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**Research Paper**

# Effects of Black Pepper, Tumeric, Corriander and Their Combination as Supplementary Antioxidants on Haematological, Serum Biochemical Indices and Sensory Evaluation of Broiler Turkeys.

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***Abstract***
*A study was conducted to evaluate the effects of black pepper, tumeric, corriander and their combination on haematological and serum biochemical indices of broiler turkeys. A total of sixty (60) two weeks old poults were used for the study. The birds were assigned in a completely randomized design (CRD) to five dietary treatments and three replicates. Turkeys were fed by standard diet from 2nd to the 16th week with a blend of supplementary antioxidants from black pepper, tumeric, corriander and their combination in dosage 1 kg per ton of feed. Turkeys were housed in group on deep litter. The experimental study lasted sixteen weeks. Packed cell volume (PCV), haemoglobin level (Hb) and total protein (Tp), white blood cells (WBC) and red blood cells (RBC) according to the methods described by Lamb (1991) at the Haematological Laboratory of Veterinary Teaching Hospital, Ahmadu Bello University, Zaria), while serum biochemical indices at the Chemical Pathology Laboratory, Ahmadu Bello University Teaching Hospital, Shika - Zaria. The PCV and haemoglobin values obtained for turkeys fed T2, T3 and T4 were significantly higher among dietary treatments. The RBC values obtained for birds were not significantly different across dietary treatments. The WBCs of birds fed diet 1 to 4 were not different. However, the values were significantly higher than those fed diet 5 (8.50). Total protein values obtained for birds fed diets 2 to 5 were similar and significantly higher than those fed control diet. The serum albumin showed a pattern with similar and significantly higher values obtained for birds fed diets 3 and 5. Serum globulin values obtained followed a similar trend, while the least value (1.60g/dl) was obtained for birds fed T2 diets. The serum cholesterol of turkey birds fed diets 2 and 3 were similar and significantly higher than those fed other diets, which were also similar. Samples of breast and thigh muscles for nutritional sensory evaluation were collected during turkey's dissection (3 samples per treatment). The observed results from the hedonic scale revealed that there were significant differences in most of the sensory evaluation parameters measured. The taste, flavour, tenderness, juiciness and acceptability were significantly better for birds fed T4 diet. The colour was not significant across dietary treatments. Black pepper, tumeric, corriander and their combination improved the haematological, serum biochemical indices and sensory characteristics of turkey meat.*

***Keywords****: Antioxidant, haematological, serum, sensory, phytogenic, turkeys*

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## I. Introduction

Turkey is one of the leanest types of poultry and a good source of protein and minerals. However, its production and consumption of its meat is still low, particularly in Nigeria, despite that there is neither religious bias nor any discriminatory legislation against its production across the globe. Therefore, its intensive production with supplementation of phytogenic as supplementary antioxidants cannot be over-emphasized for sustainable healthy meat in the diets of consumers. Presently, there is an increasing of interest to find non-synthetic alternatives for antibiotics. Dietary antibiotic growth promoters have played a key role in animal and poultry production. However, most of these antibiotics have been banned in many countries, because of public

health concern regarding their residues in the animal products and the development of antibiotic resistance in bacteria and due to the reasons like alteration of natural gut microbiota and drug resistance in bacteria and humans (Lee et al., 2004). As a result, to replace them without adversely affecting the performance of birds, natural growth promoters such as prebiotics, probiotics, synbiotics, enzymes, plant extracts, etc., can be used to feed the broilers (Borazjanizadeh et al., 2011).

