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Research Article

Growth Performance and Serum Biochemical Profile of Broiler Chickens Fed on Diets Supplemented with Afrostyrax lepidophyllus Fruit and Bark as Alternative to Antibiotic Growth Promoters

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Keywords

- *Afrostyrax lepidophyllus*
- Antibiotic
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- Growth performance
- Feed additive
- Serological parameters

Abstract

Background: Due to its side effects, antibiotic feed additives have become a real public health concern and trigger an explosion of interest in the use of alternatives such as plants products as supplements in animal rations. This study was designed to assess the effects of *Afrostyrax lepidophyllus* fruit and bark powder on growth performances and serological parameters of broiler chickens.

Methods: A total of 240 day-old Cobb 500 strain chicks were randomly assigned to five experimental diets formulated from a negative control ration ($R0^-$) by adding 1g antibiotic (Doxycycline®) which served as a positive control ($R0^+$), 2g of powder from the fruit (F), 2g of the bark powder (B) and 2g of the mixture (1/1) of fruit and bark (FB) of *Afrostyrax lepidophyllus* in a kg of basal diet.

Results: During growing-finishing phase (22-49 days) and throughout the study period (1-49 days), feed intake (FI), and live body weight (LBW) and body weight gain (BWG) were significantly higher with *A. lepidophyllus* bark powder as compared to the negative control diet. Irrespective to the study phase, *A. lepidophyllus* bark's powder and antibiotic induced the highest FI and the highest BWG, while the lowest BWG was recorded the *A. lepidophyllus* fruit-bark mixture. Gain/food ratio and abdominal fat deposit did not vary with the inclusion of *A. lepidophyllus* fruit, back and their mixture in the ration. The lowest cost of production was recorded with the ration supplemented with *Afrostyrax lepidophyllus* bark powder.

Conclusions: The study clearly showed that 2g/kg *Afrostyrax lepidophyllus*'s bark can replace antibiotics in the ration to promote growth performances and reduce the cost of production of broiler chickens in the finisher phase.

INTRODUCTION

In Africa, farmers are generally faced with the challenge of improving livestock performances in order to ensure more net returns and cover the proteins needs of populations. A lot of research and production strategies have been developed, including the use of antibiotics as feed additives to achieve this aim [1]. Although antibiotics achieved good performances, their potential side effects have become a real public health concern [2,3]. This triggers an explosion of interest in the use of naturals and non synthetics alternatives such as herbs, spices and their products (phytobiotics) as supplements in animal rations [4,5].

Phytobiotics contain active secondary plant metabolites belonging to the classes of isoprene derivatives, flavonoides and glucosinolates, and a large number of these compounds have been suggested to act as antibiotics or as antioxidants [6,7]. Beneficial effects of these products in farm animal arises from activation of feed intake and secretion of digestive secretions, immune stimulation, anti-bacterial, coccidiostatic, anthelmintic, antiviral or anti-inflammatory activity and antioxidant properties [8]. Previous studies revealed that ginger (*Zingiber officinale*), garlic (*Allium sativum*), and scent leaf (*Ocimun gratissimun*) and porridge fruit (*Tetrapleura tetraptera*) contain active substances such as alkaloids, tannins, flavonoids, saponins and phenols compounds [9-11]. Those compounds are known to improve livestock performances through their anti-oxidative and antimicrobial action, improve palatability, reduce cholesterol level in eggs and meat and maintain gut equilibrium [12].

Afrostyrax lepidophyllus fruits and bark are popular spices in Cameroon and most African countries. Fongang et al. [13], revealed that *A. lepidophyllus* bark contains sulfur and phenylpropanoid (eugenol) which have the ability to stimulate the function of pancreatic enzymes (lipases, amylases and proteases) and increase the activity of digestive enzymes of gastric mucosa. Both bark and fruits contain polyphenolics compounds possessing significant antioxidant properties [10,14,15] with many other attributes including digestive enzymes stimulation, lipid metabolism and modulation of microbial populations [8]. Fongang et al. [13], also reported that some compounds found in *A. lepidophyllus* bark like eugenol methyl, limonene, β-ocimene, apinene, trithiapentane, methyl-trithiahexane, dimethyl-tetrathiaoctane, and pentathiaundecane are not present in the fruits.

