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Response of oxidative stress markers of caged broiler by probiotics, garlic and *moringa oleifera* leaves powder supplements

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Abstract

Oxidative stress in poultry GITs is derived from nutrition, environmental heat stress, and pathological factors, which alter overall performance as well as meat and egg quality. Plant extracts containing exogenous vitamins, antioxidant supplements, and antioxidant properties wash away ROS and are beneficial in reducing oxidative stress in GIT. This study highlights gastrointestinal functionality in poultry and the involvement of oxidative stress in potential intervention strategies to maintain redox balance in GIT. . The experiment was laid out in Completely Randomized Design (RBD). There were six treatments including control, 4 sub-groups with 3 chicks in each to serve as replications with variable proportions of (basal diet + probiotic @10 kg per ton of feed, basal diet + garlic @ 10 kg per ton of feed, basal diet + *moringa oleifera* leaves powder @ 10 kg per ton feed, basal diet + probiotic + garlic @ 10 kg per ton of feed, basal diet + probiotic + *moringa oleifera* leaves powder @ 10 kg per ton of feed and basal diet + probiotic + garlic + *moringa oleifera* leaves powder @ 10 kg per ton of feed), In the view of present investigation the most effective Combined supplements of basal diet + probiotic + garlic + *moringa oleifera* leaf powder @ 10 kg per ton of feed), proved best in Oxidative stress in poultry GIT is derived from nutritional, environmental heat stress, and pathological factors, which alters overall performance as well as meat and egg quality. Supplementation of exogenous vitamins, antioxidants, and plant extract having antioxidant properties scavenge ROS and are beneficial in mitigating oxidative stress in the GIT.

Keywords: Probiotics, garlic and *moringa oleifera* leaf powder and oxidative stress markers

Introduction

Poultry is one of the fastest growing animal industry and contributes significantly to food safety and nutrition. Poultry meat and eggs are among the most common animal sources consumed globally. Poultry and egg industries are one of the largest agricultural commodities globally. Significant improvements have been made in the genetics, feed conversion ratio, fat reduction, and breast size of broiler chickens and the production of poultry eggs and the quality of poultry eggs Anderson (1995) [1]. In the poultry industry, feed is the major component of the total cost for meat and egg production. In addition, feed exposes a wide variety of birds through the gastrointestinal tract (GIT), and affects poultry health and production.

Stresses in commercial poultry result from environmental, nutritional, microbiological, and management factors which negatively impact poultry health and production. Oxidative stress is downstream of all these stresses. Oxidative stress in the cells/tissues results from an imbalance between free radical production and endogenous antioxidant defense and leads to lipid peroxidation, protein nitration, DNA damage, and apoptosis. Cells are exposed continuously with the free radicals generated during the physiological oxygen metabolism. Both reactive oxygen species (ROS) and reactive nitrogen species (RNS) at certain levels are signaling molecules involved in homeostasis. However, excessive production of ROS and RNS or their inefficient scavenging leads to oxidative stress. ROS, including superoxide, hydrogen peroxide, and the hydroxyl radical radicals, are generated by oxygen metabolism and further balanced by the rate of oxidant formation and the rate of oxidant elimination. The intracellular reduction of ROS is physiologically scavenged by superoxide dismutase, catalase, and glutathione peroxidase (GPX). Superoxide dismutase (SOD_1 and SOD_2) catalyze the dismutation of the superoxide anion (O_{-2}) to H_2O_2 (6), which in turn, is decomposed into H_2O and O_2 by catalase, while GPX reduces lipid hydro peroxides by incorporating glutathione Fukai and Ushio-Fukai (2011) [5]. The RNS that are by-products of nitric oxide synthases (NOS) are expressed in selected cells of the intestinal mucosa and submucosal regions.

The NOS metabolizes arginine to citrulline and forms the nitric oxide radical (NO•) which is crucial for cellular function including neurotransmission and immunomodulation. However, overproduction of nitric oxide radicals' damages intestinal mucous membrane and impaired nutrient utilization Ya Sklyarov *et al*., (2011) [11]. Both ROS and RNS can contribute to lipid peroxidation especially cell membrane lipids and lipoproteins since they are rich in polyunsaturated fatty acids. The end product of lipid peroxidation is 4-hydroxynonenal, which increases oxidative damage to the cell membrane and impair the cell signaling and mitochondrial dysfunctions. Inflammation in GIT is mediated through several stressors/infections which in turn generate ROS and disrupt redox balance

The intestinal mucosa is responsible for the absorption of nutrient, and the antioxidant system maintains diverse microbiota in the luminal epithelia. The intestinal mucosa is directly exposed to both feed and non-feed substances. Above physiological level, production of ROS/RNS results in intestinal inflammation and impair the absorption capacity. It has been reported that the broilers fed with the oxidized oils/fats imbalance antioxidants and immune response within the intestinal mucosa Liang *et al*., (2015) [9]. As the first line of defense against oxidative stress, the intestinal mucosa contains an extensive antioxidants defense system including enzymes (CAT, SOD, or GPX) and non-enzymatic endo- and exo-genous scavengers like glutathione, transient ions (e.g., Fe2+, Cu2+) or flavonoids Circu ML, Aw TY (2012) [2]. Glutathione and SOD are intracellular antioxidants, widely distributed in the small intestine, and their abundances are at a higher level during intestinal development Tang *et al*., (2019) [12].

