and beneficial effects on digestion (Somaieh*et al,* 2011). Nowadays, clean drinking water has become scarce due to poor land use management and pollution by sewage or waste dumping site (Aweng*et al.,* 2012). *Moringaoleifera*and other plants products were said to be useful for drinking water treatment. The use of synthetic chemical compounds (such as alum for treatment of drinking water) may be carcinogenic (Ayotunde*et*

The aim of this study therefore was to evaluate the effect of different levels of aqueous extracts from *Moringaoleifera*leaves and Gum Arabic on growth performance and haematological parameters of broiler chickens. The main objective was to highlight the potential benefits of *Moringaoleifera* leaves and Gum Arabic in antibiotic in antibiotic-free broiler chickens production.

MATERIAL AND METHODS

Plant material and Preparation of Extracts

*Moringaoleifera*leaves were collected during rainy season (June-July) in Lafia Local Government Area of Nasarawa State, Nigeria. The leaves were removed from the stem and washed with tap water from the borehole and then sun-dried under the shade at 35°C for 3-5 days. The dried leaves were milled separately into powder using a locally made miller machine (unbranded).

Dried solid granules of gum arabic (solidified secondary metabolites from the bark of acacia trees) were procured from an open market in Kaduna, Nigeria. The milled (powder) particles of *Moringa*leaves and gum arabic were used for preparation of different levels (concentration) of aqueous extracts (5,10 and 20% w/v) by soaking in hot water boiled at 100°C for 3 h. Each solution was sieved, solid matter discarded arid the filtrate allowed to cool to room temperature (28°C). A standard antibiotic (tetracin) was used as a control for comparison.

phytochemical and Anti-nutrients Analysis

Quantitative phytochemical and anti-nutrients analysis was carried out on the dried and milled *Moringa*leaves, and gum arabic according to the methods of Sofowora (1993). All the determinations were done in duplicates.

Proximate Study and Mineral Analysis

Proximate study to determine the nutrients composition (crude protein, crude fibre, fat, ash and moisture contents) of *Moringa*leaves and gum arabic were carried out according to the methods of the Association of Official Analytical Chemists (AOAC, 1990). Mineral analysis (calcium, magnesium, potassium, sodium, iron, zinc, manganese and copper) were determined using Atomic Absorption Spectrophotometer (AAS-Buck 205 model) and phosphorus was determined colorimetrically, according to the methods of AOAC (1990). All the determinations were done in duplicates. The values of calcium, magnesium and potassium were reported in percentage (%), while sodium, iron, zinc, phosphorus, manganese and copper were reported in parts per million (ppm). Total soluble carbohydrate was determined by the difference of the sum of all the proximate composition from 100%. The calorific (energy) value was obtained according to the methods of Akinyeye*et al.* (2010, 2011). This was done by multiplying the value of carbohydrate, protein and

crude fat by the Atwater factors of 17,17 and 37 respectively. The crude fat was converted into fatty acid by multiplying the value; with a conversion factor of 0.80, as described by Akinyeye*et al* (2010, 2011).

Hematological Evaluation

Blood samples were collected from the birds in each group at 2, 4 and 6 weeks of age (4 birds per group) via the jugular veni-puncture using sterile syringes and needles (one per bird). On day 6 during treatment at 2,4 and 6 weeks of age, blood (2 ml per bird) was collected and transferred immediately into a set of sterile tubes containing anticoagulant, disodium-salt of ethylene diamine tetra-aetic add (EDTA). The microhaematocrit method and cyanmethaemoglobin method were used to determine packed cell volume (PCV) and haemoglobin (Hb), respectively, while red blood cell (RBQ and white blood cell (WBC) counts were determined using the Neubauerhaemocytometermethod (Esievo and Saror, 1992; Ogbe*et al.,* 2003; Ogbeefol,, 2010).

Experimental Birds and Management

One hundred and twenty (120) day-old Abor-acre broilers were procured from a commercial hatchery in Nigeria and brooded together for the first one week of age to acclimatise. On day 7, the birds were randomly distributed into group A, B and C (10 chicks each) in duplicates. Group A comprised of chicks administered orally with *Moringa*leaf extract, B = Gum arable extract, and C = antibiotic only as control for comparison. The chicks were kept in separate wire mesh house compartment, each measuring 100x200 cm. Feed ingredients used in this study were obtained from a local market in Lafia, Nasarawa State, Nigeria. All the chicks in all the groups were fed with broiler starter, mash containing 22% CP and 2800 kcal/kg ME from 1-4 weeks of age, followed by finisher mash containing 20% CP and 2650 kcal/kg ME from 5-8 weeks of age, *ad libitum.* All the broiler chicks were given routine vaccinations against Newcastle disease (ND) and infectious bursal disease (IBD), according to the specifications of the vaccines producer (NVRI, Vom). Vitamins only were administered to all the birds in drinking water for 3 days afteteachvaccination to take care of post-Vaccination stress. ^

