ADAN J. Agric. 2023, 4: 106-118 **DOI:10.36108/adanja/3202.40.0111**

ISSN 2736-0385

Growth performance, nutrient digestibility and health status of broilers fed varied levels of *Xylopia Aethiopica* phytoadditive.

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Abstract

Phytoadditives have gained potential role as one of the alternatives to antibiotics in animal nutrition since it has been confirmed to have no residual effect on the animal tissue and this study was therefore conducted to investigate the effect of inclusion levels of Xylopia aethiopica (Negro pepper) as a replacement of antibiotics on growth performance, blood profile, nutrient digestibility and organs response of boiler chickens. Two hundred and forty (240) day old chicks were randomly divided into five treatments of 48 birds each and housed in 4 replicates of 12 birds each. This experiment lasted for a period of 8 weeks and birds were placed on the same feed ad libitum except the inclusion of test ingredient in treatments 2-5. Diet without Xylopia aethiopica served as the control (T1). Diets in T2 to T5 were supplemented with 10g, 20g, 30, 40g of Xylopia aethiopica per kg feed. The experiment was laid out in a completely randomized design. All data obtained were subjected to analysis of variance using SPSS version 21 and significant means were separated using Duncan's Multiple Range Test of the same software. The response of the broilers to dietary treatment were measured by feed intake, final weight, FCR, Cost/kg Weight gain, blood profile, organ responses and nutrient digestibility. There were significant differences (P<0.05) across the treatment in growth parameters except total feed intake and daily feed intake. The final live weight of broilers fed 10g of Xylopia aethiopica per kg feed (T2) was the highest (1858.50g/bird) while those fed 40g of Xylopia aethiopica per kg feed (T5) had the least (1411.33g/bird). This result suggested limit to the inclusion levels of the Xylopia aethiopica in the diet of broiler chickens. Addition of Negro pepper reduced the cost of per kg weight gain. Dietary treatment significantly (P<0.05) increased serum aspartate transaminase, alanine transaminase, globulin, cholesterol, but significantly reduced alkaline phosphatase. The nutrient digestibility of broiler chickens fed varied level of Xylopia aethiopica were significantly affected (P<0.05) in all parameters across the treatments and the broiler on treated groups had better nutrient digestibility. Relative organ weight of broiler chickens fed varied levels of Xylopia aethiopica were not significantly affected (P>0.05) across the treatments. It is recommended that supplementation of 10g of Negro pepper should be added to broiler diet for improved body weight gain.

Keywords: *Xylopia aethiopica, Phytoadditives, Haematology parameters, Serum chemistry*

Introduction

Poultry industry is the major source of edible and reliable meat for the populace and poultry production can be subdivided into three distinct parts namely small, medium and large scale. These are also otherwise known as backyard, semi-commercial and commercial (Ricke, *et al*. (2017), Rimi, *et al*.

(2017)). Hardly would there be any community without poultry birds either local breed or exotic breed. This singular reason establishes the important of poultry in our community. There are many reasons why broiler production is essential among the poultry birds such as high demand of broiler throughout the world, this is one of the essential qualities of broiler chickens. Broiler meat provides consumer with nutritious food, due to their freshness and nutrients, the global market would prefer poultry products that are free from any residual effect that may be hazardous to the consumer and studies have shown how meat is a crucial source of dietary nutrients for the general public. Secondly, high level of production and efficient feed conversion are the need of modern broiler industry which to a certain extent can be achieved by the use of some specific addictive as growth promoters. These additives stabilize the microflora and improve the health status and general performance of the animals (Windisch *et al., 2008*).