Many studies have concluded that combination of individual spices with different active compounds has a greater antibacterial effect than individual's spice alone, indicating a synergy between spices of different composition and origin [6,16]. Based on the chemical composition of the *Afrostyrax lepidophyllus* fruits and bark, their ability to balance biota population in gut and digestive enzyme stimulation as revealed by previous studies [6,15], we believe that this spice characterized mostly by the volatile sulfur-containing compounds [13] which are known to stimulate appetite and digestion [6] could positively impact other physiological functions, help to ensure good health and welfare, what can positively affect growth performances of broiler. We also believe based on the diversity of actives compounds found in fruits (phenols, tetrathiaoctane, pentathiadecane, trithiahexane and hydrolysable tannins) and bark (sulfur-containing compounds mainly: eugenol methyl, flavonoïds, phenylpropanoïd…) that their antibacterial and growth promoting effect could be more significant when combined. Thus the objective of the present study was to determine the effect of *Afrostyrax lepidophyllus* fruit and bark as antibiotic substitute on the growth performance and biochemical profile of broiler chickens.

MATERIALS AND METHODS

Site of study

The study was conducted at the poultry unit of the Teaching and Research Farm of the University of Dschang, Cameroon. This farm is located at 5°26′ North and 10°26′ EST and at an altitude of 1420 m above sea level. Annual temperatures vary between 10°C and 25°C. Rainfall ranges from 1500-2000 mm per annum over a 9 months rainy season (March to November).

Birds, dietary treatments and experimental design

240 day old Cobb 500 strain broiler chicks were reared on wood shaving litter floor at density of 20/m^2 and 10/m^2 respectively in brooding and finishing phase. There were randomly assigned to the five treatment diets including negative control diet in a completely randomized design with 48 birds per treatment. Each group was further sub divided into 4 replicates of 12 birds each (6 males and 6 females). The chicks were vaccinated against Newcastle diseases and Infectious Bursal Disease on day 7 and 18. Chicks were weighed at the beginning of the experiment and on weekly basis thereafter using a digital kitchen scale (SF-400 SF-400A, Capacity 7000g, Division 0.1-1g, China). Feed and water were offered *ad libitum*.

The fruit and the bark of *Afrostyrax lepidophyllus* were bought at the local market then ground, sieved and the powder was incorporated in broiler feed. Antibiotic used (Doxycycline®) in positive control ration was bought from a local veterinary pharmacy. Four experimental diets were formulated by adding in a kg of basal ration (R0-) (Table 1), 1g antibiotic (R0+) (Doxycycline®); 2g fruit powder (F), 2g bark powder (B) and 2g mixture of fruits + bark (FB) of *A. lepidophyllus*.

Growth

Feed intake (FI) was obtained by calculation at weekly intervals by difference in the quantity of feed distributed during the week and the left over for each replicate. Life body weight (BW) for each replicate was recorded weekly; BWG was obtained by difference in BW of two consecutive weeks. Gain/food ration was obtained by dividing weekly FI by weekly BWG. The mortalities recorded during the first week of the experiment were replaced by new chicks of the same size and weight; from week 2 till the end of the experiment no mortality was recorded. At the end of the feeding trial at 49 days, 16 chickens from the 4 replicates (2 males and 2 females per replicate) of each treatment groups were randomly selected, fasted for 24 hours and slaughtered for carcass evaluation.

Serum biochemical analysis

Blood from each slaughtered bird was collected for biochemical analysis. This blood was collected in non-heparinised test tubes and left at rest during 12 hours, and the serum was collected and

Table 1: Proximate nutrients composition and price of experimental diets.

Ingredients (g/kg)	Starter phase	Finisher phase
Maize	560	600
Wheat grain	30	80
Soybean Meal 49	230	130
Coton meal	50	60
Fish meal	60	55
Bone meal	5	5
Osher shell meal	5	5
Palm oil	10	15
Premix*	50	50
Calculated nutrients composition		
Metabolizable Energy (MJ/kg)	12.40	12.60
Crude Protein (g/kg)	233,2	205.4
Lysine (g/kg)	14	12.0
Methionine (g/kg)	4.8	4.5
Calcium (g/kg)	11.1	13.2
Available P (g/kg)	5.4	5.8
Crude fibre (g/kg)	47.6	49.1
Price (francs CFA/kg)	311	283.75

*Vitamin-mineral premix provided per kg of diet: Lys, 33mg; Meth, 24mg; Ca, 80g; P, 20.5g; Na, 1.5g; Fe, 80mg; Zn, 50mg; Mn, 60mg; Retinol, 2.59mg; Cholecalciferol, 30µg; DL-α-Tocopherol, 25mg; Thiamin, 5 mg; Riboflavin, 5 mg; Pyridoxin, 2,5mg; Cyanocobalamin, 0.05 mg; Folic acid, 1 mg and Niacin, 2 mg.

preserved in the freezer. Serum biochemical analysis consisted of the quantification of total protein, urea, creatinine, aspartate aminotransferase (ASAT) and alanine aminotransferase (ALAT) using colorimetric method as prescribed by the Chronolab® commercial kits.