Collection of Data and Statistical Analysis • Feed intake, weight gain and feed to gain ratio were determined as described by Ogbe*et al.* (2009). Organ weight and carcass analysis was also determined at the end of the experiment (9 weeks). All data generated (proximate nutrients, anti-nutrients, feed intake and weight gain) were analyzed using descriptive statistic and analysis of variance (ANOVA) as described by Olawuyi (1996). Statistical values that were calculated include mean and standard deviation. Duncan's (1955) multiple range test was used to separate means of significant difference ($P<0.05$).

RESULTS AND DISCUSSION Phytochemical and Anti-nutrients *of Moringa*j *oleifera*and Gum Arabic Table 1 shows that *Moringaoleifera*leaves contained tannins (21.19% ±0.25), phytates (2.59% ±0.13), trypsin inhibitors (3.0% ±0.04), saponins (1.6% ±0.05), oxalates (0.45% ±0.01) and low levels of hydrogen cyanide ((0.06% ±0.01). The result also showed that acacia gum arable contained tannins (15.15% ±0.24), phytates (2.05% ±0.12), trypsin inhibitors (2.01% ±0.10), saponins (1.47% ±0.23), oxalates (0.71% ±0.16) and low cyanide levels ((0.06% ±0.01). The levels of anti-nutrients and hydrogen cyanides detected in the *Moringa*leaves and gum arable were low (less than 5%). However, the levels of tannins in both the *Moringa*leaves and gum arable were high. Phytochemicals (like saponins)were reportedto have pharmacologically active effects (Soetan and Oyewole, 2009). Acacia trees (such as *Acacunilotica)* in which gum Arabic were obtained was said to contain condensed tannins in the leaves and pods (Nsahlai*et al.,* 2011). These plants phytoconstituents were reported as antibiotic principles of plants (Ajayi*et al.,* 2011). In this study, the presence of saponins (an important phytochemical constituent of plants) makes *Moringaoleifera*leaves and gum arabic to be valuable healthy plants products.

Phytochemicals are non-nutritive chemicals that occur naturally in plants. They offer benefits (prevent cell damage and fight infections) in plants and animals when ingested by them in food. Certain phytochemicals may however have anti-nutritional properties. They (phytates and tannins) bind essential minerals such as calcium, iron, magnesium and zinc in the digestive tract to form insoluble salts, thereby decreasing (reducing) their bioavailability or absorption (Thompson, 1993; De-Bruyne*et al,* 1999; Dei *et al,* 2007; Muhammad *et* al., 2011). Dietary tannins are known to reduce feed efficiency and weight gain in chicks (Armstrong *et al,* 1974; Dei *et al,* 2007). High levels of saponins in

feed can also affect feed intake and growth rate in poultry (Sim*etat*, 1984; Potter *etal*, 1993; Dei *et* Wt, 2007). Reduction in feed intake has been ascribed to the bitter and irritating taste of saponins(Cheeke, 1971; Oleszek*et al*, 1994). Saponins also have haemolytic activity against RBC (Khalil and Eladawy, 1994). Saponin-protein complex formation can reduce protein digestibility (Potter *et aL*, 1993; Shimoyamada*et al*, 1998). Oxalate binds with calcium to form calcium-oxalate crystals which are deposited as urinary calcium (stones) that are associated with blockage of renal tubules (Blood and Radostit, 1989). Trypsin inhibitor inhibits trypsin and chymotrypsin, which play a role in digestion of protein. Trypsin also causes pancreatic enlargement and growth depression (Aletor and Fetuga, 1987). Hydrogen cyanide is toxic when ingested by monogastric animals (including poultry) in large quantity. The toxic effects of anti-nutrients could be reduced by proper food processing such as soaking or boiling of plant materials in water (Akinyeye*et al*, 2011; Enechiand Odunwodu, 2003). It also improves utilization in terms of feed intake and protein digestibility (OkairfuL, 1995; Dei *etal*, 2007).