Antibiotics have been used as growth promoting substances in poultry nutrition since time immemorial. However, using an antibiotic as feed addictive is viewed as risky by some countries therefore use of antibiotics is restricted in many parts of the world. Although, about 80% of livestock raised, especially chickens were fed some kind of antibiotics or growth promoters irrespective of the awareness of the residual effect because there is no available effective alternative. For this reason several attempt have been made to resolve this and one of the approaches is the use of herb and spices. Herbs were fed as nontraditional feed addictive to replace antibiotics (Lee *et al.*, 2004). The usage of this nonconventional feed additives such as ginger, garlic, negro pepper were as a result of the positive effect of bioactive substances present in these herbs and spices. The natural antibiotics alternatives including (probiotics, prebiotics, symbiotics, organic acids, essential oils, enzymes, immunostimulants and phytogenic (phytobiotic) including (herbs, botanicals, essential oils, and oleoresins) are the most common feed additives that acquire popularity in poultry industry following the ban of antibiotic growth promoters (AGPs) (Mohamed *et al*., 2022). They are commonly used worldwide because of their unique properties and positive impact on poultry production. They can be easily mixed with other feed ingredients, have no tissue residues, improve feed intake, feed gain, feed conversion rate, improve bird immunity, improve digestion, increase nutrients availability as well as absorbability, have antimicrobial effects, do not affect carcass characters, decrease the usage of antibiotics, acts as antioxidants, anti-inflammatory, compete for stress factors and provide healthy organic products (Mohamed *et al*., 2022). Common examples are ginger, garlic, Negro pepper (*Xylopia aethiopica*) etc.

Antimicrobial activity of essential oils of *Xylopia aethiopica* investigated by Fleischer, *et al*. (2008) showed that the fresh and dried fruits, leaf, stem bark and root bark essential oils in *Xylopia aethiopica* produced various degrees of activity against the gram positive bacteria (*Bacillus subtilis* and *Staphylococcus aureus*), the gram negative bacteria (*Pseudomonas aeruginosa*) and the yeast-like fungus (*Candida albicans*), using the cup plate method. *Xylopia aethiopica* is an evergreen aromatic tree growing up to 20m high and belonging to the order Magnoliales and family Annonaceae. *Xylopia aethiopica* is native to the low land forests and moist fringe forests in the Savanna zones of Africa. The dried fruits of *Xylopia aethiopica* (Negro pepper) are used as a spice and an herbal medicine. For many years medicinal plants like *Xylopia aethiopica* have been used as pharmaceuticals in natural therapy. Negro pepper has been confirmed to have antimicrobial, anti-inflammatory and antioxidant properties and so can be used in the treatment of arthritis, rheumatism and other inflammatory conditions. However, limited studies have been conducted to investigate the effects of these plants as feed additives in broiler chickens.

Xylopia aethiopica has various influence on some haematological and biochemical profiles. According to the study of Nnodim, *et al.* (2011), different concentrations (100, 150, and 200 mg/body weight) of *Xylopia aethiopica* fruit extract were given to Wistar rats for 14 days. The control group received distilled water. It was discovered that the increase in haematological parameters was dose dependent. Haemoglobin concentration, packed cell volume, red blood cell count, and platelet were significantly ($P<0.05$) increased when compared with the control. Serum cholesterol, triglyceride and low-density lipoprotein (LDL) was significantly ($P<0.05$) decreased when compared with the control. Also, serum potassium and sodium were increased ($P<0.05$) when compared with the control. The findings justified the folklore claim of *Xylopia aethiopica* in arresting bleeding among women that put to bed as well as treating cardiovascular and diabetic diseases. Nnodim *et al* (2011) also suggested that the plant may be a good agent in the maintenance of electrolyte balance. We hypothesized that Negro pepper could be used as growth promoting agent on the performance and improve health status of broilers. Therefore, due to the phyto-nutrient properties of *Xylopia aethiopica* this study was designed to investigate the effect of Negro pepper (*Xylopia aethiopica*) on broiler chickens' growth performance, blood profile, nutrient digestibility and organ characteristics.

Material and Methods

Site of the Experiment:

The research was carried out at the Poultry Unit, Ladoke Akintola University of Technology (LAUTECH) Teaching and Research Farm, Ogbomoso, it lies on $8^{0}10^{1}$ North of the equator and longitude $4^{0}10^{1}$ East of the Greenwich Meridian within the Derived Savannah region of Nigeria. The altitude is between 300m and 600m above sea level while the mean temperature and rainfall are 27°C and 1247mm respectively (Ayinla and Odetoye, 2015).

