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Effect of Different Levels of Perlite on Blood Parameters in Broiler Chicks

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Abstract: An experiment was conducted to study the effects of different levels of perlite on serum calcium, phosphor and chloride in broiler chicks. The experimental design was arranged as randomized complete blocks in 4×2 factorial arrangement of treatment. About 180 male broilers of Ross 308 commercial hybrid was designated into 3 groups (0, 2 and 4%). About 3 replicates of 20 birds were assigned to each treatment. Control treatments were fed base diet and treatments with the same base diet plus 2 and 4% perlite. The feeding continued up to the age of 42 days. At the 21 and 42 days, 6 birds from each treatment were selected for serum calcium, phosphor and chloride in broiler chicks. Blood samples were collected from the vena axillaries). As intake of perlite, significantly increased serum calcium, phosphor and chloride at weeks on broiler chicks ($p<0.05$) these data suggested that perlite administration did not have significant effect on control treatment comparing to treatment.

Key words: Perlite, serum, calcium, phosphor, chloride

INTRODUCTION

Perlite is one of the volcanic, aluminum-silicate minerals which are hydrated and clear in color and there can be found tiny holes inside. Raw perlite is transparent and light grey or gloss black and if it is put in the temperature of 871°C will increase 4-20 times in volume and its color will change to snow white or grey white. Perlite has neutral pH and it was confirmed by the official congress of controlling animals as a feed additive in US. Its usage as an additive is also confirmed in Europe. Concerning the chemical constituent, it contains aluminum and silicate components (Talebali and Farzinpour, 2006) (Table 1). By concerning the chemical constituent, it contains aluminum and silicate components (Talebali and Farzinpour, 2006). Dietary addition of inorganic compounds such as natural zeolite and minerals caused considerable morphological and enzymatic changes in intestine of broiler chickens (Incharoen *et al*., 2009; Ruttanavut and Yamauchi, 2010). There are limited number of studies on the use of perlite as an adsorbent for removal of dyes such as methylene blue, methyl violet victoria blue and also removal of metal ions such as copper (II) and cadmium (Demirbas *et al*., 2002; Dogan and Alkan, 2003a, b; Dyer *et al*., 2004). Perlite is essentially a metastable amorphous aluminum silicate and has recently been used as an aflatoxin binder and adsorbent or controlling of wet litter and also decrease leve l of chloride in blood serum (Talebali and Farzinpour, 2006). Tangkawanit *et al*. (2005) have studied analcime synthesized perlite for its potential use as an exchanger ion for removal of the toxic metals such as Cu^{2+}, Ni^{2+}, Pb^{2+} and Zn^{2+}. In other study, the use of perlite in swine feed were experimented (Talebali and Farzinpour, 2006). A comparison was made between pigs fattened with

Table 1: Chemical composition of perlite (Dogan *et al*., 2000)

Percentage	Constituent
71-75	SiO_2
12.5-18	Al_2O_3
2.9-4.0	Na_2O
4.0-5.0	K_2O
0.5-2.0	CaO
0.1-1.5	Fe_2O_3
0.03-0.5	MgO
0.03-0.2	TiO_2
0.0-0.1	MnO_2
0.0-0.1	SO_3
0.0-0.1	FeO
0.0-0.1	Ba
0.0-0.5	PbO
0.0-0.1	Cr

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traditional feeds and those fattened with the same feeds combined with perlite. Researcher concluded that pigs fed with perlite achieved a higher daily weight gain (197 g) and duration of the lover breeding period by 23 days with the same feed utilization as the ration-fed control animals. Sakai and Nagao (1985) used three levels of perlite (1, 10, 20 %) for 8 weeks for feeding 21 male and 21 female mice and concluded that the mice's behavior, mortality and food consumption were not affected by the experimental food and there was no significant change in the biochemical parameters of blood and urine, the weight of the limbs, autopsy findings and pathology of tissue However, the male mice fed by 10 and 20% of perlite did not grow well but 1% of perlite was reported to be the appropriate dosage for the growth of mice. Alkan and Dogan (2001) and Sheila (1990) reported that perlite is responsible for breakdown of feces and absorption of moisture and it acts like a damper between the earth and birds and increases growth along with decreasing the respiratory diseases thigh bruise and bump in the breast.

