
IMPACT OF TURMERIC-GARLIC-GINGER POWDER AND THEIR COMBINATIONS ON CHOLESTEROL, TRIACYLGLYCEROL, HIGH DENSITY LIPOPROTEINS AND LOW DENSITY LIPOPROTEINS OF RABBIT MEAT

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ABSTRACT

The study was conducted to evaluate the effect of turmeric (Tr), garlic (Ga), ginger (Gn) powder and their combinations on cholesterol, triacylglycerol, high density and low density lipoproteins of rabbit meat. Forty-eight weaner rabbits (8 weeks) were randomly allotted into eight dietary groups designated T1 to T8 in a completely randomized design. T1 contained 0% phytobiotic, T2, T3 and T4 contained 0.6% Tr, Ga and Gn powder respectively, T5, T6 and T7 contained combination of 0.3% each of Tr+Ga, Tr+Gn and Ga+Gn while T8 contained 0.2% each of the three. Data were collected on cholesterol, triacylglycerol, HDL and LDL. There was an increase in cholesterol concentration associated with feeding phytobiotic blends in 3gGaGn (65.40 mg/g) when compared to Control and 6gTr meat samples where a reduced values of 37.70 and 44.53 were recorded. However, meat samples from 3gTrGa had elevated triacylglycerol of 183.30 while Control, 6gTr, 6gGa and 6gGn had comparable reduced values (66.87, 107.57, 100.70 and 110.77 respectively). Data pooled for HDL showed significant ($p < 0.01$) increase in 3gTrGa (40.65) and 3gGaGn (41.10) while 6gTr and 6gGn groups recorded minimal value of 25.27 and 27.20 HDL respectively. Elevated LDL concentration was recorded in 3gTrGa (23.27mg/g) as compared to Control (9.87), 6gTr (10.87) and 3gTrGn (10.47) where a comparable lower LDL were recorded. It was concluded that dietary phytobiotics improved rabbit meat quality and 6g turmeric is recommended for lower meat cholesterol while combinations (turmeric and or garlic) at 3g will increase the nutritional composition, evident with higher HDL.

Key words: Rabbit meat, Cholesterol, Turmeric, Garlic, Ginger

INTRODUCTION

For many years, synthetic antioxidants (SA) are being used as supplements in meat processing for preservation and improvement (Jayathilakan *et al.*, 2007). Recently, their usage has fallen under scrutiny due to their potential toxicological and deleterious effects on live (Naveena *et al.*, 2008) and traces of drug residues in meat (Issa and Omer, 2012) which subsequently necessitates many countries to minimize or prohibit their use. Phytobiotics are plant derived products added to the feed in order to improve performance of livestock and quality of animal product. (Harris *et al.*, 2001; Okanlawon *et al.*, 2020).

The use of turmeric, garlic and ginger have been studied for their antioxidant and antimicrobial properties in livestock diets and in food preservation (Jo *et al.*, 2003; Mancini, *et al.* 2017), however, there is dearth of information on the cumulative effects of these phytobiotics on finished meat products when fed to meat animals and owing to variation in the composition of their constituents, there is need for combination to enhance stability, establish complementary action for optimal improvement of physico-chemical properties and shelf life of meat and meat products when used in powdered form either singly or in blends. Moreover, there is also a need to establish convincing effects of the active compounds, the alkaloids, phenolic compounds and aromatic oils on the lipid profile and characteristic flavor of rabbit meat.

Materials and methods

The meat analysis was carried out at the meat processing laboratory of the Department of Animal Production and Health, Federal University of Agriculture, Abeokuta. Forty-eight 8 weeks old weaner rabbits were used for the study and were randomly allotted into eight (8) dietary groups designated T1 to T8 in a completely randomized design (CRD) with each treatment having 3 replicates of two (2) rabbits each. T1 (control) is with 0% phytobiotic, T2, T3 and T4 contained 0.6% each of turmeric (Tr), garlic (Ga) and ginger (Gn) powder respectively while T5, T6 and T7 contained combination of

0.3% each of Tr+Ga, Tr+Gn and Ga+Gn while T8 contained a blend of 0.2% each of the three test ingredients (Tr, Ga and Gn). Phytobiotic powders were added at different graded levels as treated diets while the feeding trial lasted 12 weeks.

Determination of Rabbit meat Lipoprotein (Cholesterol, triglycerol, HDL and LDL) Profile

For each sample, three grams (3g) were saponified and subjected to high-performance liquid chromatography analysis (HPLC). A lipid extraction procedure was used to analyze cholesterol. Thigh muscle composite paste was made using a 1:1 (v/v) combination of methanol and chloroform in a specified quantity. After filtering and rinsing the resultant paste solvent combination with further mixed homogenate, it was left to stand for five minutes. After equilibrating the filtered homogenate to exclude non-lipid components, the aqueous layer was treated with 2% (0.32M) w/v KCL solution. After centrifuging the filtrate, the lipid extract was decanted. Chloroform was subsequently added to the extract to get it up to a final volume. The resultant decanted mixture was subjected to AOAC (2005) HPLC analytical protocols to determine the levels of cholesterol, triglycerol, and high and low density lipoprotein. Data collected were analysed using analysis of variance (ANOVA) as contained in SAS (2002). Significant means were separated using Duncan Multiple Range Test as contained in SAS (2002).

