ISSN 1682-8356
ansinet.org/ijps

INTERNATIONAL JOURNAL OF

POULTRY SCIENCE

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International Journal of Poultry Science 5 (5): 432-435, 2006
ISSN 1682-8356

Effect of Different Levels of Perlite on Performance of Broiler Chicks

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Abstract: This experiment was conducted to study the effects of different levels of Perlite on performance of 240 day-old male Arian chickens. The experiment was performed in a completely randomized design (CRD) with four treatments and three replicates for each treatments. The experimental treatments included 0, 1, 2 and 3 percent Perlite in diets, and were respectively designated as diets A, B, C and D, fed to chickens at 1 to 42 days of age. All of the experimental groups were iso-caloric and iso-nitrogenous. Average feed intake, weight gain were measured in the end of each week of experiment and mortality was measured throughout the trial. For comparison between means Duncon's method ($P<0.05$) was used. The results show that adding perlites to the diets of broilers from 1 to 42 days of age, produced significant differences ($P<0.05$) in terms of live weight gain and feed conversion ratio (FCR). Based on these results numerically, group B (fed 1% perlite) and group A (fed 0% perlite) had the highest (1624g) and the lowest (1397g) weight gain in whole period of study respectively. Statistical differences indicated non-significant differences in feed consumption and mortality between all experimental groups ($P>0.05$).

Key words: Perlite, Arian chicken, diets of broilers

Introduction

Perlite is a generic term for naturally occurring siliceous volcanic rock which has been known 300 B.C. The chemical composition of the perlite is given by Uluatam (1991), in Table 1 cited by Dogan *et al*.,1999. Perlite expands by 10-30 times its original volume when heated up to 700-1200°C. This expansion is due to the presence of two to six percent combined water in the crude perlite rock. Almost all perlite is consumed in an expanded form, although a small amount of unexpanded perlite has been used in a few applications. Expanded perlite is an excellent thermal and acoustical insulator, resists fire, and is an ultra lightweight material. Expanded perlite can be used to control and clean up liquid spills. The perlite may also be used to provide rapid deodorizing and dehydration of animal waste liquids (Paxeus, 1996). The results showed that both expanded and natural perlite powder (NPP) have potential to suppress the deleterious alkali-silica expansion (Bektas *et al*., 2005). However, moisture retaining properties of perlite restricts its usage. Shields *et al*. (2000), Hickey and Sabatier (1997) studied the effect of moisture on granular material for some other purposes. Since perlite is a form of natural glass, it is classified as chemically inert and has a pH of approximately 7. several materials have been investigated as surfactant adsorbents. These include zeolites (Pavan *et al*., 1999), alumina (Pavan *et al*., 2000; Pavan *et al*., 1999; Huang and Somasundaran, 1996) and activated charchol (Edrington *et al*., 1997). Perlite is essentially a metastable amorphous aluminum silicate, and has recently been used as an aflatoxin detoxicant and adsorbent in the removal of wastewater (Scheideler, 1993). These are limited number of studies on the use of perlite as an adsorbent. The removal of dyes such as methylene blue (Do¢gan *et al*., 1999; Dogan *et al*., 2004) methyl violet (Do¢gan *et al*., 2003a; Do¢gan *et al*,, 2003b) and victoria blue (Demirbas *et al*., 2002) and metal ions such as copper (II) (Alkan and Do¢gan, 2001) and cadmium (Mathialagan and Viraraghavan, 2002) by perlite. TiO_2 and perlite which have been Termed "Ecopore" (Pffaf *et al*., 2001 and Von Walter *et al*., 2005) is manufactured by sintering a mixture of TiO_2 and the porogen perlite, which is a highly porous volcanic glass. Due to its structural and chemical features, Ecopore was considered an interesting biomaterial for hard tissue(bone) substitution. Small pore zeolites (Analcime) was synthesized, in its sodium form, from perlite (Dyer *et al*., 2004). Tangkawanit *et al*. (2005) have studied analcime synthesized from perlite for its

Table 1: Chemical composition of perlite

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

Uluatam, 1991. (cited by Dogan *et al*., 1999)

Table 2: Ingredient and nutrient compositions of experimental diets

Item	Level of perlite included (0-3wk) (%)				Level of perlite included (3-6 wk) (%)			
	0	1	2	3	0	1	2	3
Ingredient[1]								
Corn	57.3	56.3	56	57	65.43	64.75	64	63.4
SBM (%44)	36	36	35.6	33.2	28.5	28.22	27.9	27.63
Fish meal	4	4	4	4.4	3.167	3.135	3.1	3.07
DCP	1	1	0.8	0.6	1.2	1.2	1.2	1.2
Vitamin-premix[2]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Mineral-premix[3]	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Salt	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
oyster	0.8	0.8	0.9	0.9	0.8	0.8	0.8	0.8
Methionine	0.1	0.1	0.08	0.08	0.1	0.1	0.1	0.1
Calculated value(%)								
ME(kcal/kg)	2950	2950	2950	2950	2900	2900	2900	2900
Crude protein	23	23	23	23	22	22	22	22
Calcium	1	0.98	1	1	0.84	0.88	0.90	0.95
Phosphorus	0.45	o.45	0.44	0.45	0.42	0.42	0.40	0.42
Sodium	0.16	o.15	o.15	0.14	0.14	0.14	0.15	0.15
Methionine	0.48	0.48	0.47	0.47	0.50	0.50	0.51	0.52

[1]SBM = soybean meal; DCP = dicalcium phosphate. [2]Supplied per kilogram of diet: vitamin A, 3,600,000 IU; vitamin B_1, 720 mg; B_2, 2,640 mg; pantothenic acid, 4,000 mg; nicothenic acid, 12,000 mg; B_6, 1,200 mg; folic acid, 400 mg; B_{12}, 6 mg; vitamin D_3, 00,000 IU; vitamin E, 7,200 mg; vitamin K_3, 800 mg; biothin, 40mg; thiamine,1mg; cholin chloride, 50,000 mg. [3]Supplied per kilogram of diet: Mn, 40,000 mg; Zn, 33,800 mg; Fe, 20,000 mg; Cu, 4,000 mg; iodine, 400 mg; selenium, 80 mg.