Calcium is the major mineral in the bird responsible for skeletal development, nerve function, muscle contraction, hormone secretion and egg shell production. Calcium metabolism is tightly regulated in birds as in mammals predominately by the hormones vitamin D_3, calcitonin and Parathyroid Hormone (PTH) but the system is far more responsive. Birds can respond to low blood calcium levels in minutes compared with the mammalian response which may take up to 24 h. In the laying hen the bird is able to use up to 10% of the total body calcium content in 24 h to produce hard shelled eggs. Calcium is found in three forms in the bird reported by most pathology laboratories as total calcium. This consists of free ionized calcium, available form of the mineral and it is important to assay ionized calcium rather than total calcium wherever possible to more accurately investigate disorders of calcium metabolism.

The nutritional role of Calcium (Ca) is closely linked to that of Phosphorus (P) and to the effect of Vitamin D. >70% of animal body ashes consist of ca and p with about 99 and 80%, respectively present in the bones (Mcdowell, 1992). The metabolic and structural function of these minerals in bone and eggshell formation is poultry production (Araujo *et al*., 2005). Available Berne and Levy (1998) Ca is actively absorbed in all intestinal segments, particularly in the duodenum and the jejunum. The speed of Ca absorption is higher than that of any other ion except for Na. Animal nutritional status affects Ca absorption. Animal fed Ca deficient diets increase Ca absorption levels whereas high dietary levels of this mineral reduce absorption.

MATERIALS AND METHODS

A total number of 180 male broilers of commercial hybrid (Ross 308) were divided into 2 experimental groups (0, 2 and 4 % perlite). Each treatment group was divided into 3 replicates of 20 birds. Birds in each replicate were kept in cages separately next to each other and on litter. All conditions were same for all replicates. Chicks' diets were formulated according to NRC (1990). The control treatment group was fed basal diet (with 0.0% level of perlite) throughout the experimental period. The other two treatment groups were fed diets supplemented with 2 and 4% of perlite, respectively. Food and water were provided *ad-libitum* (Table 2).

Sample collection: In the rearing period, all conditions such as temperature, humidity, light, ventilation and management were adjusted and considered same for all treatment groups and in days 21 and 42 of the rearing period, after 6 h fasting, 2 equiponderant broilers from every pen (totally 18 chickens on each day of sampling) were elected to evaluation of serum parameters. The blood samples were collected from the vena axillaries. Samples were centrifuged at 3000×rpm for 10 min and sera were

Table 2: Ingredient and nutrient compositions of experimental diets

	1-21 days (%)			21-42 days (%)		
Nutrients	0	2	4	0	2	4
Ingredient						
Corn	54.50	54.00	45.00	62.64	39.00	59.00
SBM (44%)	34.14	34.19	35.81	27.00	27.70	27.70
Oil	2.50	2.50	2.50	2.50	2.50	2.50
Methionine	0.60	0.60	0.80	0.60	0.60	0.60
Lysine	0.00	0.00	0.00	0.20	0.20	0.20
Vitamin-premix	0.25	0.25	0.25	0.25	0.25	0.25
Mineral-premix	0.25	0.25	0.25	0.25	0.25	0.25
DCP	1.6	1.60	1.62	1.13	1.13	1.13
Oyster	1.44	1.40	1.33	1.48	1.44	1.39
Salt	0.28	0.28	0.28	0.28	0.28	0.28
Perlite	0.00	2.00	4.00	0.00	2.00	4.00
Starch	1.06	1.41	7.37	0.00	2.60	2.60
Fine Sand	3.38	1.46	0.07	3.67	2.05	0.10
Nutrients						
ME[3] (kcal kg^{-1})	2850.21	2850.11	2850.14	2920.54	2920.03	2920.03
Protein (%)	20.5	20.51	20.50	18.17	18.18	18.17
Calcium (%)	0.99	0.99	0.99	0.89	0.89	0.89
Phosphorus (%)	0.44	0.44	0.44	0.34	0.34	0.34
ME/Protein	139.00	138.96	139.03	160.69	160.64	160.64
Calcium/ Phosphorus	2.23	2.23	2.23	2.56	2.58	2.58