RESULTS AND DISCUSSION

Table 1 show the effect of phytobiotic additive on lipid profile (Cholesterol, Triacylglycerol, High and Low Density Lipoproteins) of the experimental rabbit meat. There was an increase in cholesterol concentration associated with feeding phytobiotic blends in 3gGaGn (65.40 mg/g) group when compared to Control and 6gTr meat samples where a reduced values of 37.70 and 44.53 meat cholesterol levels were recorded. However, meat samples from rabbit group fed 3gTrGa had elevated volume of triacylglycerol of 183.30 while Control, 6gTr, 6gGa and 6gGn had comparable reduced values of 66.87, 107.57, 100.70 and 110.77 respectively ($p > 0.01$). When data was pooled for HDL, it showed a significant ($p < 0.01$) increase in 3gTrGa (40.65) and 3gGaGn (41.10) groups while meat samples from 6gTr and 6gGn groups recorded the minimal value of 25.27 and 27.20 HDL respectively. Moreover, there was a significant ($p < 0.05$) increase in LDL concentration in 3gTrGa meat sample group (23.27mg/g) as compared to Control (9.87), 6gTr (10.87) and 3gTrGn (10.47) where a comparable lower concentration of LDL were recorded. The decrease in the level of cholesterol when the three phytobiotics were incorporated and at reduced level (2g/kg) could indicate that the blends plays a role in cholesterol metabolism in rabbits and subsequently influenced the meat product. Taken further, it means that inclusion of the three phytobiotics in diets may have reduced the cholesterol content of rabbit meat since research abound that phytogetic feed additives inclusion in diet could minimize the cholesterol content of meat from animals such as rabbit meat and subsequently influenced the levels in its product. Furthermore, garlic powder can facilitate activity of enzymes which are involved in conversion of cholesterol to bilious acids and subsequently, resulted in less cholesterol in the carcass (Chowdhury *et al.*, 2002). According to Mesa *et al.* (2003) oral administration of a nutritional dose of *Curcuma longa* extracts or powder reduces the susceptibility to oxidation of erythrocyte and liver microsome membranes in vitro preventing the adverse effects caused by a diet high in fat and cholesterol in blood and liver during the development of atherosclerosis. Turmeric lowers blood levels of cholesterol and triglycerides, lessens the vulnerability of low-density lipoproteins (LDL) to lipid peroxidation, and prevents platelet aggregation, according to Ahmadi (2010). Inclusion of 6g garlic (6gGa) resulted in healthier high density lipoproteins (HDL) compare to others despite the highest total cholesterol recorded in the sausage batch. This improved HDL is then attributed to the cholesterol lowering ability of allicin, the principal bioactive compound in garlic that is reported to be able to influence both the serum and meat cholesterol when fed to animal (Prasad *et al.*, 2009). Garlic contains significant quantity of insulins, sulphur and fructooligosaccharides and its biological responses are reported to include reduction of risk factors of cardiovascular diseases, stimulation of immune function, detoxification, and cholesterol-lowering properties (Amagase *et al.*, 2001). It is capable of decreasing and retarding certain diseases caused by immune dysfunction, Controls oxidation of low density lipoprotein as well as bio activation of carcinogens by its S-allylcysteine content (Ahmed *et al.*, 2001). This result is in line with the report of Shang *et al.* (2019) that the cholesterol-lowering effect of garlic in human and animals is due to the presence allicin as well as sulphur containing bioactive compounds in its homogenates (Chowdhury *et*

al., 2002). Although, Lim *et al.*, 2013, reported that the level of HDL cholesterol was not influenced by feeding garlic powder at 1, 3, and 5%, it is still evident in this study but the effect was amplified at 6g/kg and this gives credence to this research study.

Table 1: Effect of diets on Cholesterol, Triacylglycerol, High and Low Density Lipoproteins (HDL and LDL) of Rabbit Meat

| Parameters (mg/100g) | Experimental Diets | | | | | | | | SEM | P-value |
|----------------------|---------------------|---------------------|----------------------|----------------------|---------------------|----------------------|---------------------|----------------------|------|---------|
| | Control | 6gTr | 6gGa | 6gGn | 3gTrGa | 3gTrGn | 3gGa/Gn | 2gTr/Ga/Gn | | |
| Cholesterol | 37.70 ^d | 44.53 ^d | 56.77 ^{bc} | 57.20 ^{abc} | 64.37 ^{ab} | 57.20 ^{abc} | 65.40 ^a | 53.27 ^c | 2.07 | 0.000** |
| Triacylglycerol | 88.87 ^c | 107.57 ^c | 100.70 ^c | 110.77 ^c | 183.30 ^a | 141.10 ^b | 152.80 ^b | 134.77 ^b | 6.37 | 0.000** |
| HDL | 27.90 ^{cd} | 25.27 ^d | 29.50 ^{bed} | 27.20 ^d | 40.65 ^a | 36.30 ^{ab} | 41.10 ^a | 35.67 ^{abc} | 2.17 | 0.000** |
| LDL | 9.87 ^d | 10.87 ^d | 11.90 ^{cd} | 16.87 ^c | 23.27 ^a | 10.47 ^d | 21.20 ^{ab} | 18.87 ^{ab} | 1.24 | 0.000** |

a,b,c,d, Means in the same row with different superscripts differ significantly (0<0.05)

