MEAT LIPID PROFILE OF BROILER CHICKENS ADMINISTERED AQUEOUS BAMBOO (Bambusa vulgaris) LEAF EXTRACT SYNTHESIZED SILVER NANO PARTICLES IN DRINKING WATER.

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ABSTRACT

This study investigated the effect of aqueous bamboo leaf extract (ABLE) synthesised silver nano particles (AgNPs) in drinking water on the meat lipid profile of broiler chickens. One hundred- and twenty-eight-day-old Ross broiler chicks were used for the experiment. The birds were allocated to four treatments in a completely randomized design. Each treatment had four replicates with eight birds each. The treatments were a control (ordinary water (T1)), antibiotics (T2), 15ml/L of ABLE AgNPs (T3) and 30ml/L of ABLE AgNPs (T4). Meat samples were collected from three birds per treatments for the meat lipid profile analysis. All data collected were subjected to one-way analysis of variance using SAS (2009) and significant means separated using Tukey test. The meat total cholesterol (TC) for broilers given antibiotics (97.60 mg/dl) and those given ABLE synthesized AgNPs at 15ml/L (94.20 mg/dl) was lower (P<0.05) than those in the control group. Triglyceride (TG) reduced for broilers administered ABLE synthesized AgNPs at 30ml/L (72.30 mg/dl) compared to those in the control and antibiotics group (P<0.05). The low-density lipoprotein (LDL) was lower (P<0.05) for broilers given ABLE synthesized AgNPs at 15ml/L and 30ml/L than those of the control group. Lower (P<0.05) very low-density lipoprotein (VLDL) was observed for broilers given ABLE synthesized AgNPs at 15ml/L compared to those in the control and antibiotics group. It was concluded that the oral administration of ABLE synthesised AgNPs for broilers at 15ml/L reduces broiler's meat TC, LDL and VLDL. Broiler's meat triglyceride can be reduced with oral administration of ABLE synthesised AgNPs for broilers at 30ml/L

Keywords: Broiler, bamboo leaf extract, silver nano particles, meat, lipid profile

INTRODUCTION

Antibiotics have been engaged to tackle bacterial infections thereby increasing feed conversion rate to meat and promoting growth (Emami *et al*., 2012). The continuous use of antibiotics as growth promotants in food producing animals including poultry birds raised intensively has resulted in the generation of antibiotics resistant strains of bacteria (Manyi-Loh *et al*., 2018). In addition, the indiscriminate use of antibiotics has resulted in human health issues due to deposits of antimicrobial residues in meat (Darwish *et al*., 2013). This development has intensified the search for suitable alternatives that can serve therapeutic purpose without harmful residual effect. Phytobiotics also known as herbs can serve as an alternative to antibiotics due to the possession of secondary metabolites such as isoprene, flavonoids and glucosinolates derivatives that supports detoxification and exhibit antioxidant properties (Krauze *et al*., 2021). Bamboo belongs to the class of phytobiotic plants which the leaves are rich in bioactive molecules such as flavonoids (Cheng *et al*., 2023). Bamboo leaf extract has been reported to help improve growth performance, antioxidant status, cholesterol metabolism and reduced the risk of atherosclerosis (Sunga *et al*., 2013). The hydroxyl groups present in the flavonoids interacts with the silver ions, causing its reduction and yielding silver nano particles (AgNPs) (Nguyen *et al.,* 2023). Nanoparticles are novel alternative compounds recognised for their abilities to penetrate intact physiologic barriers and far-reaching molecular levels (Zhang *et al*., 2010). Existing methods for nanoparticles synthesis involve the use of harmful chemicals which necessitates the advocacy for green synthesis. Phenols and flavonoids inherent in bamboo leaves, can serve as an effective reducing agent enabling biosynthesis of AgNPs from its extract which exhibits antimicrobial properties against sample bacteria cultures (Yasin *et al*., 2013). Therefore, this study seeks to determine the effect of silver nano particles synthesized with bamboo leaf extracts on meat lipid profile of broilers.

MATERIALS AND METHODS

Experimental site

The study was carried out at the Poultry Unit of the Teaching and Research Farm, School of Agriculture, Lagos State University, Epe Campus, Lagos, Nigeria. The study area has an average temperature of 26.30^{o}C and rainfall of about 1990mm per annum (https: //en.climate-data.org/africa/nigeria/lagos/epe-46640/).