Preparation of Test Ingredients: Negro pepper ('Eru' in Yoruba language, *Xylopia aethopica*) was gotten from a local market in Ogbomoso, Oyo state, Nigeria. It was sun-dried until it becomes crispy, ground and was kept in a container for subsequent use.

Experimental Birds and Management: A total of two hundred and forty (240) day old chicks were used for this experiment. The day-old chicks were obtained from a reputable hatchery. The birds were divided randomly into five treatments of 48 birds each and housed in 4 replicates of 12 birds each. The experiment lasted for a period of 8 weeks which was split into starter and finisher phases and the birds were placed on similar feed *ad libitum.* T1 was the control group which had no inclusion of *Xylopia aethiopica* in the diet. Diets in T2-T5 were given 10g, 20g, 30g, 40g of *Xylopia aethiopica* as feed additives, respectively in 1000g diet.

Data Collection

Growth parameters: The chicks were weighed on the day of arrival and at the end of each week regularly to estimate weekly body weight gain. Daily and Weekly feed intake were recorded. Total live weight gain was recorded at the end of the feeding trial. Data recorded for weight gain and feed intake were used to calculate the feed conversion ratio (FCR).

Haematological Indices

At week 8, three birds per replicate were bled for blood collection into two different carefully labeled bottles for haematological and serum biochemistry investigation. The blood samples for haematological parameters analyses were collected into EDTA bottle, while blood samples for serum biochemical indices were collected into plain bottles. These samples were spurned in the centrifuge at 3,000 rpm and the clearer portion decanted (after centrifugation) into small sample tubes stored in a freezer (-4^{0}C) and used for the serum biochemical assessments. The haematological indices examined include Red Blood count (RBC), white blood cell (WBC), packed cell volume (PCV), Leucocytes differential count (monocyte, lymphocyte, eosinophil etc.) and haemoglobin concentration (Hb). The packed cell volume (PCV) was determined by spinning about 75µl of each blood sample in heparinized capillary tube in a haematocrit centrifuge for about 5 minutes and read on haematocrit reader (Himel and Deepa, 2020). Erythrocyte and Leucocytes counts were determined using nebular chamber method as described by Lamb (1981).

Nutrient digestibility: At the end of feeding trial, digestibility trial was conducted using two birds from each replicate. The birds were fed the same experimental diet used in the feeding trial. The trial lasted for 7 days with total faecal collection from each bird for 3 days. Total faecal output from each bird was recorded daily and was oven-dried at 80 degrees centigrade until constant weight was obtained (for dry matter determination). Samples of experimental diets and collected faeces were sent to the standard laboratory for proximate analysis according to the method of AOAC (2000).

Organ Characteristics: Also, at the end of the 8th week, two birds from each replicate were randomly selected and sacrificed. The birds starved over night before slaughtering. They were weighed with a sensitive scale and were tagged to distinguish them. The birds were then restrained to severe the jugular veins and carotid arteries with a sharp knife and were allowed to bleed. The liver, spleen, kidney, pancreas, heart and lungs were then removed to obtain the organs, and each was weighed.

Statistical Analysis

All data collected were subjected to analysis of variance (ANOVA) using SPSS Version 21, where significant differences were indicated, Duncan's Multiple Range Test of the same software was used to separate the means.