Phytogenic feed additives such as herbs and spices are commonly incorporated into the diets of agricultural livestock, particularly swine and poultry, to improve flavor and palatability, therefore enhancing productive performance. Herbs and spices are well identified to exert potent antimicrobial properties *in vitro* against various pathogens, and as alternative feeding strategy to replace antibiotic growth promoters. However, knowledge regarding their modes of action and aspects of their application is still limited. Phytogenics are derived from herbs, spices or aromatic plants and have shown antimicrobial, antifungal, antiviral, antioxidant and sedative properties (Hashemi and Davoodi, 2010). Several researchers attributed the positive effects of plant extracts on nutrient digestibility to the appetite and digestion-stimulating properties and antimicrobial effects. Therefore they may exert multiple functions in the animal body. Using phytogenic or herbal plants containing essential oils in poultry farms has developed with successful results (Hashemi and Davoodi, 2010). Besides, immune enhancing, antimicrobial, and performance enhancing effects, phytogenics also have anti-oxidant property. Some other common herbs, spices and fruits that have antioxidant property are ginger, turmeric, garlic, plum, pine bark extract, berries, pomegranate, caraway, cinnamon, clove etc (Khan et al., 2012; Zhao et al., 2011; Botsoglou et al., 2013).

Black pepper (*Piper nigrum*) is a flowering vine extracted from the core of a pepper plant, and belongs to the family Piperaceae, genus Piper and species Piper nigrum. Black pepper has been shown to be rich in glutathione peroxidase and glucose-6-phosphate dehydrogenase (Karthikeyan and Rani, 2003). The antioxidant and radical scavenging properties of black pepper seeds have been well documented (Gülcin, 2005). Khalaf et al. (2008) showed that piperine can increase the absorption of selenium, vitamin B complex, beta-carotene and curcumin as well as other nutrients. Furthermore, it is an active alkaloid modulate benzopyrene metabolism through cytochrome P450 which is essential for metabolism and transport of xenobiotics and metabolites (Reen et al., 1996), enhances thermogenesis of lipid (Malini et al., 1999), and increases the flow of digestive juice (Moorthy et al., 2009).

Turmeric (*Curcuma longa*) is an extensively used spice, food preservative and coloring material which has biological actions and medicinal applications (Burt, 2004). The active and main ingredient found in turmeric is curcumin, which was found to have antioxidant (Karami et al., 2011) and antibacterial activities (Negi et al., 1999). Additionally, Soni et al. (1997) proved the protective effect of turmeric as feed additives on aflatoxin induced mutagenecity and hepatocarcinogenicity.

Another herbal plant, coriander (*Coriandrum sativum*) is mainly used for its seeds which used primarily as a flavoring agent in the food industry or as a spice in bread, curry, fish, meat and confections. Coriander seeds contain an essential oil up to 1%, the main component is linalool, which has potential antibacterial (Burt, 2004), antioxidant (Wangensteen et al., 2004), antidiabetic (Gallagher et al., 2003), and hypolipidemic properities (Chithra and Leelamma, 2000). It has also appetizing and stimulatory effects in the digestion process (Çabuk et al., 2003).

Aji et al. (2011), Ayasan (2011) and Hanieh et al. (2010) have reported the roles of these herbs in improving growth performance, meat quality and anticholesteremic effects, as well as their immune-modulating effects on broiler chickens. Shahwar et al. (2012) suggested that certain plant phytochemicals are considered as an effective tool to cure various human physiological disorders because of the bioactive constituents with antioxidant activity found in high concentration in the plants. These botanicals need to be examined further, because of the complexity regarding the number and variability of their bioactive compounds. The knowledge regarding their modes of action and aspects of their application is equally limited. Therefore, the aim of this present study was to determine the effect of black pepper, tumeric, corriander and their combination as supplementary antioxidants on haematological, serum biochemical indices and sensory evaluation of broiler turkeys.

## II. Materials and Methods

**Experimental Site**

The experiment was carried out at the Poultry Research Unit of the Department of Agricultural Science Education, Federal College of Education (Technical), Bichi, Kano.