Preparation of bamboo leaf extract synthesised silver nano-particles

The bamboo leaves were harvested in the premises of the School of Agriculture, Epe campus, from existing bamboo plants. The leaves were thoroughly washed to remove adhering soil particles. The leaves were sun dried and then cut into small pieces. 50g of the leaves was placed in 1L of water and allowed to boil for 30 minutes. After boiling, it was allowed to cool and macerate for 24 hours after which it was collected using Whatsmann filter paper while the extract was collected and stored under room temperature. Silver nanoparticles was synthesized according to the method described by Jayarambabu *et al*. (2023) and simply modified. The silver nanoparticles were prepared by mixing 0.5mM silver nitrates in 100ml of distilled water. 100ml of the extract was added to the prepared silver nitrate and stirred for 1 hour at the temperature of 60^{o}C. The change in colour of the mixture was observed for the reduction effect of the bamboo leaf extract.

Animals' management, design and treatment

Disinfection of the poultry pen was carried out before the arrival of the chicks while anti-stress and multivitamins were administered after arrival. The birds were raised on wood shavings as bedding materials. Feeding and watering troughs were made available and supplementary heat was provided using charcoal pots. All vaccination programs were maintained. One hundred and twenty-eight Ross 308 broiler chicks were purchased from a reputable hatchery and were allotted into four dietary treatments in a completely randomized design. Each treatment was replicated four times and each contained eight birds. The treatments include a control (ordinary water), the 2nd treatment had commercial antibiotics (Dee-Doxygen (contains active ingredient Doxycycline HCL and Gentamycin Sulphate)) included at the recommended dosage (1g/3 litres of H_20), 3rd and 4th treatments had BLE synthesized silver nanoparticles at 15ml/L and 30ml/L respectively. The birds were raised for six weeks (three weeks each for starter and finisher phase). Diet was formulated for each phase (Table 1) to meet the nutrient requirement of the birds according to the nutrient requirement guide (Ross Nutrition Specification, 2016).

Table 1: Gross composition of experimental diet for starter and finisher

Starter		Finisher	
Ingredients	**Quantity (%)**	**Ingredients**	**Quantity (%)**
Maize	55.00	Maize	60.00
Soybean meal	31.00	Soybean meal	26.00
Fish meal	2.00	Limestone	2.50
Limestone	2.00	Dicalcium phosphate	2.50
Dicalcium phosphate	2.00	Salt	0.25
Salt	0.25	Lysine	0.25
Lysine	0.25	Methionine	0.25
Methionine	0.25	Vitamin/mineral premix	0.25
Vitamin/mineral premix	0.25	Wheat offal	8.00
Wheat offal	7.00	**Total**	**100**
Total	**100**		
Calculated nutrient		**Calculated nutrient**	
Metabolizable energy (kcal/kg)	2946.45	Metabolizable energy (kcal/kg)	3060.00
Crude protein (%)	22.00	Crude protein (%)	20.56
Crude fibre (%)	2.20	Crude fibre (%)	3.42
Ether extract (%)	3.05	Ether extract (%)	3.12
Calcium (%)	1.15	Calcium (%)	1.26
Phosphorus (%)	0.58	Phosphorus (%)	0.63

*Starter premix: vit. A 10,000,000 IU, vit. D_3 2,500,000 IU, vit. E 23,000 mg, vit. K_3 2,000 (mg), vit. B_1 ,800 (mg), vit. B_2 5,500 (mg), niacin 27,500 (mg), pantothenic acid 7,500 (mg), vit. D_6 3,000 (mg), vit. B_{12} (15mg), folic acid (750mg), biotin H_2 60mg, chlorine chloride 300,000mg, cobalt 200mg, copper 3,000mg, iodine 1,000mg, iron 20,000mg, manganese 40,000mg, selenium 200mg, zinc 30,000mg.

*Finisher phase: vit. A 8,500,000 IU, vit. D_3 1,500,000 IU, vit. E 10,000mg, vit. K_3 1,500mg, vit. B_1 1,600mg, vit. B_2 4,000mg, niacin 20,000mg, pantothenic acid 5,000mg, vit. D_6 1,500mg, vit. B_{12} 10mg, folic acid 500mg, biotin H_2 750mg, chlorine chloride 175,000mg cobalt 200mg, copper 3,000mg, iodine 1,000mg, iron 20,000mg, manganese 40,000mg, selenium 200mg, zinc 30,000mg.

Meat collection for determination of meat lipid profile

At the end of the sixth week, one carcass per replicate were dissected and samples from the breast meat were collected. The samples were homogenized using a blender with horizontal blades and samples were frozen and stored in freezer at -2^{0}C. Fat was extracted from the samples with ethyl ether using Soxhlet Apparatus (AOAC 2005). Then the lipid

profiles (total cholesterol (TC), triglyceride (TG), high density lipoprotein (HDL), Low density lipoprotein (LDL) and very low-density lipoprotein (VLDL)) of the samples were determined spectrometrically using commercial kits.