Results and Discussion

Growth performance of broiler chickens fed varied levels of *Xylopia aethiopica* feed additive

Final weight gain (FWG) was significantly ($P<0.05$) different with broilers fed 1% *Xylopia aethiopica* (T2) having the highest FWG (1,858.50g) and T5 having the lowest (1,411.33g) as shown in Table 1. Average total feed intake (ATFI), and Total cost of feed intake (TCFI) were not significantly ($P>0.05$) affected. Negro pepper exhibited growth promoting activities particularly at finisher phase when fed at 1%. Young chicks lack the full capacity to utilize feed effectively because their gastrointestinal tract is not well developed and endogenous secretions such as gastric juice components (e.g. hydrochloric acid) and mucus are inadequate. The gastrointestinal tract needs a booster to enhance the capacity to secrete vital substances for effective utilization of nutrients. The Negro pepper could have assisted in this regard as spices have reported to aid endogenous secretions (Ezekwesili *et al*., 2010). The outcome of this study indicated that as the level of the spice was increased, average daily intake and feed conversion ratio were affected clearly showed that the Negro pepper had inclusion limit which when exceeded could be detrimental to broiler birds. Lee *et al*., (2004) has earlier reported that the essential oils contained in Negro pepper reduced growth of broilers at higher level of inclusion. However, Al-Kassie *et al*., (2011) reported that Negro pepper improved both feed intake and growth of broiler chickens. Natural feed additives such as herbs, spices and prebiotics are known to positively affect feed intake at certain levels and also improve their health status. The result agrees with Isikwenu and Udomah (2015) which reported improvements in the feed intake of broilers fed *Xylopia aethiopica.* Solomon *et al*. (2022) recorded no significant different between the treated group when *Xylopia aethiopica* was used as feed additive Also, variation in feed conversion ratio (FCR) shows there was significant (P<0.05) effect with T2 having the best value (1.99) and T1 having the worst value (2.44). It means with this result that the broiler chickens ate smaller quantity of feed to gain one kilogram compared to control group. Reduction in FCR we help to reduce the cost of feed and increase the profit margin. Obodo *et al*., (2013) has established that *Xylopia aethiopica* can influence body weight gain and growth performance. The health of the animal was not compromised during the research and this might have direct influence on the growth of the animal, as a result of many bioactive compounds in the *Xylopia aethiopica* additive. Plants and derivatives of plants have long been identified to play a key role in health and have long been known to possess biological activities (Abass, 2012). Also, the World Health Organization (WHO) estimates that almost 75% of the world's population has therapeutic experience herbal remedies principally because of a belief that herbal remedies may have fewer side effects and can enhance the effects of conventional agents (Liu *et al.*, 2007; Desai *et al.*, 2009). Although the work of Muhammad *et al*. (2016) concluded that higher level of *Xylopia aethiopica* in the diets of Uda rams more than 2.5 g/kg might significantly reduce performance of sheep. Therefore, there is need for caution when *Xylopia aethiopica* is to be used.

Table 1: Growth performance of broiler chickens fed varied levels of *Xylopia aethiopica* additive

Parameters	T1	T2	T3	T4	T5	SEM
IWG(g)	37.47	37.13	37.57	37.57	37.20	
ATFI(g)	3740.82	3654.68	3752.45	3607.38	3315.55	64.60
ADFI(g)	63.99^{ab}	65.26^{ab}	67.01^{a}	66.43^{a}	59.85^{b}	62.50
TCFI(₦)	965.05	942.91	968.13	930.71	864.70	16.66
FWG(g)	1540.50^{b}	1858.50^{a}	1762.00^{a}	1514.50^{b}	1411.33^{b}	43.16
TWG(g)	1503.03^{b}	1821.40^{a}	1724.43^{a}	1476.93^{b}	1374.13^{b}	43.13
FCR	2.44^{a}	1.99^{b}	2.14^{ab}	2.42^{a}	2.40^{a}	0.06
Cost/Kg/WG (₦)	629.25^{a}	513.57^{b}	552.30^{a}	623.43^{a}	618.56^{b}	16.18

^{abc} Means on the same row followed by different superscripts are significantly different ($p < 0.05$); SEM = Standard Error of Mean. IWG = initial weight gain, ATFI = Average total feed intake, TCFI = Total cost for feed intake, FWG = Final weight gain, TWG = Total weight gain, FCR = Feed conversion ratio, ADFI = average daily intake. T1 = control, T2 = 1% of *Xylopia aethiopica*, T3 = 2% of *Xylopia aethiopica, T4* = 3% of *Xylopia aethiopica, T5* = 4% of *Xylopia aethiopica*