** : Significant difference at 1% (P<0.01)

Control: Basal diets, 6gTr- Basal diet + 6g of turmeric powder, 6gGa- Basal diet + 6g garlic powder, 6gGn- Basal diet + 6g ginger powder, 3gTrGa- Basal diet + 3g each of turmeric and garlic powder, 3gTrGn- Basal diet + 3g each of turmeric and ginger powder, 3gGaGn- Basal diet + 3g each of ginger and garlic powder, 2gTrGaGn- Basal diet + 2g of turmeric, ginger and garlic powder. HDL: High Density Lipoproteins; LDL: Low Density Lipoproteins

CONCLUSION AND RECOMMENDATION

Feeding diets containing turmeric, garlic and ginger improve the meat quality. It is therefore recommended that inclusion of 6g of turmeric will lower meat cholesterol content while turmeric and or ginger at 3g will increase the nutritional composition of rabbit meat which is evident with higher HDL.

3g and 6g of additive... is it per kg diet? It is not explained in the conclusion. I think the inclusion levels of the additive in the diets should be maintained 100kg of diet???

REFERENCES

- Amagase, H., Petesch, B.L., Matsuura, H., Kasuga, S. and Itakura, Y.Y. (2001). Intake of garlic its Bioactive component. *Journal of Nutrition* 131(3s):955S-62S. DOI: 10.1093/jn/131.3.955S.
- Ahmed, M.M.M., El Hag, F.M., Wahab, F.S. and Salih, S.F. (2001). Feeding strategies during dry summer for lactating desert goat in a rain fed area under tropical conditions. *Small Rumin. Res.*, 39:161-166. Doi. Org/10.1016/50921-4488 (00)00185-1.
- Chowdhury, S.R., Chowdhury, S.D. and Smith, T.K. (2002). Effects of dietary garlic on cholesterol methabolism in laying hens December 2002. *Poultry science* 81(12):1856-62 DOI: 10.1093/ps/81. 12. 1856.
- Harris, J. C., Cottrell, S., Plummer, S. and Liloyd, D. (2001). Antimicrobial properties *Allium sativum* (garlic). *Application of Microbiology and Biotechnology*. 57:282-286.
- Jayathilakan, K., Gopal, K.S., Kerisha, R. and Amarinder, S.B. (2007). Antioxidant potential of synthetic and natural antioxidants and its effect on warmed-over avour in different species of meat. *Food chemistry*. 105(3):908-916.
- Joo, S. T., Kim, G. D., Hwang Y. H. and Ryu, Y. C. (2013). Control of fresh meat quality through manipulation of muscle fiber characteristics. *Meat Science*, 95(4), pp. 828-36.
- Lima, D. M., Rangel, A., Urbano, S., Mitzi, G. and Moreno, G.M. (2013). Oxidação lipídica da carne ovina. *Acta Veterinaria Brasilica*, 7(1), 14-28.
- Mancini, S., Preziuso, G., Fratini, F., Torracca, B., Nuvoloni, R., Dal Bosco, A. and Paci, G. (2017). Qualitative improvement of rabbit burgers using *Zingiber officinale* Roscoe powder. *World Rabbit Sci.* 2017, 25, 367.
- Naveena, B.M., Sen, A.R., Ambrose, K. and Singh, D.B. (2008). Antioxidant activity pomegranate ring powder extract in cooked chicken patties. *International journal of food science and technology*. 44(10): 1807-1812. Doi: 10.1111/j.1365-2621.2007.01708.x
- Okanlawon, E.O., Bello, K.O., Akinola, O.S., Oluwatosin, O.O., Irekhore and Ademolue, R.O. (2020a). Evaluation of Growth, Reproductive Performance And Economic Benefits Of Rabbits

Fed Diets Supplemented With Turmeric (*Curcuma Longa*) Powder. Egyptian Poultry Science Journal.

Prasad, R., Rose, M.K., Vermani, M., Garg, S.L. and Puri, J.P. (2009). Lipid profile of chicken (*Gallus domesticus*) in response to dietary supplementation of garlic (*Allium sativum*).

Shang, A., Cao, S.-Y., Xu, X.Y., Gan, R.Y., Tang, G.Y., Corke, H., Mavumengwana, V. and Li, H.B. 2019. Bioactive Compounds and Biological Functions of Garlic (*Allium sativum* L.). *Foods* 2019, 8, 246.

SAS. (2002). SAS/STAT Software: Changes and Enhancements through Release 8.1, SASInstitute Inc., Cary, NC.