Cost of production

The cost of a kg of feed was calculated based on the price of each ingredient as practiced in the local market. The cost of feed intake was obtained by multiplying the average feed intake by the price of a kg of the corresponding diet. The cost of production of a kilogram of live body weight was calculated by multiplying the cost of the kg of feed by the corresponding feed conversion ratio.

Statistical analysis

The results on growth parameters, carcass characteristics and biochemical profile obtained from each replicate were expressed as means and used for statistical analysis. The data were analyzed using one way Analyses of Variance test by General Linear Model's procedure of Statistical Package for Social Science (SPSS 21.0) software. Significant treatment means were separated using Duncan's multiple range tests and probability values less than 0.05 were considered as significant [17].

RESULTS

Performances and carcass traits

Table 2 summarizes the effects of *Afrostyrax lepidophyllus* fruits, bark and their mixture on feed intake (FI), live body weight (BW), body weight gain (BWG) and the gain/food ratio. All these parameters were significantly affected (*P<0.05*) by the treatments, except for FI and gain/food ratio during the brooding phase (1-21 days).

During growing-finishing phase (22-49 days) and throughout the study period (1-49 days), the lowest FI was recorded with *A. lepidophyllus* fruits powder (RF) and the highest with the bark powder of this spice (RE). During the whole trial period, the consumption of the rations supplemented with the fruits and the fruits-bark mixture were comparable (*P>0.05*).

Irrespective of study phases, the highest BW and BWG were recorded with the antibiotic ($R0^+$) as compared to the mixture of *A. lepidophyllus* fruits-bark (RFE) and the control ration without supplement ($R0^-$) during the growing phase and all over the study period. During the growing phase (22 to 49 days), birds fed on diets supplemented with antibiotic and *A. lepidophyllus* bark were comparable (*P>0.05*) for BW and BWG. In the same way, there was no significant difference (*P>0.05*) between BW and BWG of animals fed on control diet without supplement ($R0^-$) and those fed on diet supplemented with the mixture of *A. lepidophyllus* fruits-bark, and between chickens fed on diets supplemented with the antibiotic and the mixture of bark and fruits of *Afrostyrax lepidophyllus*. During the growing phase (22-49 days) and throughout the experimental period (1-49 days) antibiotic induced the lowest gain/food ratio whereas the highest value was recorded with the negative control ration without supplement.

The carcass characteristics of broiler birds fed on diets supplemented with *A. lepidophilus* fruits and bark are presented in Table 3. There were substantial variations within each parameter from one treatment to another (*P<0.05*) except for abdominal fat. *A. lepidophyllus* fruits powder promoted a significantly (*P<0.05*) lower carcass yield as compared to antibiotic. The smallest

Table 2: Effects of *Afrostyrax lepidophyllus* on growth performances of broiler chickens.

Study periods (days)	Rations						
	$R0^-$	$R0^+$	F	B	FB	SEM	*P-value*
Feed intake (g)							
1 - 21	1003.29^{a}	1024.38^{a}	982.29^{a}	1018.04^{a}	994.19^{a}	29.95	0.271
22 - 49	4746.38^{ab}	4825.37^{bc}	4663.87^{a}	4883.72^{c}	4705.44^{ab}	113.00	0 .019
1 - 49	5749.67^{ab}	5849.74^{bc}	5646.16^{a}	5901.76^{c}	5699.63^{a}	121.76	0. 003
Body weight (g)							
21	763.92^{ab}	774.60^{b}	743.79^{ab}	761.69^{ab}	742.98^{a}	21.03	0.034
49	2584.00^{a}	2929.83^{b}	2761.31^{ab}	2834.64^{b}	2629.01^{a}	174.84	0.010
Body weight gain (g)							
1 -21	726.96^{ab}	737.64^{b}	706.83^{ab}	724.73^{ab}	706.02^{a}	21.03	0.034
22 -49	1820.08^{a}	2155.22^{c}	2017.52^{abc}	2072.95^{bc}	1886.03^{ab}	171.81	0.017
1 -49	2547.04^{a}	2892.87^{b}	2724.35^{ab}	2797.68^{b}	2592.05^{a}	174.84	0.010
Feed conversion ratio							
1 -21	1.38^{a}	1.39^{a}	1.39^{a}	1.41^{a}	1.41^{a}	0.04	0.897
22 - 49	2.62^{b}	2.24^{a}	2.31^{ab}	2.36^{ab}	2.53^{ab}	0.23	0.006
1 - 49	2.26^{b}	2.02^{a}	2.07^{ab}	2.11^{ab}	2.21^{ab}	0.15	0.008