SBM[1] = Soybean Meal, DCP[2] = Dicalcium Phosphate. ME[3] = Metabolisable Energy, Per 2.5 kg mineral supplement containing 99200 mg magnesium, 84700 mg zinc, 50000 mg iron, 10000 mg copper, 990 mg iodine, 200 mg selenium, 250000 mL gram colin chloride. Per 2.5 kg vitamin supplement containing 900000 IU of Vitamin A, 200000 IU of Vitamin D_3, 19000 IU of Vitamin E, 200 mg Vitamin K_3, 18050 mg Vitamin B_1, 49000 mg Vitamin B_2, 9800 mg Vitamin B_3, 29650 mg Vitamin B_5, 2940 mg Vitamin B_6, 1000 mg Vitamin B_9, 15 mg Vitamin B_{12}, 100 mg biotin, 190000 mg cholin chloride, 1000 mg antioxidant

collected. The analysis of serum calcium, phosphor and chloride levels were measured on biochemical auto analyzer (Alcyon abbot-300, USA) by using commercially available kits.

Statistical analyses: Results were statistically analyzed using the Linear Model of SAS (2001) Software and Multivariate Analysis Variance. Comparative analysis of the average of treatments was performed using Duncan's multifunctional method in the random of 5%.

RESULTS AND DISCUSSION

According to Table 3 and 4 adding perlite to the diet of the broilers at different ages caused variety of influences on the serum calcium, phosphor and chloride. Adding 2 and 4% perlite to the chicks diet at the 21 and 42 days old had not significant in treatment than control groups ($p<0.05$). Perlite had not significant effect on serum calcium, phosphor and chloride in different ages. Many researches have been conducted on the role of perlite in different animals in which perlite is responsible for dissection of excretion and its absorption through transmission of moisture and it acts like a damper between the earth and chicks and increases the growth concomitant with decreasing the respiratory diseases thigh scorch and callus in the breast (Doga *et al*., 2000). The swine which were fed daily by perlite were heavier (197 g) than control and it leads to reduction of the fattening period (De Matos, 2008). Three levels of perlite (1, 10 and 20%) were used for 8 weeks to 21 male and 21 female mice and concluded that the mice's behavior, causality and food consumption were not affected by the experimental regime and there was no significant change in the parameters related to biochemical components of the blood and urine, the weight of the limbs, autopsy findings and pathology of tissue, however the male mice fed by 10 and 20 levels of perlite did not grow well after all level 1 of perlite was reported to be the appropriate dosage for the growth of mice (Mathialagan and Viraraghavan, 2002). Also were demonstrated that use of chicks' turnover it was designated that the appropriate perlite mixed in diet of broilers causes decrease in toxicity of aflatoxin and chloride in blood serum. In a research on perlite level for the diet of broilers was 1-3 and 3% for hatching chickens (Doga *et al*., 2000).

Table 3: Comparison of average serum calcium, phosphor and chloride between treatments in 21 day in broiler chicks (Mg D^{-1} Lit)

	21 days		
Groups	Calcium	Phosphor	Chloride
Control group	9.52±0.22	4.80±0950	72.75± 25.15
2% group	9.94±0.59	4.84±0.20	96.80±4.54
4% group	9.98±0.71	5.22±1.99	66.80±36.90

Table 4: Comparison of average serum calcium, phosphor and chloride between treatments in 42 days in broiler chicks (Mg D^{-1} Lit)

	42 days		
Groups	Calcium	Phosphor	Chloride
Control group	11.34±1.35	7.78±0.95	120.60±5.310
2% group	10.44±0.55	7.18±0.71	118.60±12.75
4% group	10.58±0.70	9.02±1.81	116.80±5.930

[a, b]Means in the same row that do not have common superscripts differ, $p<0.05$ (X±SD)

CONCLUSION

Results can be conclude that use of 2% perlite in broilers is preferable.

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