BIOCHEMICAL INDICES OF BROILER CHICKENS FED DIETS CONTAINING GINGER, GARLIC AND GARLIC-GINGER MIXTURE

John, U. E*. Onunkwo, D. N. and Udofia, S. M.

[1]Department of Animal Nutrition and Forage Science, Michael Okpara University of Agriculture, Umudike, Abia State
*E-mail of the corresponding author: uduakobongjohn@gmail.com, +2348089268849

ABSTRACT
This study was conducted to evaluate haematological response of broiler chickens fed garlic, ginger and garlic-ginger mixture. Four experimental broiler starter and finisher diets were formulated such that the diets contained 1.0% ginger (T_2),garlic (T_3) and garlic-ginger mixture (0.5 ginger + 0.5 garlic) (T_4), respectively. The control diet (T_1) contained no garlic or ginger or their mixture. The diets were fed to one hundred and twenty (120) day old Cobb broilers in a 56- day feeding trial. The diets were randomly assigned to four groups of 30 birds in a completely randomized design (CRD) replicated 3 times. Each replicate contained 10 birds. Broiler starter and finisher diets were fed for 0-28 and 29-56 day of age, respectively. The result obtained showed no significant differences in all the parameters measured on biochemical indices of broiler chickens. Birds on treatment group were slightly better than control group on biochemical indices of broiler fed diets containing ginger, garlic and their mixture. Ginger, garlic and their mixture should be considered an effective phytogenic feed additive in diets formulation for improved health and welfare of the birds.
Key Words: Garlic, Ginger, Mixture, Broiler, Biochemical Indices

INTRODUCTION
The ban on the use of antibiotic growth promoters in livestock and poultry nutrition by the European Union has generated interest in the search for an alternative. This has given rise to the use of different feed materials in poultry feed formulations to enhance growth rate, improve feed efficiency and utilization (Raeesi *et al.*, 2010; Oleforuh-Okoleh *et al.*, 2014; John and Emenalom 2018).Phytogenic feed additives are currently used in livestock and poultry production because of their positive properties including; anti-inflammatory, antiseptic, sedative, bactericidal, gut functions, fungicidal, antiviral, antioxidant, growth-promoting efficacy, dietary palatability, immune stimulating, stimulation of digestive enzyme and absorption of nutrients (Cross *et al.*, 2007; Steiner, 2009; Puvaca *et al.*, 2013).

These plant-derived compounds which include; herbs, spices and essential oils or oleoresins, are normally incorporated into diets for improved productivity in livestock and poultry. A variety of these phytogenic feed additives including ginger and garlic have been widely used as alternatives to synthetic antimicrobial growth promoters in livestock and poultry rations. Ginger,(*Zingiber officinale*) and garlic (*Allium sativum*) are widely used species in various foods and beverages and in medicine (Chrubasik *et al.*, 2005). Ginger contains; gingerol, gingerdiol and gingerdione which have the ability to stimulate digestive enzymes, affect microbial activity, anti-oxidative, anti-inflammatory, antiseptic, anti-parasitic and immune modulatory properties when used in poultry diet (Zhang *et al.*, 2009; Mohamed *et al.*, 2012; Akintobi *et al.*, 2013). On the other hand, garlic contains sulphur compounds; allin, diallysulphide, allyldisulphide and allicin (Chang and Cheong, 2008).

According to Shewita and Taha (2018), Ebegbulem (2018), Herve *et al.*, (2018) and Oleforuh-Okoleh *et al.*, (2015), George *et al.*, (2015), Ebrahimnezhad *et al* (2014) who reported role of ginger and garlic on biochemical indices of broiler chickens. The aim of this work therefore, is to determine the biochemical indices of broiler chickens fed diets containing 1% ginger or garlic and ginger-garlic mixture, respectively.

MATERIALS AND METHOD
Experimental site
This experiment was conducted at the Poultry Unit of the Teaching and Research Farm of the School of Agriculture and Agricultural Technology, Federal University of Technology, Owerri, Nigeria. Owerri is located in the South-East agro-ecological zone of Nigeria. It lies between latitude $4^0 4^1$ and

$6^0 3^1$Nand longitude $6^0 15^1$ and $8^0 15^1$E with mean annual rainfall, temperature and relative humidity of 2250mm, 26.5-27^0C and 70-80%, respectively (Adeyemi, 2011).

Processing of test materials and diets

Ginger and garlic used for the experiment were procured fresh from a market in Owerri. The light scaly leaves on garlic were removed and the bulb separated into cloves. Both ginger and garlic were then sliced into 3-4 slices, sun-dried for 5 - 7 days depending on the intensity of the sun, ground into meals using an attrition mill and stored for use in broiler diets. Four experimental broiler starter and finisher diets were formulated such that diet 1 (control) contained none of the test materials. Diets 2, 3 and 4 contained 1.0% ginger, garlic and mixture (0.5 ginger + 0.5 garlic), respectively. The ingredient composition of the experimental diet is shown in Table1.