Materials and Methods

The experiment was carried on a private farm for broiler production. The experimental technical programmer with Commercial Broilers., 5 weeks of study, no of treatments: 07, no. of birds: 84, No of replications per treatment: 4 and no of birds in each replication: 3.The data on various parameters *viz*, body weight of day old chicks, weekly body weight, gain in weight, weekly feed consumption and feed efficiency was given as per treatment as basal application.

Experimental design

A total of 84 day old broiler chicks of same hatch was be procured and was be randomly divided into 7 groups as per following dietary regimens:

T_1-(control)-Basal diet without probiotics, garlic and *moringa oleifera* leaves powder.

T_2-Basal diet + probiotic @10 kg per ton of feed.

T_3-Basal diet + garlic @ 10 kg per ton of feed.

T_4-Basal diet + *moringa oleifera* leaves powder @ 10 kg per ton feed.

T_5-Basal diet + probiotic + garlic @ 10 kg per ton of feed.

T_6-Basal diet + probiotic + *moringa oleifera* leaves powder @ 10 kg per ton of feed.

T_7-Basal diet + probiotic + garlic + *moringa oleifera* leaves powder @ 10 kg per ton of feed.

Blood Samples

Samples were randomly selected from four birds from each treatment (one bird per replicate) at the end of the experiment. The hematological and biochemical characteristics were analyzed based on the methods described by Kairalla, Alshelmani.

Ingredient and nutrient composition (%) of experimental diets (on dry matter basis)

Ingredients	Broiler starter (0-21 days)	Broiler finisher (22-35 days)
Maize	60.00	63.00
Ground nut cake	23.14	18.00
Fish meal	12.50	14.67
Premix (Vitamin)	2.50	2.50
Trace minerals	0.125	0.125
Common salt	0.30	0.30
Methionine	0.10	0.09
Lysine	0.10	0.09
D.C.P	1.20	1.20
Lincomycin	0.004	0.004
Diclazuril (CMP-200)	0.020	0.020
	100	100
Nutrient composition		
Moisture (%)	6.29	6.22
Crude protein (%)	23.29	21.28
Total ash (%)	8.02	9.34
Cruds protein	22	19
ME (Kcal/kg)	2900	3000

Results and Discussion

The data regarding the hematological parameters of broilers after six weeks of age are presented in table 1.

Table 1: Oxidative stress in broiler of different treatments

Treatments	Blood SGPT (unit/ml)	Blood SGOT (Unit/Ml)	Blood R.B.C. Count (Mill)
T_0	31.43	110.11	2.20
T_1	31.42	110.68	2.43
T_2	31.44	111.41	2.23
T_3	31.45	108.13	2.38
T_4	31.47	111.11	2.33
T_5	31.55	111.53	2.55
T_6	31.92	112.06	2.56

From the perusal of the data on blood SGPT (unit/ml) of broiler in different treatments contained in Table 1, it was noted that irrespective of treatments the blood SGPT (unit/ml) of broiler. The highest mean blood SGPT (unit/ml) of broiler was recorded in T_6 (31.92), followed by T_5 (31.55), T_4 (31.47), T_3 (31.45), T_2 (31.44), T_0 (31.43) and T_1 (31.42), the differences in these values between the treatments were non-significant. The data on blood SGOT (unit/ml) of broiler in different treatments contained in Table 4.83, it was noted that irrespective of treatments the blood SGOT (unit/ml) of broiler. The highest mean blood SGOT (unit/ml) of broiler was recorded in T_6 (112.06), followed by T_5 (111.53), T_2 (111.41), T_4 (111.11), T_1 (110.68), T_0 (110.11), and T_3 (108.13), the differences in these values between the treatments were non-significant. From the perusal of the data on blood R.B.C. count of broiler in differ count of broiler, the highest mean blood R.B.C. count of broiler was recorded in T6 (2.56), followed by T_5 (2.55), T_1 (2.43), T_3 (2.38), T_4 (2.33), T_2 (2.23), and T_0 (2.20), the differences in these values between the treatments were non-significant. In poultry production, intestinal health and function play a critical role in efficient feed utilization and growth, and the overall profitability of the farm. The GIT microbiota mainly consists of bacteria, fungi, and protozoa. Microbiota population varies across the compartment with maximal at the distal segments of the GIT Gabriel *et al*. (2006) [6]. Also Intestinal epithelial in response to commensal bacteria generate ROS, which serves as a second messenger and participates in cellular signaling. Tight junctions between intestinal epithelial cells from the barrier and prevent the invasion of the microorganism Anderson and Van Itallie (1995) [1]. Ulluwishewa *et al*. (2011) [13] have suggested that interaction of mucosa with microbes or their toxin triggers oxidative stress. Eimeria primarily produces oxidative stress, thereby destroy the intestinal epithelial barrier and tight junctions, lipid peroxidation, antioxidants insult, as a result, infected birds display reduced feed intake, absorption of nutrients and decreases weight gains Naidoo *et al*. (2008) [10].

Natural feed additives of plant origin are generally believed to be safer, healthier and less subject to hazards for humans and animals. Many herbs and plant extracts, and their essential oils have antimicrobial activities and antioxidant properties, which make them useful (Faixova and Faix, 2008) [4] for quality safe meat production. Therefore, we rcommend using it in poultry feed.

Conflict of interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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