**Experimental Feed Preparation**

The black pepper, turmeric and coriander seeds used in this study were purchased from local farmers in Kano Farm Produce Market in their raw forms. They were broken into smaller pieces and dried sufficiently in the sunlight for a period of two weeks. After drying, the required amount of dried black pepper, turmeric and

coriander seeds were prepared by fine grinding, passing through 1 mm sieve into smooth powder and stored separately in air-tight containers at the Agricultural Education Department Feed mill and experimental farm. The premixes were sourced from a reputable nutrient feed additives and premixes distributor, while other ingredients were sourced from a reputable animal feed resources mill in Kano, Nigeria. Five isonitrogenous and isocaloric diets each containing 28% CP; 3831 Kcal/kg ME and 25 % CP; 2929 Kcal/kg for the starter and grower phases, respectively were formulated as follows:

T1 = basal diet with no supplement
T2 = basal diet plus 1% black pepper (BP)
T3 = basal diet plus 1% turmeric powder (TUR)
T4 = basal diet plus 2% coriander seeds (COR)
T5 = basal diet plus a mixture of BP + TUR + COR

All diets were formulated to meet nutrient requirement standards of meat type turkeys (NRC, 1994).

**Source of Experimental Birds**

A total of sixty male day-old turkey poults used for the study were purchased from Obasanjo Farms Nigeria Limited, Abeokuta, Ogun State.

**Design and Management of Experimental Birds**

A total of sixty (60) two weeks old poults were used for the study. The birds were assigned in a completely randomized design (CRD) to five dietary treatments and three replicates. All necessary and routine management practices of sanitation, appropriate medication and vaccination were strictly observed. Feed and water were provided *ad libitum.* The birds were weighed at the beginning of the trial and weekly thereafter. Weight gain, feed intake, and feed conversion ratio was calculated. Mortality record was taken as it occurs.

**Haematological and Serum Biochemical Analysis**

At the end of the grower phase, fifteen samples of birds were randomly selected from each treatment group (i.e. one bird per replicate) and 2mls of blood sample was collected from each of them via the wing vein and put into a sample bottle containing anti-coagulant, ethylene di-amine tetra acetic acid (EDTA) and later analyzed for packed cell volume (PCV), haemoglobin level (Hb) and total protein (Tp), white blood cells (WBC) and red blood cells (RBC) according to the methods described by Lamb (1991) at the Haematological Laboratory of Veterinary Teaching Hospital, Ahmadu Bello University, Zaria using the procedure of Schalm*et al*., (1975). Another 2mls blood samples collected in the plain bottles was use to analyse for serum biochemical indices at the Chemical Pathology Laboratory, Ahmadu Bello University Teaching Hospital, Shika - Zaria.

**Meat Sensory Evaluation**

Samples of meat were obtained from breast and thigh muscles after slaughter. During dissection, three samples per each group were collected. The collected meat samples were evaluated using the 9 point hedonic scale as described by Dutcosky (2007). Chicken samples were prepared with 0.25% salt. After cooking, samples were cut into relatively uniform portions and kept in foil papers until they were served. The test was applied with 30 (thirty) untrained randomly selected panelists. The samples were presented to the panelist: comprising of both academic staff and undergraduate students of Agricultural Education and Home-Economics departments who were constituted at the Food Nutrition Laboratory, Home-Economics Department, Federal College of Education (Technical), Bichi. The panelists were asked to compare each sample to the control on the following sensory attributes (color, flavor, texture, juiciness, and overall acceptability) according to the 9-point hedonic rating scale. The samples were placed in disposable plastic plates with a glass of water to rinse the mouth.