Statistical analysis

Data collected was subjected to one-way analysis of variance using SAS (2009). The significant means were separated using Tukey's test of the same software. Significant difference was considered at $P<0.05$.

RESULTS AND DISCUSSION

Meat lipid profile of broiler chickens administered ABLE synthesized AgNPs in drinking water in drinking water.

Table 2 shows the meat lipid profile of broilers administered ABLE synthesized AgNPs in drinking water. Broilers administered ABLE AgNPs at 15ml/L and those given antibiotics had reduced TC compared to the control ($P<0.05$). The reduction in TC observed for broilers in 15ml/L ABLE synthesised AgNPs group could be as a result of BLE used in the synthesis of AgNPs which reduces lipid accumulation. This is supported by the observation of Kwon *et al.* (2017) who reported that BLE inhibit adipogenesis by regulating the adipocytes formation resulting to hindered lipid accumulation in tissues. This is also in agreement with the report of Yang *et al*. (2017) who stated that bamboo leaf extract exhibits antiadipogenic properties. The TG content in meat reduced for broilers administered AgNPs at 30ml/L but it increased for those in the control group and those given antibiotics while those administered AgNPs at 15ml/L had intermediate TG content ($P<0.05$). This could be associated with the impact of ABLE synthesised AgNPs in the functionality of the liver thereby regulating the production, storage, release and distribution of lipids in the blood (Zaefarian *et al.,* 2019).

The HDL content of the meat of broilers in the antibiotic group and those in the ABLE synthesised AgNps at 15ml/L group was lower ($P<0.05$) than that of the control. However, broilers given ABLE synthesised AgNps at 30ml/L had similar HDL content to those of the control group. This observation suggests that despite the reduction effect of ABLE synthesised AgNps on TC and TG it does not increase HDL content. The administration of ABLE synthesised AgNPs at 15 and 30ml/L for broilers resulted in lower ($P<0.05$) LDL compared to those given ordinary water. The LDL is implicated for the occurrence of sudden deaths in rapid growing animal species, including broilers and pigs (Fan *et al.,* 2021). This finding implies that oral administration of ABLE synthesised AgNPs is potent in reducing the level of circulating and stored LDL thereby reducing fat content in broiler meat. The VLDL levels increased for broilers in the control group and those given antibiotics but it reduced for those administered AgNPs at 15ml/L while those administered AgNPs at 30ml/L had intermediate VLDL content ($P<0.05$). This indicates that ABLE synthesised AgNPs administration is effective in preventing blockage of blood vessels that arises from accumulation of VLDL. The bad cholesterol is known to form plaques which accumulates causing narrowing of blood transport channels (arteries) which impedes blood circulation (Huff *et al.,* 2023). The findings from this study implies that the use ABLE synthesised AgNPs can prevent the broilers from cardiovascular attack and in addition yields broiler meat healthy for human consumption

Table 2: Meat lipid profile of broiler chickens administered ABLE synthesized AgNPs in drinking water

Parameters	Control	Antibiotics	AgNPs(15ml/L)	AgNPs (30ml/L)	SEM	P-value
TC (mg/dl)	106.83^{a}	97.60^{b}	94.20^{b}	101.17^{ab}	1.61	0.007
TG (mg/dl)	105.87^{a}	104.27^{a}	86.84^{ab}	72.30^{b}	5.05	0.023
HDL (mg/dl)	53.40^{a}	48.80^{b}	47.07^{b}	50.57^{ab}	0.81	0.007
LDL (mg/dl)	32.93^{a}	28.60^{ab}	23.17^{b}	23.83^{b}	1.34	0.004
VLDL (mg/dl)	23.87^{a}	24.60^{a}	17.05^{b}	19.07^{ab}	1.13	0.022

^{ab} Means on the same row with different superscript are significantly different ($P<0.05$)

SEM: Pooled standard error of mean, AgNPs: Sliver nano particles, TC: Total Cholesterol, TG: Triglycerides, HDL: High density lipoprotein, LDL: Low density lipoprotein, VLDL: Very low density lipoprotein

CONCLUSION

The oral administration of ABLE synthesised AgNPs to broilers at 15ml/L reduced TC and VLDL in the meat of broilers. The LDL in meat of broilers can be reduced with the inclusion of ABLE synthesised AgNPs in the drinking water of broilers at 15ml/L and 30ml/L

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