Nutrient digestibility of broiler chickens fed varied levels of *Xylopia aethiopica* is shown in Table 2. The increasing level of *Xylopia* in the diet from 1% to 4% led to decreases in CP, CF, EE, DM, and NFE digestibility, with the lowest values recorded at either 3% or 4% *Xylopia* levels. In contrast, ash digestibility increased under the bird fed different levels of Xylopia compared to control group, with the highest ash digestibility observed at 2% *Xylopia* level. These findings are consistent with previous studies that have investigated the effect of spices on nutrient digestibility in broiler chickens. Akande *et al*. (2015) reported decreases in CP, CF, and EE digestibilities in broiler chickens fed diets containing ginger and garlic. Similarly, Al-Mufarrej and Ahsan (2004) observed a decrease in CP and CF digestibility in broiler chickens fed diets containing black pepper as an additive. The decrease in nutrient digestibility observed in this study may be attributed to the anti-nutritional factors present in *Xylopia*. *Xylopia* contains tannins, which can bind to dietary protein and reduce its digestibility (Aletor *et al*., 2010). In addition, *Xylopia* also contains saponins, which can form complexes with cholesterol and other lipids, thereby reducing their digestibility (Oboh and Rocha, 2008).

Animals on 1% Xylopia had higher nutrient digestibility for all measured parameters compared to control, except crude fibre digestibility. This might be an indication that higher level effect of *Xylopia aethiopica* had depressing effect on nutrient digestibility. The improved nutrient digestibility in broilers fed 1% Xylopia supported the earlier findings. According to Muhammad *et al.* (2016), *Xylopia aethiopica* with growth promoting activity increase stability of feed and beneficially influence gastrointestinal ecosystem mostly through growth inhibition of pathogenic microorganisms, thus consequently helps to increase the animal's resistance to stress and increase the absorption of essential nutrients.

Table 2: Nutrient digestibility of broiler chickens fed varied level of *Xylopia aethiopica* additive

Parameters	T1	T2	T3	T4	T5	SEM
CP	73.33^{ab}	76.10^{ab}	71.39^{b}	71.15^{b}	72.17^{b}	1.46
CF	65.93^{a}	51.70^{b}	45.47^{b}	30.60^{c}	49.86b	2.91
EE	52.09^{b}	68.76^{a}	67.75^{a}	61.20^{ab}	63.39^{ab}	2.05
Ash	56.71^{b}	56.83^{b}	65.34^{a}	64.55^{c}	57.52^{b}	1.37
DM	74.19^{ab}	76.99^{a}	70.55^{bc}	58.65^{d}	66.87^{c}	1.43
NFE	75.11^{ab}	79.72^{a}	70.86^{ab}	66.90^{b}	76.67^{a}	1.51

^{abc} means on the same row followed by different superscript are significantly different ($p<0.05$); SEM = means standard error of mean, CP- Crude protein, CF-Crude fibre, EE-Ether extract, DM-Dry matter and NFE-Nitrogen free extract. T1 = control, T2 = 1% of *Xylopia aethiopica* , T3 = 2% of *Xylopia aethiopica* ,T4 = 3% of *Xylopia aethiopica* ,T5 = 4% of *Xylopia aethiopica*

Haematological characteristics of broiler chickens fed varied level of *Xylopia aethiopica* additive