## III. Results and Discussion

The effect of supplementary antioxidant diets on haematological and serum biochemical indices of growing turkey is shown in Table 1. The turkeys fed diets 2, 3 and 4 had similar and significantly higher PCV values than those fed control and T5 dietary treatment. Similar trend was observed with the values obtained for haemoglobin, while birds on diet 5 recorded the least value among dietary treatments. The higher PCV and haemoglobin values obtained for turkeys fed T2, T3 and T4 is an indication that the diets contained essential nutrients which tends to increase the values. It implied that birds utilized the nutrients efficiently. This indicated that the bone marrow of the birds functioned maximally and showed absence of hypochromic anaemia. PCV is descriptor of the function and concentration of red blood cells (Kenedy, 2011). High concentration of haemoglobin is a reflection of efficient oxygen carrying capacity which was reflected in healthy status of the experimental birds. This is corroborated by Oleforuh-Okoleh, *et al*., 2015) who reported improved PCV and Hb contents of birds fed ginger and garlic, Aikpitanyi and Egweh (2020) who fed black pepper and ginger.

The RBC values obtained for birds were not significantly different across dietary treatments. This implied that there was improvement in the oxygen-carrying capacity of the cells in blood translated into availability of nutrients for improvement in health status of the birds. The WBCs of birds fed diet 1 to 4 were not different. However, the values were significantly higher than those fed diet 5 (8.50). This implied that birds

fed diets 1 to 4 were conferred with similar immunity. White blood cells are known for their defensive role in animal body system against any invading pathological organisms. The white blood cells (WBC) protect the body against infection and disease with the production of antibodies through the process of phagocytosis (Soetan *et al.*, 2013).

Total protein values obtained for birds fed diets 2 to 5 were similar and significantly higher than those fed control diet. The higher values obtained implied that supplementary antioxidants were able to unlock the nutrients in the diets with efficient utilization of protein. Total protein had been reported to depend on quality and quantity of protein supplied in the diet. The serum albumin showed a pattern with similar and significantly higher values obtained for birds fed diets 3 and 5, followed by those of control and T5 diets, which were similar and the least value was obtained for birds fed T2 diet. Albumin is said to be involved in blood clotting and so birds fed treatment diets in this study has less risk for any form of haemorrhage when compared with the control. Serum globulin values obtained followed a similar trend, while the least value (1.60g/dl) was obtained for birds fed T2 diets.

The serum cholesterol of turkey birds fed diets 2 and 3 were similar and significantly higher than those fed other diets, which were also similar. This implied that birds fed diets 2 and 3 have less risk factor for myocardial infarction usually associated with higher cholesterol in the blood as well as emaciation resulting from low serum cholesterol. However, the cholesterol values obtained in this present study were within the normal range of values for poultry by Mitruka and Rawnsley (1997). These effects corroborated Shahwar (2012) that one of the important sources for the search of natural antioxidants is with the use of herbs and spices.

The effect of antioxidants on meat sensory evaluation of turkey is showed in Table 2. The observed results from the hedonic scale revealed that there were significant differences in most of the sensory evaluation parameters measured. The taste was significantly better in meat of birds fed diet 4 than those fed other supplemented antioxidants diets which were similar. Similarly, the birds fed with diet 4 had significantly higher value of flavour, while those fed diet 5 had the least value (5.80). These results corroborated reports by Akinboye *et al.* (2018) that the treatment diets had effect on the sensory attributes of the final products of broiler meat. The assessment also revealed that tenderness of the meat from birds fed T2, T3 and T4 treatment diets were significantly higher than those fed control diet, while birds fed T5 diet obtained the least value. The colours of meat from birds in this present study were not significantly affected across the supplemented antioxidants dietary treatments. However, the value obtained for birds fed T4 was better among treatment diets. However, the assessment of juiciness followed a pattern, where meat from birds fed diets 2 and 4 were similar and higher than those fed control and T3, while meat from birds fed T5 diet obtained the least value among dietary treatments. The assessment for general acceptability showed similar trend. The non significance observations made in this present study for colour was corroborated by the reports of the studies by Zakaria *et al*. (2010), Dalólio *et al.* (2015) and Zaki *et al.* (2018) that enzyme additive supplementation in diets based on corn and soybean meal did not influence the colour parameters of chicken meat.