a.b.c: Means with the same superscript on the same row are not significantly different (*P>0.05*).
SEM= standard error of mean;
R0 $^-$ = control diet; **R0** $^+$ = R0 $^-$ +0.1% Doxycycline ®; **F** = R0 $^-$ +0.2% of the fruit of *Afrostyrax lepidophyllus*;
B = R0 $^-$ +0.2% of the bark of *Afrostyrax lepidophyllus*; **FB** = R0 $^-$ +0.2% of the fruit+bark mixture.

relative weight of the liver was recorded with the antibiotic as compared to the bark powder of *A. lepidophyllus* which induced the heaviest liver. The fruits and the bark powder of this phytobiotic respectively induced the highest relative weights of the heart and the pancreas (*P<0.05*) as compared to all other treatments.

Cost of production

Throughout the study period, the highest (*P<0.05*) costs of feed intake and cost of production of a kilogram of live body weight were recorded with the antibiotic ($R0^+$). The lowest production cost of a kilogram of the live body weight during growing phase (22 to 49 days) and throughout the experimental period (1 to 49 days) was recorded with the bark and fruits of *A. lepidophyllus* (Table 4).

Serum biochemical parameters

Proteins and urea serum contents were not significantly affected by antibiotic and phytobiotics. Creatinine, ALAT and ASAT concentrations significantly (*P<0.05*) increased with *A. lepidophyllus* fruits, antibiotic and *A. lepidophyllus* back respectively (Table 5). The phytobiotic bark and the mixture of bark and fruits supplement decreased the creatinine contents of blood serum as compared to negative (R0-), positive (R0+) control and fruits powder. The lowest ASAT content was recorded with antibiotic whereas the highest (*P<0.05*) value was recorded with *A. lepidophyllus* bark powder. The supplementation of broiler diet with antibiotic induced the lowest (*P<0.05*) ASAT serum content whereas the highest value was recorded with *A. lepidophyllus* bark powder (RE).

DISCUSSION

The present result revealed that the feed intake of broilers increased with *A. lepidophyllus* bark powder as compared to the fruits and their combinations. This increase in feed intake could be attributed to the improvement of diet flavor by the volatile fractions of *A. lepidophyllus* bark [18] made up by the sulfur-containing compounds which provided the garlic- or onion-like odor to the feed [13]. This flavor might have stimulated the appetite of the chickens. The absence of these compounds in the fruits can explain the difference recorded in feed intake in the present study. Sadji et al. [19] reported that good flavor of feed prepare the digestive tract to feed intake through stimulation of digestive secretions and intestine motility. The variation in feed intake in this study could also be explained by the variability and the complexity of actives compounds found in the fruits and bark. In fact, in the same plant the type and the amount of actives compounds found in leaves differed from compounds found in the

Table 3: Carcass characteristics of broilers fed on diets supplemented with fruit and bark of *A. lepidophilus* powder.

Carcass parameters	Rations					SEM	*P-value*
	$R0^-$	$R0^+$	F	B	FB		
Final body weight (g)	2584.00^a	2929.83^b	2761.31^{ab}	2834.64^b	2629.01^a	174.84	0.010
Carcass yield (% BW)	74.29^{ab}	76.34^b	73.58^a	75.54^{ab}	74.66^{ab}	2.18	0.028
Head (% BW)	2.27^a	2.00^a	2.54^b	2.19^a	2.04^a	0.32	0.001
Liver (% BW)	1.83^b	1.61^a	1.68^{ab}	1.85^b	1.74^{ab}	0.24	0.009
Heart (% BW)	0.47^{ab}	0.46^{ab}	0.54^b	0.50^{ab}	0.41^a	0.09	0.004
Pancreas (% BW)	0.16^a	0.19^{ab}	0.17^{ab}	0.22^b	0.18^{ab}	0.06	0.009
Abdominal fat (% BW)	1.68^a	1.38^a	1.35^a	1.75^a	1.13^a	0.67	0.322

a, b: means along the same row with different superscripts are significantly different (*P < 0.05*).
SEM= standard error of mean; BW: body weight
R0 $^-$ = control diet; **R0** $^+$ = R0 $^-$ +0.1% Doxycycline ®; **F** = R0 $^-$ +0.2% of the fruit of *Afrostyrax lepidophyllus*;
B = R0 $^-$ +0.2% of the bark of *Afrostyrax lepidophyllus*; **FB** = R0 $^-$ +0.2% of the fruit+bark mixture.