Experimental birds and design

One hundred and twenty (120) day-old broiler chicks of Cobb strains were used for the trial. The birds were divided into 4 groups of 30 birds each. Each group was sub-divided into 3 replicates of 10 birds each and housed in a 1.4 x 1.4 m compartment in the cemented floor, covered with wood shavings as the litter material in an open-sided poultry building. The pens were covered with black polythene for the first two weeks to control wind and heat. Each pen contained a feeder, drinker and a stove (to supply heat) for the first two weeks. Three pens were randomly assigned to an experimental diet in a completely randomized design. Feed and water were provided *ad libitum.* The starter and finisher diets were fed for 0 – 28 day and 29 – 56 day of age, respectively. Routine medications and other routine poultry management practices were maintained. The blood samples were collected into heparinized tubes from the basilica wing vein of the birds between 07 – 08 am at 56 day of age from three birds *per* treatment for biochemical analysis. The samples were sent to Federal Medical Centre, Owerri for the blood analysis. Data collected were subjected to statistical analysis using the General Linear Models (GLM) procedure of SAS® and the Student Newman-Keul's test $P < 0.05$.

Results and Discussion

The inclusion of garlic, ginger and their mixture did not affect the biochemical indices of the bird measured. However, garlic, ginger and their mixture tended to be superior to control group which increase the biochemical indices of the birds as shown in table (2). This result is in line with the finding of Ebrahimnezhad *et al* (2014) documented no significant differences (P>0.05) in all the parameters except low density lipoprotein on blood chemistry of broilers fed different level of ginger root powder. Shewita and Taha (2018) documented non-significant effect on low density lipoprotein, globulin, albumin, alanine aminotransferase and aspartate aminotransferase. George *et al.,* (2015) also reported that, inclusion of graded levels of ginger on broilers diets has no significant effect on total protein, creatinine, urea, aspartate aminotransferase, alanine aminotransferase and alkaline phosphate. Ebegbulem (2018) observed significant effect on total protein, cholesterol, glucose, globulin, creatinine and urea of birds fed ginger supplemented diets.

This result is not in agreement with the findings of Herve *et al.,* (2018) that reported significant effect on total protein, cholesterol, triglyceride, globulin, aspartate aminotransferase and alanine aminotransferase of Japanese quail fed ginger essential oil. Oleforuh-Okoleh *et al.,* (2015) also reported significant difference on biochemical response of broiler chickens to aqueous extract of ginger and garlic. The slight increase in biochemical indices of birds may be due to bioactive compound in ginger such as gingerol, shogaols, gingerdiol, gingerdione, and some related phenolic ketone derivatives which have powerful antioxidant and immunostimulatory properties that allow them to improve immune responses.

Table 1: Ingredient and Nutrient Composition of the Experimental Starter and Finisher Broiler Diets

	STARTER				FINISHER			
Ingredient	T_1 (0%) Control	T_2 (1%) Ginger	T_3 (1%) Garlic	T_4 (0.5+0.5%) Ginger+Garlic	T_1 (0%) Control	T_2 (1%) Ginger	T_3 (1%) Garlic	T_4 (0.5+0.5%) Ginger+Garlic
Maize	48.00	48.00	48.00	48.00	58.00	58.00	58.00	58.00
Soybean Meal	26.00	26.00	26.00	26.00	19.00	19.00	19.00	19.00
PKC	7.00	7.00	7.00	7.00	6.00	6.00	6.00	6.00
Wheat Offal	4.00	3.00	3.00	3.00	3.00	2.00	2.00	2.00
Spent Grains	7.00	7.00	7.00	7.00	6.00	6.00	6.00	6.00
Fish Meal	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
Bone Meal	3.00	3.00	3.00	3.00	3.00	3.00	3.00	3.00
L-Lysine	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
L-Methione	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Vit/Tm Premix+	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Ginger	-	1.00	-	0.50	-	1.00	-	0.50
Garlic	-	-	1.00	0.50	-	-	1.00	0.50
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**
Chemical Analysis(%DM)								
Crude Protein	23.13	22.64	22.71	22.50	18.65	18.46	18.58	18.84
Crude Fibre	6.05	7.85	5.80	6.33	4.57	5.16	4.81	5.09
Esther Extract	6.88	5.26	3.19	1.93	5.57	5.61	5.25	5.99
Ash	10.39	10.78	9.99	10.00	13.42	12.33	12.58	13.12
NFE	53.54	55.47	58.31	59.54	57.79	59.54	59.18	56.96
ME (Kcal/kg)	3268.30	3110.95	3106.95	3025.00	3148.95	3168.70	3153.90	3162.20

Table 2: Effect of different diet treatments on the biochemical indices of broiler

PARAMETERS	T_1 (0%) Control	T_2 (1%) Ginger	T_3 (1%) Garlic	T_4 (0.5+0.5%) Garlic+ginger	SEM
Uric acid (mg/dl)	2.77	4.70	4.45	1.99	0.57
Calcium (mg/dl)	8.38	8.76	9.56	8.87	0.21
Phosphorus (mg/dl)	2.40	2.70	3.80	3.40	0.26
Urea (mg/dl)	11.45	11.65	11.10	10.55	0.19
Creatinine (mg/dl)	0.55	0.45	0.40	0.40	0.03
Total protein (g/dl)	3.33	4.00	4.84	4.24	0.26
Albumin (g/dl)	1.94	1.94	2.20	1.99	0.07
Globulin (g/dl)	1.40	2.06	2.64	2.25	0.22
ALT (ul)	16.00	11.50	12.00	14.00	1.35
AST (ul)	89.50	87.00	70.50	67.00	7.98
ALP (ul)	1435.45	1474.40	1548.45	1459.40	52.40

References

Adeyemi, A. (2011). Complete guide to Nigerian tourism, local culture and investment opportunities. www.cometonigeria.com.