## IV. Conclusions

The conclusions drawn from this study are:

1. Haematological and serum biochemical indices of turkey birds fed supplemented antioxidants were significantly influenced and the values were within the normal range of values for poultry species.
2. Black pepper, tumeric, corriander and their combination had no deleterious effect on the haematological and serum biochemical indices of turkey birds.
3. Black pepper, tumeric, corriander and their combination had positive effect on the sensory and nutritional parameters of turkey meat.
4. Black pepper, tumeric, corriander and their combination improved the haematological, serum biochemical indices and sensory characteristics of turkey meat.

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**Table 1: Effects of black pepper, tumeric, corriander and their combination as supplementary antioxidants on haematological and serum biochemical indices of turkey meat**

| | Levels of supplementary antioxidants | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **T1** | **T2** | **T3** | **T4** | **T5** | **SEM** |
| **PCV (%)** | **39.00$^{b}$** | **42.00$^{a}$** | **41.00$^{a}$** | **43.00$^{a}$** | **37.00$^{c}$** | **0.62** |
| **Hb (%)** | **13.00$^{ab}$** | **14.00$^{a}$** | **13.80$^{a}$** | **14.20$^{a}$** | **12.40$^{b}$** | **0.39** |
| **RBC** | **1.34** | **1.80** | **2.60** | **2.30** | **1.70** | **0.05** |
| **WBC** | **8.90$^{abc}$** | **9.60$^{a}$** | **9.00$^{abc}$** | **9.40$^{ab}$** | **8.50$^{bc}$** | **0.31** |
| **Total protein (g/dl)** | **4.70$^{b}$** | **5.60$^{a}$** | **5.40$^{ab}$** | **5.40$^{ab}$** | **5.60$^{a}$** | **0.22** |
| **Albumin (g/dl)** | **2.40$^{ab}$** | **2.00$^{b}$** | **2.80$^{a}$** | **2.40$^{ab}$** | **2.80$^{a}$** | **0.17** |
| **Globulin (g/dl)** | **2.00$^{ab}$** | **1.60$^{b}$** | **2.20$^{a}$** | **2.20$^{a}$** | **2.00$^{ab}$** | **0.16** |
| **Cholesterol (mg/dl)** | **124.33$^{b}$** | **128.20$^{a}$** | **7.50$^{ab}$** | **7.90$^{a}$** | **6.50$^{bc}$** | **0.42** |

$^{abc}$Means in the same row with different superscript are significantly ($p<0.05$) different. SEM= Standard error of the means.

**Table 2: Effects of black pepper, tumeric, corriander and their combination as supplementary antioxidants on sensory characteristics of turkey meat**

| | Levels of supplementary antioxidants | | | | | |
|---|---|---|---|---|---|---|
| **Parameters** | **T1** | **T2** | **T3** | **T4** | **T5** | **SEM** |
| **Taste** | **6.30$^{b}$** | **6.80$^{b}$** | **6.70$^{b}$** | **7.20$^{a}$** | **5.60$^{b}$** | **0.60** |
| **Flavour** | **6.30$^{bc}$** | **7.00$^{ab}$** | **6.40$^{bc}$** | **7.80$^{a}$** | **5.80$^{c}$** | **0.58** |
| **Tenderness** | **6.30$^{b}$** | **7.50$^{a}$** | **7.20$^{a}$** | **7.20$^{a}$** | **6.00$^{c}$** | **0.54** |
| **Colour** | **6.20** | **6.80** | **6.30** | **7.20** | **6.20** | **0.72** |
| **Juiciness** | **6.10b$^{c}$** | **7.40$^{ab}$** | **7.20$^{abc}$** | **7.70$^{a}$** | **6.00$^{c}$** | **0.52** |
| **Acceptability** | **6.80$^{bc}$** | **7.70$^{a}$** | **7.50$^{ab}$** | **7.90$^{a}$** | **6.50$^{bc}$** | **0.42** |

$^{abc}$Means in the same row with different superscript are significantly ($p<0.05$) different. SEM= Standard error of the means.