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Lipid Profiles of Grower-Finisher Broiler Chickens to Dietary Ginger

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Abstract

Study was carried out to investigate the effect of graded levels of ginger on the lipid profiles of grower-finisher chickens. 120 day-old chicks were used in the investigation. The chicks on arrival at the venue of study were first brooded for 2 weeks after which they were randomly allotted to their experimental diets. There were 30 birds/treatment with 3 replicates of 10 birds/replicate. Treatment 1 (T_1, control contained 0gram of ginger), treatment 2 (T_2, contained 4 gram of ginger), treatment 3 (T_3, contained 6 gram of ginger) and treatment 4 (T_4, contained 8 gram of ginger)/kg of diet, respectively. The birds received their respective experimental diets for 6 weeks. At the end of the last 6 weeks 3 birds from each replicate of the 4 treatments were killed by severing at their necks and blood collected into non-ethylene diamine tetra-acetic acid (EDTA) sample tubes for lipid profiles analyses. Results showed that birds of the T_1 grouphad significantly ($P < 0.05$) higher total cholesterol (TC), total glyceride (TG), low-density lipoprotein (LDL) as well as very low-density lipoprotein (VLDL) levels compared with ginger-containing diets' (T_2, T_3 and T_4) groups that had them linearly reduced; whereas, the T_2, T_3 and T_4birds linearly had significantly ($P < 0.05$) higher levels of high-density lipoproteins (HDL) compared with the T_1 group of birds. It was concluded that dietary ginger lowered TC, TG and LDL contents and simultaneously increased broiler HDL contents.

Keywords: Lipids, Contents, Ginger, and Grower-Finisher Broiler Chicken

Introduction

Broiler chickens are fast-growing species reaching market weights of about 3kg of body weight in 8 weeks. Consumers cherish poultry meat as it is recognized as 'white meat', indicating that it is not a pro-cardiovascular product (NRC, 2012) [13]. However, one of the environmental factors militating against broiler production thereby impeding its known fast growing characteristics is nutrition, especially now that the use of antibiotics in the diets of non-ruminant animals have been banned (Cromwell, 2002) [6].

Fats and oil are usually employed in poultry diets to increase their diet energy concentration (Attia *et al.* 2017) [2]. Furthermore, fat-enriched feeds increase the efficiency of the feed energy and thus animal productivity, more so as oil improves the absorption of fat-soluble vitamins, diet palatability and decreases feed dustiness. More importantly, it reduces the passage rate of feed in the gut thereby providing more time for sufficient absorption of dietary ingested nutrients (Attia *et al.* 2017) [2]. Attia *et al.* (2017) [2] also demonstrated that fatty acid profiles of muscle mirrors that of dietary profile that is capable of affecting or altering the blood levels of lipoproteins and glycerides. Lipid profile is simply a blood test that measures various lipid or fat-related parameters, particularly TC, TG, LDL, VLDL and HDL in the blood of the animal. Therefore, lipid profile can be used in assessing cardiovascular health due to lipid being highly correlated or associated with heart diseases in both humans and animals (NRC, 2012) [13]. Increased levels of blood lipids are one of the major risk factors for cardiovascular diseases (Zahra *et al.*, 2017) [16]. Therefore, ideal cardiovascular health for humans and animals represents an important opportunity to improve the prevention of cardiovascular diseases (Brian *et al.*, 2018) [4]. Ginger has been touted to improve lipid profilesof the animal (Michael and Turley, 2002) [10].

In nutrition studies, changes observed in the constituents of blood of the animal after diet ingestions, including lipid profileswhen compared to the control values can be used to explain at least in part the metabolic state of the animal, quality of feed and the health status of the animal, including meat quality (Ekenyem and Madubuike, 2006) [7]. Therefore, the objective of this study is to investigate the effects of graded levels of dietary ginger on TC, TG, LDL, VLDL and HDL in grower-finisher

broiler chickens.

Materials and Methods

Animals:120 *Agrited* day-old chicks were used in the study. The chicks on arrival at the teaching and research farm section of the Rivers State University where the study was conducted were first brooded to condition them to their new environment for 2 weeks. After brooding, the birds were randomly assigned to 4 dietary treatments.Animals' pens were thoroughly cleaned and allowed to dry before introducing the animals to their individual treatment pens. Animals received their respective experimental diets for 6 weeks. Water was provided *ad libitum*.

Experimental Diets:The experimental diets fed to the birds in the last 4 weeks were similar in all nutrients except their dietary ginger concentrations as: Treatment 1 (T_1, control diet,contained 0 gram of ginger), treatment 2 (T_2, contained 4 gram of ginger), treatment 3 (T_3, contained 6 gram of ginger) and treatment 4 (T_4, contained 8 gram of ginger)/kg of diet, respectively. There were 30 birds/treatment with 3 replicates of 10 birds/replicate.

Blood Sample Collection: At the end of the last 6 weeks of receiving their experimental diets,9 birds consisting of 3 birds from each replicate were slaughtered by severing their necks with a sharp knife and blood collected into non-EDTA sample tubes for lipid profiles analyses.Lipids were analyzed according to the method of Nauck *et al*. (2002) [12].

