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Effect of Taurine and Methionine Supplementation on Leukocyte Profile of Broiler Chickens

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ABSTRACT

The animal protein sources are rich in essential amino acids but transmission of zoonotic diseases and their high cost limits its use. Therefore it becomes necessary to supplement the synthetic amino acids in plant proteins based broilers diet. A study was conducted in a 3×2 factorial arrangement of three levels of taurine (0, 0.025%, and 0.05%) and two levels of methionine (0 and 0.15%) to determine the effect of taurine and methionine supplementation on leukocyte profile of broiler chickens. The study showed significantly ($P < 0.01$) increased total leukocyte count (TLC) in taurine and methionine supplemented treatments. As the taurine level increased in the diet heterophil and eosinophil count significantly ($P < 0.01$) increased whereas, lymphocyte and monocyte count significantly ($P < 0.01$) decreased . The result reveals that graded level of dietary taurine and methionine plays significant role in reducing the oxidative damage by altering the leukocyte profile.

Keywords: Broiler chickens, Leukocyte profile, Methionine, Taurine

Plant proteins are deficit in different essential amino-acids. However, the animal protein sources are rich in essential amino acids but they are very pricey. Supplementation of animal protein also enhances the risk of diffusion of various zoonotic diseases. Therefore it becomes necessary to fortify the poultry diets with synthetic amino acids to meet out their amino acids requirement for growth, maintenance and production.

Taurine (2-amino ethanesulfonic acid), is an organic acid which repressed the lipopolysaccharide induced osteoclastogenesis by inhibiting the production of reactive oxygen species (Jang and Kim, 2013). Methionine is the first limiting amino acid in broilers fed on corn-soybean based diet. Apart from this, it acts as methyl group donor, which is required for several metabolic reactions such as carnitine and creatine synthesis (Schutte *et al*., 1997). It has been reported that dietary supplementation of taurine and methionine in the broilers diet plays significant role in lowering total cholesterol and increasing the HDL cholesterol (Sahu *et al*., 2014). In domestic fowl surplus sulfur containing amino acids are transformed to taurine via transsulfuration pathway (Hosokawa *et al*., 1988). Therefore, the objective of the present study was to determine the effect of dietary taurine and methionine supplementation on leukocyte profile of broiler chickens.

MATERIALS AND METHODS

Experimental design and housing

Present experiment was conducted in the Department of Animal Nutrition, College of Veterinary Science and Animal Husbandry, Anjora, Durg, Chhattisgarh, India. This study was a 3×2 factorial arrangement of three levels of taurine (0, 0.025, and 0.05%) and two levels of methionine (0 and 0.15%). In this experiment, day-old Vencobb broiler chicks (n = 180) were randomly assigned

Table 2. Proximate composition of broiler starter and finisher rations (% on DM basis)

Particulars	Broiler starter	Broiler finisher
Crude protein	22.90	19.87
Crude fibre	3.72	3.25
Ether extract	5.42	8.48
Total ash	7.35	6.89
Acid insoluble ash	1.32	1.35
Nitrogen free extract**	60.61	61.51
Calcium	0.87	0.96
Phosphorus	0.63	0.69
ME (kcal/kg)**	2800	2900
**Calculated value		

Table 1. Ingredient composition of broiler starter and finisher diet (on % DM basis)

Feed ingredients	Broiler starter	Broiler finisher
Yellow maize	58.5	63.38
Soya DOC	35.74	31
Maize gluten	-	0.3
Deoiled rice bran	0.12	-
Soyabean oil	1	3
Dicalcium phosphate	2.18	1.05
Limestone powder	0.94	0.21
DL-methionine	0.34	0.22
Lysine	0.08	0.11
Soda-bi-carb	0.11	0.05
Choline chloride	0.07	0.03
Salt	0.33	0.26
Premix*	0.49	0.39

* Trace mineral premix mg/kg diet: Mg 300, Mn 55, Fe 56, Zn 30, Cu 4; vitamin premix per kg diet: vit. A 8250IU, vit. K 1mg, vit. E 26.84 mg, vit. B_1 2 mg, vit. B_2 4 mg, vit. B_{12} 100µg, Niacin 60 mg, pantothenic acid 10 mg; choline 500 mg and 30 ppm salinomycin (Coxistac 12%), 55 ppm bacitracin methylene di salicyclate (BMD110)

Table 3. Taurine and methionine in leukocytic profile of broilers (Mean ±SE)