Table 4: Costs of production of broiler fed on diets supplemented with *A. lepidiphillus.*

Study periods (days)	Rations					SEM	*P-value*
	$R0^-$	$R0^+$	F	B	FB		
Cost of feed intake (FCFA)							
1 – 21	$312,02^a$	$395,41^b$	$320,82^a$	$319,67^a$	$316,95^a$	33.19	<0,000
22 – 49	$1346,79^a$	$1731,10^d$	$1673,16^c$	$1400,41^b$	$1371,87^{ab}$	148.02	<0,000
1 – 49	$1658,81^a$	$2126,51^d$	$1993,98^c$	$1720,07^b$	$1688,82^{ab}$	179.67	<0,000
Cost of production of kg of live weight (FCFA)							
1 – 21	$429,44^a$	$536,36^b$	$449,69^a$	$441,18^a$	$449,13^a$	41.46	<0,000
22 – 49	$743,17^{ab}$	$803,651^b$	$685,86^a$	$676,36^a$	$736,78^{ab}$	70.18	0,051
1 - 49	$652,49^a$	$735,23^b$	$630,60^a$	$615,38^a$	$656,018^a$	54.15	0,004

a, b: means along the same row with different superscripts are significantly different (*P < 0.05*).
SEM= standard error of mean; FCFA=Francs CFA (1 US$= 600 CFA)
R0 $^-$ = control diet; **R0** $^+$ = R0 $^-$ +0.1% Doxycycline ®; **F** = R0 $^-$ +0.2% of the fruit of *Afrostyrax lepidophyllus*;
B = R0 $^-$ +0.2% of the bark of *Afrostyrax lepidophyllus*; **FB** = R0 $^-$ +0.2% of the fruit+bark mixture.

twigs, bark and fruits [13]. The properties of spices identified so far are extremely varied and their main active compounds made up mainly by terpenoids and phenolics acids [20,21] produced a wide range of beneficial effects on growth performances traits in chickens which can be enhanced through synergetic effects with other compounds of different composition and origin.

Due to the wide variety and amount of active compounds, different herbs and spices affect digestion process and growth performance differently [6]. In the present study, supplementing broiler chickens with fruits and bark powder of *A. lepidophyllus* markedly enhanced BW and BWG as compared to negative control and their combination. This result can be explained by the presence of the anti-oxidative and antimicrobial [12] substances such as alkaloids, flavonoids and phenolics compounds [10,11] which are known to maintain gut equilibrium and improve growth performances of chickens [6]. The fruits-bark combination (1/1) felt to enhance growth performances as expected suggesting a negative synergistic effect between active compounds found in *A. lepidophyllus* fruits and bark. The previous study of Fongang *et al.* [13] based on the phytochemicals screening of this spice revealed that many compounds found in bark like eugenol methyl, limonene, β-ocimene, apinene, trithiapentane, methyl-trithiahexane, dimethyl-tetrathiaoctane, and pentathiaundecane are not present in the fruits, and compounds like tetrathiaoctane, pentathiadecane, trithiahexane, hydrolysable tannins present in the fruits are absent in the bark. The present result could also be explained by the low amount (1/2) of individual active compounds in the combination (1/1) which was half the amount found in the rations supplemented with fruits or bark alone.

Body weight of chickens fed on diets supplemented with antibiotic and *A. lepidophyllus* bark were comparable and significantly higher than the BW recorded with the fruits alone and the fruits-bark mixture. The improvement in BW recorded with bark could be attributed to the antimicrobial properties of their specifics active compounds and their impact on gut function [22]. In fact, the bark of this spice contains flavonoïds and phenylpropanoids compounds not present in the fruits; which are known to improve livestock performances by changing the intestinal ecosystem of the animal through their antimicrobial action [12]. These compounds act by forming the complexes with many proteins, cause the destructuration of the bacterial membranes, making unavailable certain substrates for the bacteria and inactivate bacterial enzymes [6]. The changes in intestinal ecosystem due to their antimicrobial action could lead to a greater availability of some nutriments for the host and consequently improve BWG. This is in agreement with Frankič et al. [6], who noticed that the growth promoting effect of most herbs and extracts of spices act by killing parasites that hinder digestibility and growth performance of birds. Moreover, it was reported by Nain et al. [23], that the animals selected for their rapid growth, like broiler suffered from a significant oxidative stress. The improvement in BW of broilers achieved with bark of *A. lepidophyllus* could also be attributed to the potent antioxidant properties of their major components as reported by Fongang et al. [13], and Moukette et al. [15].