Blood parameters are needed to determine whether changes in the blood system of broiler are part of the thermoregulatory responses acquired by birds to enable them to withstand large fluctuations in the body system or otherwise. Table 3 shows that there was significant increase ($P < 0.05$) in the PCV, Lymphocyte, Basophil, Platelet, RBC and MCV particularly for broilers fed 1% xylopia. Mitruka and Rawnsley (1977) stated that the number of erythrocytes (RBC) in chickens is influenced by the conditions of the animal. The increase in PCV, HB, and RBC contents of the blood of birds fed the test ingredients is an indication of improved oxygen carrying capacity of the cells which translated to a better availability of nutrients to the birds consequently affecting their well-being. This implies that Negro pepper could be potentially useful in improving blood circulation on account of its inhibitory effects on platelet aggregation (Muhammed and Lakshmi, 2007). Lawson observed similar inhibitory effect *et al.* (1992). Platelets observed in the present study were higher than the normal range 60.4×10^6mm^3 as reported by Mitruka and Rawnsley (1977). Except treatment 4, other treatments had similar platelet count, platelets are colourless blood cells that assist in blood clothing by forming plugs in the blood vessel holes (Swati, 2016). Having it similar across the treatments proved the xylopia effect in supporting platelet production in broiler chickens. According to Swati (2016) viral infection or imbalance in the immune system are the major causes of sub-normal platelet count. Similar response proved that the xylopia and the level used did not affect the platelet function of broiler chickens. It has also been reported that low mean corpuscular haemoglobin concentration (MCHC) value less than 29.0 g/dl can be attributed to iron and other trace element deficiency reported by Howlett, (2000). In the present study however, all the xylopia treatment groups had MCHC value of higher than 29.00g/dl, although not within the recommended ranges of 24.00g/dl – 31.00g/dl (Simaraks *et al.*, 2004), in which the cause of variation could be as a result the feedstuff having more iron and trace element. Based on the available literature about the vitamin and mineral content of the test ingredients, it can be inferred that the additives improved the availability and utilization of essential trace elements such as copper, zinc, iodine and selenium. Lymphocytes response was numerically similar except treatment four, this establishes the fact that the animal on each treatment responded equally to both conventional antibiotic and phytobiotic (Xylopia). The percentage was in accordance with the literature opined lymphocytes to be the largest among other white blood cell count, may be as a result of their function to create antibodies to fight against bacteria, viruses, and other potentially harmful invaders in the body of animals. Lymphocytes play a fundamental role in the immune system due to their influence on immune response to infectious microorganisms and other foreign invader (Kondo, 2010). Packed cell volume also called hematocrit is the proportion of whole blood occupied by red cells, expressed as a ratio or as a percentage, fluctuation may be as a result of thermoregulatory ability of individual bird and may not have to do with the treatment effect since the result shows similarity between the control and the treatment 5 with the highest inclusion level. For example, Yahav *et al*. (1997) observed low PCV when the environmental temperature was high and high PCV when environmental temperature was low. PCV is one of the simplest, most accurate and most valuable of all haematological investigations, it is of greater reliability and usefulness than the red cell count (Yared *et al*., 2006).

Table 3: Haematological characteristics of broiler chickens fed varied levels of *Xylopia aethiopica* additive

Parameters	T1	T2	T3	T4	T5	SEM
Platelet ($x10^6/\mu L$)	177.00^a	182.00^a	178.50^a	160.50^b	223.00^a	2.86
Packed cell volume (%)	32.50^a	32.50^a	28.00^b	27.00^b	32.00^a	0.70
Red blood cell ($x10^6/\mu L$)	3.55^a	3.55^a	3.05^b	2.95^b	3.55^a	0.08
Hemoglobin (g/dl)	10.80^a	10.85^a	9.38^b	8.95^b	10.75^a	0.23
MCH (g/dl)	30.40	30.55	30.60	30.35	30.34	0.83
MCV (fL)	91.54^a	91.51^a	91.84^a	91.61^a	90.19^b	0.16
MCHC (%)	33.24	33.41	33.34	33.15	33.64	0.07
WBC($x10^3/\mu L$)	325.00^a	173.00^b	237.00^b	285.00^{ab}	241.00^{ab}	11.78
Lymphocyte (%)	73.50^b	76.00^{ab}	75.00^{ab}	76.50^a	76.00^{ab}	0.43
Eosinophil (%)	3.50^c	2.50^{ab}	3.00^{ac}	2.00^b	2.00^b	0.17
Monocyte (%)	1.50	1.50	1.50	1.50	1.50	0.09
Basophil (%)	1.50^a	1.50^a	1.00^{ab}	1.00^{ab}	0.50^b	0.10
Heterophils (%)	20.00	18.50	20.00	19.00	20.00	0.29