Proximate Composition of *Moringaoleifera*Leaves and Gum Arabic

Table 2 showed the proximate (nutrients) composition of *Moringa*leaves and Gum Arabic. The results showed that Moringa leaves contained appreciable amounts of crude protein (17.01% ±0.1), carbohydrate (63.11% ±0.09) and energy (1440.11kcal/kg). The leaves also contained significant amounts of crude fat (2.11% ±0.11) and fatty acid (1.69% ±0.09). The presence of significant level of ash content showed that it contained valuable amount of minerals. Gum Arabic also contained significant amounts of crude protein (1538% ±0.3), carbohydrate (62.26% ±0.50), ash (9.05% ±0.11), crude fat (1.83% ±0.06) and fatty acid (1.46% ±0.05) with a slightly lower energy level (1387.59 ±0.11) when compared to *Moringa*leaves. A higher crude protein value (30.65%) was reported in Moringa*oleifira*leaves by Mutayoba et al. (2011). OlugbemietaL (2010) also reported a higher crude protein (27.44%) value in Moringa leaves. The crude fibre, fat and ash contents reported by them were also slightly higher than the values obtained in this study. These differences may be due to variations in the geographical locations of the growth and development or stage of maturity of the plants. In this study, the dry mattet (DM) Afalue of leaves was higher (96.79%) than the value reported by Olugbemi*et al* (2010) and Mutayoba*et al* (2011). They reported DM values of 93.7% and 87.20%, respectively. The presence of these important nutrients implies these plant products could be used as a nutritionally valuable and healthy ingredient to improve growth performance and health of poultry.

Table 3 showed that Moringa*oleifera*leaves and gum arabic contained appreciable amounts of essential minerals. These minerals in Moringa leaves (magnesium - 0.38% ±0.01, potassium - 0.97% ±0.01 (ppm), sodium - 192.95 ±4.5 (ppm), iron - 107.48 ±8.8 (ppm), zinc - 60.06 ±0.3 (ppm), manganese - 81.65 ±2.31 ppm) and those of gum arabic (magnesium « 0.42% ±0.01, potassium - 1.30% ±0.04, sodium - 259.85 ±1.78 (ppm), iron - 98.42 ±1.55 (ppm), zinc - 47.77 ±1.06 (ppm) and manganese " 58.83 ±0.54 ppm) were significant ($P<0.05$). Mutayoba*et al.* (2011) also reported higher values of iron (318.81), potassium (1.63%) and magnesium (1.03%). In this study, the values of magnesium, potassium, sodium, iron, zinc and manganese were significantly^ different ($P<0.05$). These differences may be due to the variations in the locality of growth and the stage of maturity of the plants. The presence of these essential nutrients also implies that these plants (products) could be utilized as nutritionally valuable and healthy ingredients for poultry.

Minerals are required for normal growth, activities of muscles and skeletal development (such as calcium), cellular activity and oxygen transport (copper and iron), chemical reaction in the body and mte^tinal ^absorption (magnesium)7 fluid balance and nerve transmission (sodium and potassium), as well as the regulation of acid-base balance (phosphorus). Iron is useful in prevention of anemia and other related diseases (Oluyemi*et al*, 2006). Manganese plays a role in energy production and in supporting the immune system (Muhammad *et al*, 2011). It also works with vitamin K to support blood clotting, and with B complex vitamins to control the effects of stress (Muhammad *et al*, 2011). Zinc is useful for protein synthesis, normal body development and recovery from illness (Muhammad ef*al*, 2011). Deficiency of these nutrients and minerals are known to affect the performance and-health of poultry (Merck, 2005).

Table 1: Phytochemical composition and anti-nutrients of *Moringaoleifera*leaves and Gum Arabic from Nasarawa State, Nigeria

Phytochemical/anti-nutrients	Mean values (% ±SD) *Moringaoleifera*	Gum Arabic	LOS
Phytates	2.59±0.13[a]0.	2.05±0.12[b]	*
Oxalates	45± O.01[b]	0.71 ± 0.16[b]	*
Saponins	1.60 ±0.05[a]	1.47±0.23[b]	*
Tannins	21.19± 0.25[a]	15.15 ± 0.24[b]	*
Trypsin inhibitors	3.00± 0.04[a]	2.01±0.10[b]	*
Hydrogen cyanide (HCN)	0.10 ±0.01	0.06 ± 0.01	NS

Data are mean values ± standard deviation (SD) of duplicate results; mean values bearing different superscript (a, b) on the same row differ significantly (P<0.05); NS • no significant difference (P>0.05); LOS - level of significance; asterisk* •» means significant difference (P<0.05).