Although not significant, *A. lepidophyllus* fruits and bark tend to reduce gain/food ratio compared to the control diet. This could be attributed to the higher weight gain recorded in birds fed on diets supplemented with fruits and bark. Windisch et al. [24], reported that incorporating phytobiotics in the rations improved intestinal health, and animals are less exposed to microbial toxins and other undesired microbial metabolites such as ammonia and biogenic amines. As a result, animals are relatively relieved from immune defense stress during critical situations and there is increased availability of essential nutrients for absorption, thereby helping the animals to grow better within the framework of their genetic potential. Al-Kassie et al. [20], also provided an evidence of the enhancement of gain/food ratio through the dietary addition of *Capsicum annum* which contain active substances such as alkaloids, flavonoids and phenolics compounds found in *A. lepidophyllus* used in the present study.

Within the framework of this study, supplementing broilers feed with *A. lepidophyllus* fruits and bark did not have any marked effect on the carcass yield as compared to the control diet without any supplement. This could be attributed to the low quantity (2g/kg of feed) of supplements used in this study. The present findings contradict the results of Al-Kassie et al. [20], who reported that some common spices containing the same active substances like flavonoids and phenolics compounds present in *A. lepidophyllus* such as green pepper (*Capsicum annum*) at 0.5; 0.75 and 1% in the ration significantly increased the carcass yield of broiler chickens. The difference with the present findings could be explained by the high quantities of green pepper (0.5; 0.75 and 1%) compared to the 0.2% of *A. lepidophyllus* fruits and bark used in the present study.

Table 5: Serum biochemical parameters of broilers fed on diets supplemented with fruit and bark of *A. lepidophyllus.*

Serum parameters	Rations					SEM	*P-value*
	R0⁻	**R0⁺**	**F**	**B**	**FB**		
Proteins (g/dl)	2.48	2.57	2.58	2.57	2.54	0.24	0.964
Urea (mg/dl)	0.96	0.79	1.21	0.94	0.54	0.65	0.663
Creatinin (mg/dl)	1.20^{c}	1.08^{b}	1.14^{c}	0.62^{a}	0.69^{ab}	0.36	<0.000
ALAT (IU/L)	20.84^{ab}	57.24^{c}	33.81^{b}	10.90^{a}	27.11^{b}	17.17	<0.000
ASAT (IU/L)	$119,12^{b}$	$59,93^{a}$	$130,28^{b}$	$186,88^{c}$	$117,57^{b}$	50.27	<0.000
ASAT/ALAT	0.16^{a}	0.95^{b}	0.30^{a}	0.07^{a}	0.25^{a}	0.35	<0.000

a, b, c: means along the same row with different superscripts are significantly different ($P < 0.05$).
SEM= standard error of mean; ASAT: aspartate aminotransferase; ALAT: alanine aminotransferase
R0 ⁻ = control diet; **R0** ⁺ = R0 ⁻ +0.1% Doxycycline ®; **F** = R0 ⁻ +0.2% of the fruit of *Afrostyrax lepidophyllus*;
B = R0 ⁻ +0.2% of the bark of *Afrostyrax lepidophyllus*; **FB** = R0 ⁻ +0.2% of the fruit+bark mixture.

Biological effects of active compounds in the plants depend on their amount which varies depending on the variety of plant. This preliminary study on feeding *A. lepidophyllus* fruits and bark, and their 1/1 mixture to broiler chickens revealed no significant effect on the relative weights of liver and heart as compared to the control diet. This result suggest that the amount of the secondary metabolites or active compounds contained in 2g of fruits and bark of *A. lepidophyllus* in a kg of feed are not toxic to chickens. The present results are close to the findings of Uno [25] who revealed that feeding 0.25% of the gingember, garlic and the gingember-garlic mixture to broiler chickens have no significant effect on the relative weight of the liver and the heart.