^{abc}Means on the same row followed by different superscripts are significantly different ($p < 0.05$), SEM – Standard Error of Mean, T1 = control, T2 = 1% of *Xylopia aethiopica* , T3 = 2% of *Xylopia aethiopica* ,T4 = 3% of *Xylopia aethiopica* ,T5 = 4% of *Xylopia aethiopica*, WBC= White blood cell, MCH= mean corpuscular haemoglobin, MCV= mean corpuscular volume, MCHC= mean corpuscular haemoglobin concentration

Serum Biochemistry of broiler chickens fed varied levels of *Xylopia aethiopica* additive

All parameters measured were significantly affected (P<0.05) across treatment except albumin, urea and creatinine. The level of ALP in the blood of experimental animal significantly increases (P<0.05) as Negro pepper increased except T2 (10g/1000g of feed) which has a slightly reduced value. The levels of ALP were higher than the recommendation of Mitruka and Rawslay (1977), although comparing with the control it might be as a result of availability of zinc and magnesium (Obiloma *et al*., 2020) in the *Xylopia aethiopica* which are major coenzyme in the formation of ALP. According to Lowe *et al*. (2024) alkaline phosphatases (ALP) are a group of isoenzymes located on the outer layer of the cell membrane, the enzyme catalyzes the hydrolysis of organic phosphate esters found in the extracellular space and zinc together with magnesium are essential cofactors of this enzyme. Aspartate transaminase and ALT were both significant (P<0.05) with T2 (10g/1000g of feed) and T5 (40g/1000g) having the highest value respectively although were within the recommended values. Cholesterol was significantly different (P<0.05) across the treatments and treatments T3 and T5 (150.50g/dL, 144.25g/dL, respectively) recorded significantly higher values. Control, treatments 2 (10g/1000g) and 3 (20g/1000g) recorded significantly (P<0.05) higher total protein values (35.50g/dL, 36.50g/dL, and 39.50g/dL respectively). Table 4 showed that the globulin values were slightly higher than those reported by Maidala and Abdullahi (2016) who fed other phytoadditives (neem leave, Guerra leave and commiphora leave) to broilers. The difference might be because of the processing method used, but also established the variation that exist among various phytoadditives. The different levels of the phytogenic plants (negro pepper) increase the cholesterol level slightly (P<0.05), this is at variance with the findings of Liukkonen-Anttila (2001) who reported decrease in cholesterol level on broilers fed xylopia powder. Albumin had similar values indicating effective utilization of different levels of meal and effective working ability of the liver since albumin production takes place in the liver. Albumin helps to stabilize and maintaining extracellular fluid volume, provides nutrition to tissues, binds molecules such as fatty acids, magnesium ions, cortisol, hormones, vitamins, and drugs. Albumin plays many important roles in maintenance of appropriate osmotic pressure of blood, binding and transport of various substances like hormones, drugs. According to Cleveland Clinic (2024), low albumin levels can be a sign of liver or kidney disease and high levels may be a sign of dehydration. Similar response across the xylopia treatment help to establish positive effect of the additive on the kidney and liver of the broiler chickens.