Table 2 Proximate composition *of Moringaoleifera*leaves and Gum Arabic from Nasarawa State, Nigeria

Nutrients analyzed (% DW)	Mean composition (% ± SD) *Moringaoleifera*	Gum Arabic	LOS
Crude Protein (CP)	17.01 ±0.10*	15.38 ± 0.30[b]	*
Crude Fibre (CF)	7.09 ± 0.11	7.41 ± 0.12	NS
Crude Fat (lipid)	2.11 ± 0.11*	1.83 ± 0.06[b]9.05	
Ash Content	7.93±0.12[b]	± 0.11*	
Moisture	3.21 ± 0.10*	3.00±0.04[b]	*
Nitrogen (N)	2.83 ± 0.16	2.55 ±0.20	NS
Carbohydrate (CHO)	63.11 ±0.09	62.26 ±0.50	NS
Fatty acid	1.69 ± 0.09*	1.46±0.05[b]	*
Dry Matter (DM)	%.79±0.10	97.00 ± 0.04	NS
Energy value (Kcal/100kg)	1440.11 ±0.30*	1387.59 ±0.90[b]	

Data are mean values ± standard deviation (SD) of duplicate results; mean values bearing different superscript (a, b) on the same row differ significantly (P<0.05); NS » no significant difference (P>0.05); LOS <level of significance; asterisk* = means significant difference (P<0.05).

Table 3 Mineral composition *of Moringaoleifera* and Gum Arabic from Nasarawa State, Nigeria

Element*	Mean composition (±SD)	*Moringaoleifera* Gum Arabic	LOS
Calcium (%)	1.91 ±0.08	2.10±10.13	NS
Magnesium (%)	0.38±0.01[b]	0.42±10.10* ,	*
Potassium (%)	0.97±0.01[b]	1.30±10.04*	*
Sodium (ppm)	192.95±4.48[b]	259.85±11.78*	*
Iron(ppm)	107.48±18.81*	98.42 ±11.55[b]	*
Zinc (ppm)	60.06 ±0.30*	47.77 11.06[b]	*
Phosphorus (ppm)	30.15±10.47	30.11±10.20	NS
Manganese (ppm)	81.65±12.31*	58.83± 10.54[b]	*
Copper (ppm)	6.10±10.19	5.941±0.30	NS

Data are mean 1 standard deviation (SD) of duplicate results; mean values bearing different superscript (a, b) on the same row differ significantly (P<0.05); NS - no significant difference (PX).05); LOS • level of significance; asterisk* • means significant difference (P<0.05); ppm - parts per million (1mg/kg =Ippm).

Table 4 Group weekly mean feed intake (kg/bird) of broiler chickens administered aqueous extracts from *Moringaoleifera* leaves and Gum Arabic in comparison with antibiotic

		Group mean (±SD) feed intake (kg/bird)			
Parameters		A	B	C	LOS
Age (week)					
Initial feed intake	1	0.34±0.04	0.34±0.01	0.34±0.01	NS
Feed intake at 5% w/v	2	0.35±0.01	035±0.03	0.35±0.03	NS
Feed intake at 10% w/v	4	0.56±0.06	0.58±0.02	0.58±0.01	NS
Feed intake at 20% w/v	6	1.11±0.01	1.11±0.04	1.16±0.03	NS
Final feed intake	8	1.10±0.02	1.00±0.02	1.05±0.03	NS
Total feed intake	1-8	5.84±0.03	5.81±0.02	5.95±0.02	NS

Data are mean * standard deviation (SD) of duplicate results; Group A - represented broilers administered with aqueous *Moringa* leaf extract, B - Gum Arabic extract, C - antibiotic only; NS - no significant difference (PXJ.05); LOS - level of significance.

Table 5 Group weekly mean weight gain (kg/bird) of broilers administered aqueous extract of *Moringao*/«(/Vrw leaves and Gum Arabic in comparison with antibiotic

Parameters Age (week)		Group mean	(*SD) weight gain	(kg/bird)	
			B	C	LOS
Initial mean weight (kg/bird)	1	0.16±0.01	0.16±0.01	0.15±0,02	NS
Mean weight at 5% extract	2	0.41±0.01	0.43±0.02	0.44±0.01	NS
Mean weight at 1 0% extract	4	1.02±0.08*	1.09±0.05	1.08±0.04	*
Mean weight at 20% extract	6	1.50±0.06*	1.60±0.03	1.60±0.06	*
Mean final weight (kg/bird)	8	2.31±0.02	2.40±0.04	2.44±0.04	NS
Mean weight gain (kg/bird)	1-8	2.15±0.01	2.23±0.04	2.29*0.04	NS
Dressed (carcass) weight (kg/bird)		1.88*	1.94	1.94	*
Feed to gain ratio		2.7	2.6	2.6	NS

Data are *mum* * Maadarddrrtauoa (SO) of d.pltcaUrwulta; Gnu| i A • repraaMaai raflanadnt^« tared with •::/
•qoMwt*Mortog leaf extract, B • Gum Arabk extract, *C* • antibiotic only; NS • ao**
• level el dgatflcaacetaatartak* - HC*M atfaiflcaatdifTerwnce (P<OJW).