In the present study, the *A. lepidophyllus* bark powder markedly increased relative weight of the pancreas as compared to the control ration. This finding might suggest that pancreas released more enzymes with *A. lepidophyllus* bark powder in the ration. A number of reports have also provided evidence of the enhancement of digestive enzyme secretion through the dietary addition of herbs, spices and their products [5,8,26,27].

The effects of active compounds from herbs and spices depend largely on dosage used. Incorporating 2g of fruits and bark, and the fruits-bark mixture of *A. lepidophyllus* powder in a kg of feed did not have any significant effect on the abdominal fat deposit. However, Muneendra et al. [8], reported that *A. lepidophyllus* bark and fruits contain polyphenolics and flavonoids compounds possessing a significant attributes on digestive enzymes stimulation and lipid metabolism. In the present study the effect of polyphenolics and flavonoids was not significant on fat deposit, may be due to their low content since they are not the major active compounds found in this spice.

Spices are not only appetite and digestion stimulants, they impact on other physiological functions that can help to sustain good health and improve animal performance. The biochemical values obtained in this study indicated no detrimental impact of *A. lepidophyllus* bark and fruits, and their combination on serum content in total protein, creatinin, urea, ALAT and ASAT. In fact, the *A. lepidophyllus* bark and the fruits-bark combination markedly decreased the serum content in creatinin. This decrease in creatinin content can be attributed to the active compounds present in *A. lepidophyllus* bark and fruits on the glomerular function of chickens. The fruits and fruits-bark mixture led to a marked variation in the serum content of ALAT within the references range (5-25 IU/L) without however affecting the content of ASAT. This result is in contradiction with the findings of Al-Shuwaili et al. [21], which revealed that the addition of ginger, garlic and cinnamon in the ration of the turkeys lowers the serum content in ALAT and ASAT.

CONCLUSION

The results of this study suggest that supplementing broilers diet with *Afrostyrax lepidophyllus* bark indicate favorable influences on growth performance, blood serum components and reduced the cost of production. The present findings provided a ray of hope to the natural alternative to the antibiotic additives that are still commonly and very intensively used in animal husbandry in tropical area where climate conditions are very suitable for microbial growth.

REFERENCES

1. Kehinde AS, Obun CO, Inuwa M, Bobadoye O. Growth performance, haematological and some serum biochemical indices of cockerel chicks fed ginger (*Zingiber officinale*) additive diets. Animal Research International. 2011; 8: 1398-1404.
2. Donoghue DJ. Antibiotic residues in poultry tissue and eggs. Human health concerns. Poult Sci. 2003; 83: 618-621.
3. Nweze BO, Nawankwagu AE, Ekwe OO. The performance of the broilers chickens on African porridge fruit (*Tetrapleura tetraptera*) pod under different feeding regimes. Asian J Poult Sci. 2011; 5: 144-149.
4. Anyanwu M. Evaluation of the feed preservative potentials of *Ocimum gratissimum L.* B.Sc. project Department of Animal Science Federal Unversity of Technology, Owerri. 2010.
5. Owen J. Introduction of alternative antibiotic growth promoters (AAGPS) in animal production in Nigeria: A review. Proceedings of the 36th Conference of Nigerian Society of Animal Production, 13-16th March, 2011 Univ. of Abuja, Nigeria. 2011.
6. Frankič T, Voljc M, Salobir J, Rezar V. Use of herbs and spices and their extracts in animal nutrition. Acta argiculturae Slovenica. 2009; 94: 95-102.
7. Toghyani M, Tohidi M, Gheisari AA, Tabeidian SA. Perfoemance, immunity, serum biochemical and hematological parameters in broiler chicks fed dietary thyme as alternative for an antibiotic growth promoter. Afr J Biotech. 2010; 9: 6819-6825.
8. Muneendra K, Vinod K, Debashis R, Raju K, Shalini V. Application of Herbal Feed Additives in Animal Nutrition - A Review. Int J Livest Research. 2014; 4: 1-8.
9. Muhammad J, Fazil-Raziq D, Abdul H, Rifatullah K, Ijaz A. Effects of aqueous extract of plant mixture on carcass quality of broiler chicks. J Agricult Biol Sci. 2009; 4: 37-40.
10. K-W Lee, H Everts, HJ Kappert, H Wouterse, M Frehner and AC Beynen. Cinnamaldehyde, but Not Thymol, Counteracts the Carboxymethyl Cellulose-induced Growth Depression in Female Broiler Chickens. Int J Poult Sci. 2004; 3: 608-612.
11. Abdou Bouda A, Njintang YN, Scher J, Mbofung CMF. Phenolic compounds and radical scavenging potential of twenty Cameroonian spices. Agricu Biol J N Am. 2010; 1: 213-224.
12. Odoemelam VU, Nwaogu KO, Ukachukwu SN, Esonu BO, Okoli IC, Etuk EB, et al. Carcass and Organoleptic assessment of Broiler fed *Ocimum gratissimum* Supplemented diets. Proceediongs of the 38th Conferences of Nigeria Society of Animal Production. 17-20th March, 2013, Rivers state University of Sciences and Technology., Port Harcourt. 2013.
13. James Ndukui, Murithi B, Muwonge H, Sembajwe LF, Kateregga J. Antidiarrheal activity of ethanolic fruit extract of *Psidium guayava* (Guava) in castor oil induced diarrhea in albino rats. Natl J Physiol Pharm Pharmacol. 2013; 3: 191-197.
14. Fogang HPD, Maggi F, Tapondjou LA, Womeni HM, Papa F, Luana Quassinti, et al. *In vitro* Biological Activities of Seed Essential Oils from the Cameroonian Spices *Afrostyrax lepidophyllus Mildbr* and *Scorodophloeus zenkeri Harms* Rich in Sulfur-Containing Compounds. Chemist Biod. 2014; 11: 161-169.
15. Oben J, Etoundi CB, Kuaté D, Ngondi JL. Anti-amylase, anti-lipase and antioxidant effects of aqueous extracts of some Cameroonian spices. J Nat Products. 2010; 3: 165-171.
16. Moukette M, Constant AP, Prosper CNB, Vicky JAM, Eustace B, Jeanne YN. *Afrostyrax lepidophyllus* extracts exhibit *in vitro* free radical