Particulars			Total leukocyte count	Heterophil	Lymphocyte	Monocyte	Eosinophil	Basophil	H/L ratio
	Taurine (%)	Methionine (%)	(10^3/mm^3)	(%)	(%)	(%)	(%)	(%)	
T_1	0	0	16.42±0.00 ^{a}	32.00±0.29 ^{b}	58.10±0.21 ^{e}	7.93±0.11 ^{d}	1.97±0.00 ^{a}	-	0.55±0.01 ^{b}
T_2	0	0.15	16.51±0.00 ^{b}	28.57±0.15 ^{a}	62.57±0.19 ^{f}	6.71±0.06 ^{b}	2.15±0.02 ^{b}	-	0.46±0.00 ^{a}
T_3	0.025	0	16.72±0.03 ^{c}	33.85±0.23 ^{c}	57.59±0.27 ^{d}	6.40±0.07 ^{a}	2.15±0.00 ^{b}	-	0.59±0.01 ^{c}
T_4	0.025	0.15	16.80±0.03 ^{c}	35.43±0.26 ^{d}	55.61±0.40 ^{a}	6.72±0.03 ^{b}	2.24±0.01 ^{c}	-	0.64±0.01 ^{d}
T_5	0.05	0	16.74±0.02 ^{c}	33.67±0.17 ^{c}	57.32±0.24 ^{c}	6.85±0.07 ^{c}	2.16±0.02 ^{b}	-	0.59±0.01 ^{c}
T_6	0.05	0.15	16.74±0.04 ^{c}	35.33±0.17 ^{d}	56.05±0.24 ^{b}	6.41±0.05 ^{a}	2.20±0.02 ^{bc}	-	0.63±0.01 ^{d}
Taurine main effect (%)									
0			16.47±0.01^a	30.28±0.45 ^{a}	60.34±0.56^b	7.32±0.16^b	2.06±0.02^a	-	0.50±0.01^a
0.025			16.76±0.02^b	34.64±0.28 ^{b}	56.60±0.34^a	6.56±0.05^a	2.20±0.01^b	-	0.61±0.01^b
0.05			16.74±0.02^b	34.50±0.23 ^{b}	56.69±0.22^a	6.63±0.07^a	2.18±0.01^b	-	0.61±0.01^b
Methionine main effect (%)									
0			16.63±0.03^a	33.17±0.21	57.67±0.15	7.06±0.13 ^{b}	2.09±0.02 ^{a}	-	0.58±0.00
0.15			16.68±0.03^b	33.11±0.64	58.08±0.64	6.61±0.04 ^{a}	2.20±0.01 ^{b}	-	0.58±0.02
Source of variations (Probabilities)									
Taurine			P<0.01	P<0.01	P<0.01	P<0.01	P<0.01	-	P<0.01
Methionine			P<0.01	NS	NS	P<0.01	P<0.01	-	NS
Taurine × Methionine Interaction			NS	P<0.01	P<0.01	P<0.01	P<0.01	-	P<0.01

Superscripts are read column wise for comparison of means. Means in the same column with different superscript a, b, c are significantly different, NS= Non significant.

Treatments and additives

The diets were isonitrogenous in control and treatment groups and formulated according to BIS (1992). The diet was based on corn-soybean meal. Ingredient and proximate composition of broiler starter and finisher diet was presented in table 1 and 2, respectively. The six different dietary treatments were: T_1- Control diet without taurine and methionine; T_2- Control diet with 0.15% methionine; T_3- Control diet with 0.025% taurine; T_4- Control diet with 0.025% taurine and 0.15% methionine; T_5- Control diet with 0.05% taurine and T_6- Control diet with 0.05% taurine and 0.15% methionine.

Leukocyte profile

Blood samples were collected from wing vein in heparinised vials (Heparin @10 IU/ ml of blood) on 35th day of experiment. The observations were recorded in 3 birds randomly selected from each replicate. Total leukocyte count (TLC) was determined as per method of Nambiar (1960) using diluting fluid recommended by Natt and Herrick (1954). Differential leukocyte count (DLC) was measured as per method described by Jain (1986).

Statistical analysis

The data recorded were subjected to statistical analysis by the software SPSS version 10 (SPSS, 1997) following 3×2 factorial design.

RESULTS AND DISCUSSION

There were significant ($P < 0.01$) interaction between taurine and methionine for heterophil, lymphocyte, monocyte and eosinophil count (Table 3). The study revealed significantly ($P<0.01$) increased TLC in taurine and methionine supplemented treatments than control. TLC was highest in birds fed 0.025% taurine with 0.15% methionine (T_4) and the level was found to be almost 2.27 % more as compared to control (T_1) whereas, the interaction between taurine and methionine was nonsignificant. As the taurine level increased in the diet heterophil and eosinophil count significantly ($P<0.01$) increased whereas, lymphocyte and monocyte count significantly ($P<0.01$) decreased. Heterophil: Lymphocyte ratio (H/L) showed a significant ($P<0.01$) increase over control as taurine increased in diet. Heterophil, lymphocyte count and H/L ratio was not significantly influenced by increasing methionine level in the diet.

Present findings corroborated with Anand *et al*. (2010). Taurine present in neutrophils and monocytes reacts with hypochlorous acid, produced by the myeloperoxidase pathway, to produce less toxic compound taurine-chloramine (Schuller-Levis and Park, 2004) than hypochlorous acid which might be reduces the oxidative damage. Moreover, taurine have affinity to nucleic acids, alleviate the oxidative DNA degradation and reduces the DNA damage in lymphocytes (Sokol *et al*., 2009). It also modulates cell viability, which is an important protective mechanism against free radical damage (Shiny, 2007). It has been reported that supplementation of DL methionine enhanced the plasma methionine concentration and increased the heterophil/lymphocyte ratio (Yodseranee and Bunchasak, 2012).

On the basis of above findings, it may be concluded that dietary taurine as well as methionine reduces the oxidative damage by altering leukocyte profile in broilers.

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