Table« Mean (*SD) luematologlcaiparaaaeten of broilers administered *olttftn*and Gum Arabk in oompwriaoa with antibiotic

Group	Haematotogkalpanunete rs	At 5% trMtment	At 10% treatment	At 20% treatment	LOS
		Week 2	Week 4	Week *6*	
A	PCV	4230±4.00	44.30±2.30	40.00±0.50	NS
	Hb	14.10±1.00	14.60±2.80	12,70±0.0	NS
	RBC	4.20±0.20	3.80±1;20	3.50±0.60.	NS
	WBC	630±0.40	5.40±0.10	6.90±0.20	NS.:
B	PCV	49.50±0.0	46.50±0.50	43.30±3^0	NS '
	Hb	16JO±0.10	15.40±0,40	13,60±0.50	NS
	RBC	4.90±0,50	3.60±0.10	4.40±0.60	NS
	WBC	5.80±1.10	6.50±1.50	5,90±0.80	NS
C	PCV	49.50±2.00 '	50.30±6,20	42.50±0.40	NS
	Hb	16.70±0.40	16.60±2.00	15.20±1.30	NS
	RBC	5.20±0.10	5.60±0.40	4.90±0.60	NS
	WBC	5.30±0.05	5.60±0.60	6.80±0.50	NS

Date are mean * standard deviation (SD) of duplicate **results; Group A•« represented broilers administered aqueous *Moringa*leaf extract, B « Gum Arabk**extract, D = antibiotic **only; NS * no significant difference (P>0.05); LOS * level of significance.**

Feed Intake and Growth Performance of Broiler Chickens

The results of oral administration of different levels of aqueous extracts from *Moringa*leaves and Gum Arabic on feed intake and growth performance (weight gain) of broiler chickens are presented on Table 4 and 5. The feed intake of the broilers in all the groups was not significantly affected (P>0.05) when they were administered with the different levels of the aqueous extracts. However, the total feed intake of broilers in group A (5.84kg/bird) and B (5.81 kg/bird) were slightly lower than antibiotic treated group C (5.95 kg/bird). This slight decline in feed intake may possibly be due to the presence of high anti-nutrients (tannins) in Moringa leaves and Gum Arabic (Table 1), High dietary tannins were reported to depress the digestibility of feed by affecting (or suppressing) the activity of the enzymes involved in carbohydrate and protein breakdown (Nsahlai*et al,* 2011). Generally in this study, the broiler chickens that were administered with *Moringa*leaves and Gum Arabic compared favourably well with those given antibiotic in terms of feed intake.

Table 5 showed the mean weight gain of the broilers in group A and B were significantly affected (P<0.05) when they were administered with high concentration of aqueous extract (10 and 20% w/v). This also significantly affected the dressed (carcass) weight of the birds (PO.05). The high feed to gain ratio in group A (2.7) means that the birds were - depressed. Tannins (in excess) have ability to form complexes with metal ions (minerals) and this can reduce feed intake and weight gain (Dei *et al.*, 2007; Armstrong *et al,,* 1974). High levels of saponninsand phytates can also reduce feed intake due to reduction of protein digestibility and bioavailability of minerals (Shimoyamada*et al.*, 1998; Thompson, 1993). This study has shown that high concentration of aqueous extract of Moringaleaves and Gum Arabic can reduce (depress) feed intake and weight gain of broilers. Adequate processing of these plant products may be required to reduce anti-nutrients that may be present in them for their effective utilization in broilers.

Generally, the carcass and organ weights and the haematological parameters of the broilers in all the groups did not show any appreciable variations. All the haematological parameters examined were within the normal range values (Table 6). Fluctuations in haematological parameters of broilers were earlier reported to be a normal phenomenon (OgbeetaZ., 2003;OgbeetaZ., 2010).

CONCLUSION

In conclusion, the result of this study showed that Moringa*oleifera*leaves and Gum Arabic contained appreciable amounts of carbohydrate, protein and minerals, which are nutritional requirements of poultry. These plants products could be utilized as a potential source of feed supplement and as medicine in poultry to promote health and growth performance. The benefits of Morings leaves and Gum Arabic in broilers compared favourably well with the antibiotic that was used in this study. The anti-nutritional factors present in these plant products could be reduced through adequate processing by boiling in hot water during aqueous extraction. It was recommended that the proximate and phytochemical analysis of Moringa*oleifera*seeds and their utilization (experimental trials) in chickens should be conducted.

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11

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