Table 4: Serum Biochemistry of broiler chickens fed varied levels of *Xylopia aethiopica* additive

Parameters	T1	T2	T3	T4	T5	SEM
ALP (1U /L)	222.00^{a}	206.50^{ab}	198.50^{a}	216.50^{a}	223.00^{a}	2.86
AST ((1U /L)	59.00^{b}	116.00^{a}	90.50^{ac}	94.50^{ac}	84.50^{ab}	5.22
ALT ((1U/L)	3.50^{a}	4.50^{c}	2.00^{b}	5.50^{d}	5.00^{cd}	0.26
Total protein (g/dl)	35.50^{a}	36.50^{a}	39.50^{a}	31.50^{b}	37.50^{a}	o.63
Albumin (g/dl)	15.00	16.00	15.50	15.50	16.50	0.20
Globulin (g/dl)	18.00^{b}	20.00^{a}	24.00^{a}	16.00^{b}	21.50^{ac}	0.72
Cholesterol (g/dl)	115.40^{b}	115.40^{b}	150.50^{a}	117.30^{b}	144.25^{a}	4.21
Urea (g/dl)	8.10	9.60	9.00	9.90	9.30	0.29
Creatinine (g/dl)	0.28	0.16	0.20	0.20	0.28	0.01

^{abc} Means on the same row followed by different superscripts are significantly different (p < 0.05), SEM – Standard Error of Mean, T1 = control, T2 = 1% of *Xylopia aethiopica* , T3 = 2% of X*xylopia aethiopica* ,T4 = 3% of *Xylopia aethiopica* ,T5 = 4% of *Xylopia aethiopica*, ALP= Akaline phosphatase, AST= Aspartate transaminase, ALT= Alanine transaminase.

Relative organ weight of broiler chickens fed varied levels of *Xylopia aethiopica* additive

Table 5 showed the relative organ weight of broiler chickens fed varied levels of *Xylopia aethiopica*. All organs measured were not significantly affected (P>0.05) across various level of *Xylopia aethiopica* additive. Negro pepper does not affect the physiological function of broiler organs, these observations were not in line with the result of Duruna *et al* (2006) in which all parameters were significantly affected. These result shows that inclusion of Negro pepper up to 4% has no adverse effect on relative organ weight. This might be as a result of the various organs not being subjected to any stress or additional works. Analysis of organ weight in any phytoadditives studies is an important endpoint for identification of potentially harmful effects of some phytoadditives. Steven *et al*. (2004) opined that analysis of organ weight in seemly toxicological studies is an important endpoint for identification of potentially harmful effects of chemicals. Differences in organ weight can be the most sensitive indicator of an effect of test ingredients, as significant differences in organ weight between treated and untreated groups of animals may occur in the absence of any morphological changes. The occurrence of any changes will help to diagnose the nutritionally induced weigh changes.

Table 5: Relative organ weight of broiler chicken fed varied levels of *Xylopia aethiopica* additive

Parameters (%)	Control	Xylopia1%	Xylopia2%	Xylopia3%	Xylopia4%	SEM
Liver	2.25	2.38	2.62	2.57	2.61	0.07
Spleen	0.14	0.14	0.15	0.15	0.15	0.01
Pancreas	0.30	0.25	0.29	0.33	0.28	0.01
Kidney	0.32	0.29	0.29	0.39	0.33	0.02
Heart	0.45	0.47	0.43	0.45	0.47	0.01
Lungs	0.44	0.49	0.39	0.72	0.48	0.05

^{abc} means the same row followed by different superscript are significantly different ($p<0.05$); SEM = means standard error of mean, T1 = control, T2 = 1% of *Xylopia aethiopica*,T3 = 2% of .hv*Xylopia aethiopica*,T4 = 3% of *Xylopia aethiopica*,T5 = 4% of *Xylopia aethiopica.*

Conclusion

It can be concluded that *Xylopia aethiopica* at 1% could be used for improved growth performance, blood profile and nutrient digestibility of broiler chickens without any deleterious effect on growth performance, blood profile, nutrient digestibility, organs characteristics of broiler chickens.

Recommendation

Since the result shows a better performance, the inclusion of 1% Negro pepper had better performance in terms of final body weight and feed conversion ratio and the result also shows that the inclusion of the additive in the feed improved the weight, nutrient digestibility, haematological and serum parameters studied. So, the inclusion of *Xylopia aethiopica* as an additive in the feed of broiler chickens is recommended in broiler production for improved nutritional digestive physiology and health status traits in broiler chickens.

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