scavenging, antioxidant potential and protective properties against liver enzymes ion mediated oxidative damage. BMC Res Notes. 2015; 8.

17. Oleforuh-Okoleh, Harriet MN-F, Solomon OO, Joesph OU. Evaluation of Growth Performance, Haematological and Serum Biochemical Response of Broiler Chickens to Aqueous Extract of Ginger and Garlic. J Agric Res. 2015; 7: 167.

18. Steel RGD, Torne JH. Principles and procedures of statistics a biometrical approach. 2nd edn. McGraw-Hill International. U.S.A. 1980.

19. Adepoju OT, Oyewole EO. Nutritional importance and Micronutrients potentials of non-conventional indigenous green leafy vegetable from Nigeria. Agri J. 2008; 3: 362-365.

20. Sajid HQ, Ahsan H, Fawwad A, Shahid R, Pervez A, Naeem A, et al. Vying Efficacy of Livol, Livotal, and Hepato Promoter on Performance and Immune Response of Broiler. Advances Zool Botany, 2015; 3: 31-37.

21. Al-Kassie GAM, Al-Nasrawi MAM, Ajeena SJ. The Effects of Using Hot Red Pepper as a Diet Supplement on Some Performance Traits in Broiler. Pak J Nutrition. 2011; 10: 842-845.

22. Al-Shuwaili MA, Ibrahim IE, Naqi Al-Bayati MT. Effect of dietary herbal plants supplement in turkey diet on performance and some blood biochemical parameters. GJBB. 2015; 4: 85-89.

23. Nain S, Ling B, Bandy B, Alcorn J, Wojnarowicz C, Laarveld B, et al. The role of oxidative stress in the development of congestive heart failure in a chicken genotype selected for rapid growth. Avian Pathol. 2008; 37: 367-373.

24. Windisch W, Schedle K, Plitzner C, Kroismayr A. Use of phytogenic products as feed additives for swine and poultry. J Anim Sci. 2008; 86: 140-148.

25. Onu PN. Evaluation of two herbal spices as feed additives for finisher broilers. Biotech Anim Husb. 2010; 26: 383-392.

26. Simsek UG, Ciftci M, Dalkilic B, Guler T, Ertas ON. The effects of dietary antibiotic and anise oil supplementation on body weight, carcass characteristics and organoleptic analysis of meat in broilers. Revue Méd Vét. 2007; 158: 514-518.

27. El-Deek AA, Al-Harthi MA, Mona O, Fahd Al-Jassas, Rehab N. Hot pepper (*Capsicum annum*) as an alternative to oxytetracycline in broiler diets and effects on productive traits, meat quality, immunological responses and plasma lipids. Archiv Geflügelkunde. 2012; 76: 73-80.

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