Experimental Design and Statistical Analysis: The study was carried out as a completely randomized design (CRD). Data were subjected to analysis of variance (ANOVA) using general linear model (GLM) procedure of SAS. Treatment means were compared using Tukey's test. Because CRD was used, the model was: $Y_{ij} = \mu + X_i + E_{ij}$; where Y_{ij} = individual observation of the treatment, μ = population mean, X_i= effect of the i^{th}(i = 1, 2, 3,4) treatment and E_{ij}= the error term. An *α-level* of *0.05* was used for all statistical comparisons to represent significance.

Results

The results of the feeding of ginger-based diets on grower-finisher broiler chickens'lipid profiles are shown in Table 1.

Table 1: Lipid Profiles of Grower-Finisher Broiler Chickens Fed Ginger-Based Diets

	Diets				
Parameter	T_1	T_2	T_3	T_4	SEM
TC (mmo/L)	2.99[a]	2.48[b]	2.12[c]	2.07[c]	0.03
TG (mmo/L)	1.90[a]	1.70[b]	1.13[c]	1.11[c]	0.01
LDL (mmo/L)	1.90[a]	1.69[b]	1.36[c]	1.11[d]	0.01
VLDL (mmo/L)	0.82[a]	0.77[b]	0.65[c]	0.45[d]	0.00
HDL (mmo/L)	1.11[d]	1.51[c]	1.72[b]	1.91[a]	0.01

[a,b,c,d]Means within the same row with different superscripts are significantly ($P < 0.05$) different**KEYS**: TC = total cholesterol; TG = triglycerides; LDL = low density lipoprotein; VLDL = very low density lipoprotein; HDL = high density lipoprotein; SEM = standard error of the mean

All birds in the 4 dietary treatment groups readily consumed their diets and grew throughout the study period suggesting that ginger is not appetite-depressing. However, the ingestion of dietary ginger demonstrated profound effects on the lipid profiles of the birds as evidenced by the quantitative variations in the serum lipid contents of the birds across the different treatment groups. Birds in the T_1 group significantly ($P < 0.05$) had the highest levels of TC after which it significantly ($P < 0.05$) linearly reduced with the T_4 group of birds having the lowest TC levels.The levels of TG, LDL and VLDL mirrored the pattern of TC except HDL that the T_4 birds significantly ($P < 0.05$) had the highest levels whereas the T_1 birds significantly ($P < 0.05$) had the lowest levels compared with other ginger-positive treatment groups. These results demonstrate that ginger significantly reduced TC, TG, LDL and VLDL serum levels and simultaneously significantly increased that of HDL.

Discussion

Lipid profile is a blood test that measures the various lipid parameters, such as TC, TG, LDL, VLDL and HDL. This test is highly correlated or important in assessing cardiovascular health due to its association with heart diseases in humans and animals.High levels of blood lipids is one of the major risk factors for cardiovascular diseases (Zahra *et al.*, 2017) [16]. Conversely, humans and animals with ideal cardiovascular health have a very low lifetime risk of cardiovascular disease; suggesting that ideal cardiovascular health represents an important opportunity in improving or preventing cardiovascular disease (Brian *et al.*, 2018) [4].

It has been reported globally that a low plasma level of HDL is a strong predictor of coronary heart disease (CHD). This is due to the fact that HDL aids in removing excess cholesterol from the bloodstream leading to a beneficial effect for heart health (Hajjar and Gotto, 1990) [9]. Furthermore, HDL has a direct beneficial effect on the arterial wall. Metabolically, HDL induces the removal of cholesterol from cells, including those of atherosclerotic plaques (Frank, 2002) [8]. Thus, it is not a gainsaying to state that CHD develops as a result of high plasma levels of LDL as well as LDL modifications, such as its oxidation.

The medicinal values of plants have been identified as one of the major strategies in dealing with CHD as a result of some inherent bioactive compounds in the plants (Chinedu and Jivini, 2019) [5]. Ginger is one of such plants because of its various bioactive compounds, including *gingerols* and *shogaols* (Shukla and Singh, 2007) [15]. The major objective of this current study was to investigate the effects of dietary ginger on the lipid profiles of grower-finisher broilers. In this study, dietary ginger intake significantly reduced serum levels of TC, TG, LDL and VLDL and simultaneously increased that of HDL. These findings are in agreement with the data of Bhandari *et al.* (2011) [3] and those of Mohammadi *et al.* (2012) [11]. These authors attributed this effect of ginger to the bioactive compounds namely *gingerols* and *shogaols* found in ginger.

Again, the findings of this study are in agreement with of those of *Reza et al.* (2008) [14] that found that ginger reduced TC, TG and increased HDL levels by its anti-inflammatory and antioxidant properties thereby improved lipid profile. Furthermore, HDL has special features or plays some crucial roles in the protection against atherosclerosis, such as inhibiting lipid oxidation and plaque growth (Arablou *et al.*, 2014) [1]. Overall, ginger was found to improve lipid profile in this study by improvingsignificantly HDL levels and significantly reduced those of TC, TG, LDL and VLDL, respectively.

Conclusion

Consumption of ginger could be beneficial in the attenuation of atherosclerosis development as it reduced serum contents

of TC, TG, LDL and VLDL. Reduction in these lipids would lead to a reduced cellular cholesterol accumulation; the hall mark of atherosclerosis. This is further supported by the finding that ginger simultaneously increased HDL serum contents.

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