Akintobi, O. A., Onoh, C. C., Ogele, J. O., Idowu, A. A., Ojo, O. V. and Okonko, I. O. (2013). Antimicrobial activity of *Zingiber officinale* extract against some selected pathogenic bacteria. *Natural Science*, 11(1):7-15.

Chang, K. J. and Cheong, S. H. (2008). Volatile organosulfur and nutrient compounds from garlic by cultivating areas and processing methods. *Fed. Am. Soc. Exp. Bio. J.,* 22: 1108-1112.

Chrubasik, S., Pittler, M. H. and Roufogalis, B. D. (2005). *Zingiberis rhizome*: a comprehensive review on the ginger effect and efficacy profiles. Phytomedicine, 12(9):440-449.

Cross, D. E., McDevitt, R. M., Hillman, K. and Acamovic, T. (2007). The effect of herbs and their associated essential oils on performance, dietary digestibility and gut microflora in chickens from 7 to 28 days of age. *British Poultry Science*, 48:496–506.

Ebegbulem, V. N. (2018). Haematological and biochemical indices of broiler chickens fed ginger (zingiber officinale) based diets. *Ife Journal of Agriculture,* 30 (2): 1-7.

Ebrahimnezhad, Y., Azarakhsh, V. and Salmanzadeh, M. (2014) The effects of ginger root (*zingiber officiale*) processed to different levels on growth performance, carcass characteristics and blood biochemistry parameters in broiler chickens. *Bull. Env. Pharmacol. Life Sci.,* 3 (5): 203-208.

George, O.S., Kaegon, S.G. & Igbokwe, A.A., (2015). Feed additive effects of graded levels of ginger *(Zingiber Officinale)* on serum metabolites of broilers. J. Agric. Vet. Sci. 8, 59-62. Doi: 10.9790/2380-08325962.

Herve, T., Raphaël, K. J., Ferdinand, N., Vitrice, F. T. L., Gaye, A., Outman, M. M. and Marvel, N. M. W. (2018). Growth Performance, Serum Biochemical Profile, Oxidative Status, and Fertility Traits in Male Japanese Quail Fed on Ginger (*Zingiber officinale*, Roscoe) Essential Oil. *Veterinary Medicine International*, 1-8.

John, U. E. and Emenalom, O. O. (2018). Effect of dietary garlic, ginger and their mixture onthe performance of broiler chickens. *Proc. 43rd Annual Conference of the Nigerian Society for Animal Production, FUT Owerri, March 18th-22nd, 2018,* 542-545.

Mohamed, A. B., Al-Rubaee, A. M. M. and Jalil, A. Q. (2012). Effect of Ginger (*Zingiber officinale*) on Performance and Blood Serum Parameters of Broiler. *Int. J. Poult. Sci*., 11: 143-146.

Oleforuh-Okoleh, V. U., Chukwu, G. C. and Adeolu, A. I. (2014). Effect of ground ginger and garlic on the growth performance,carcass quality and economics of production of broiler chickens. *Global J. Bio-Sci. Biotechnol*., 3: 225-229.

Puvaca, N., Glamocic, D., Levic, J., Peric, L., Stanacev, V. and Milic, D. (2013). Beneficial effects of phytoadditives in broiler nutrition. *World's Poultry Science Journal*, 69: 27-34.

Raeesi, M., Hoseini-Aliabad, A., Roofchaee, A., Zareshahneh, A. & Pirali, S. (2010). Effect of periodically use of garlic (*Allium sativum*) powder on performance and carcass characteristics of broiler chickens. *World Academy of Science, Engineering and Technology*, 44.

Shewita, R.S. and Taha, A. E. (2018). Influence of dietary supplementation of ginger powder at different levels on growth performance, haematological profiles, slaughter traits and gut morphometry of broiler chickens. S. Afr. J. Anim. Sci. 48: 997-1008.

Steiner, T. (2009). Phytogenics in animal nutrition, natural concepts to optimize gut health and performance. Nottingham University Press, Nottingham, NG11 0AX, UK. 191p.

Zhang, G. F., Yang, Z. B., Wang, Y., Yang, W. R., Jiang, S. Z. and Gai, G. S. (2009). Effects of ginger root (*Zingiber officinale*) processed to different particle sizes on growth performance, anti- oxidant status, and serum metabolites of broiler chickens. *Poult. Sci*., 88:2159-2166.