Table 3: Effect of different levels of perlite on some traits of broiler

Experimental groups	0%perlite (A)	1%perlite (B)	2%perlite (C)	3%perlite (D)
Whole period				
Feed conversion ratio (FCR) (g/g)	0.38^b	0.44^a	0.42^a	0.38^b
Feed consumption (g/bird)	3668^a	3704^a	3789^a	3740^a
Weight gain (g)	1397^b	1624^a	1593^a	1412^b
Mortality (%)	0^a	0^a	0^a	0^a
Grower (22-42days)				
Feed conversion ratio (FCR) (g/g)	0.37^a	0.43^a	0.42^a	0.34^a
Feed consumption (g/bird)	2450^a	2497^a	2605^a	2516^a
Weight gain (g)	908^a	1090^a	1093^a	881^a
Mortality (%)	0^a	0^a	0^a	0^a
Starter(1-21 days)				
Feed conversion ratio(FCR) (g/g)	0.40^a	0.44^a	0.42^a	0.43^a
Feed consumption (g/bird)	1216^a	1208^a	1184^a	1223^a
Weight gain(g)	489^a	533^a	500^a	531^a
Mortality (%)	0^a	0^a	0^a	0^a

potential use as an ion exchanger for removal of the toxic metals Cu^{2+} Ni^{2+} Pb^{2+} and Zn^{2+}. Glodek (1980) experimented the use of perlite in hog feed. A comparison was made between hogs fattened with traditional feeds and those fattened with the same feeds combined with perlite. It must be especially emphasized that the perlite fed pigs achieved a daily weight gain higher by 197g and a duration of fattening lower by 23 days with the same feed utilization as the ration-fed control animals. Perlite is mined and expanded all over the world (USGS). Other leading countries producing perlite include China, Greece, Japan, Hungary, Armenia, Italy, Mexico, Philippines, and Turkey. Iran is estimated to be one of the largest producer of crude and expanded perlite. Very little is known about the effects of perlite as a feed on the animals performance, particularly poultry performances. The goal of this study is to investigate, for the first time, the effects of perlite as a feed component on the performance of broiler chicks.

Materials and Methods

240 day old Arian strain male broiler chicks obtained from a commercial hatchery were kept in a poultry house during the experiment. Birds were weighed and maintained with feed and water *ad libitum* for 42 days under standard management conditions. The poultry house was divided into 12 pens (1×1 m; height: 100 cm) built side by side along a corridor where the pens were accessible. The pens were separated by plywood walls. The walls were made of wire. Each pen was littered with wood shavings and equipped with a suspended bell-drinker and a feeder. The birds were maintained on a 24-Light schedule with free access to water and diets. The temperature was maintained at 32 from 1 to 5 d and

then was gradually reduced according to standard brooding practices. The experiment was performed in a completely randomized design (CRD) with four treatments and three replicates for each treatments, and 20 chicks per replicate groups. From d 1 to 42 of age, birds were kept under ideal conditions and fed with the experimental diets. The composition and proximate analyses of experimental diets are presented in Table 2. Four experimentals isocaloric and isonitrogenous diets, were formulated to contain: 1) basal diet (control), 2) 1% perlite, 3) 2% perlite, and 4) 3% perlite. The basal diet used in the study was a typical corn-soybean diet and formulated to meet nutrient requirements for starter (1 to 21 d) and grower (22 to 42 d) periods. Birds were individually measured weekly to determine body weight gain on a pen basis. Mortality was individually measured throughout the trial (on pen basis). Feed consumption determined for each pen. Significant differences between treatment means were separated using the Duncan's multiple range test. All statements of significance were based on the 0.05 level of probability.

Results and Discussion

The body weight gain, feed intake, feed conversion ratio (FCR), and mortality rate are summarized in Table 3. The results presented in Table 3 show that adding perlites to the diets of broilers from 1 to 42 days of age produced significant differences($P<0.05$) in terms of live weight gain and feed conversion ratio(FCR). Although the results derived from Table 3 show that adding perlites to the diets of broilers during whole period of study, produced no significant differences in terms of feed consumption and mortality. For comparing the results, unfortunately there is not clearly defined in the literature about the finding of this study. Further literature review indicates, this work probably, is the first study which evaluate the effects of perlite as a feed component on the performance of broiler chicks. One well cited assertion is Dr. Glodek,s previous study (1980). According to the results of the Dr. Glodek,s work, There is agreement between these two studies. One possible explanation for this finding is the similarity between pigs and poultry as a monogastric animals. Glodek (1980) has reported that the perlite fed pigs achieved a daily weight gain higher by 197g and a duration of fattening lower by 23 days with the same feed utilization as the ration fed control animals. He believed that perlite is used as a carrier for animal feed for faster growth. Another possible explanation for the effect of perlite on body weight gain is due to perlite absorptive and carrier properties as a aluminum silicate (Scheideler, 1993). Accordihg to Alkan (2005), most perlites have a high silica content, usually greater than 70%, and are adsorptive, they are chemically inert in many environments and hence are excellent filter aids and fillers in various processes and materials (Cited by Alkan *et al.*, 2005). It should be concise but informative to mention that little is known about effective factors. These results are in agreement with the findings of Evans and Farrell (1992), who concluded from several experiments that aluminum silicate had no consistent beneficial effects.

Acknowledgements

This work was funded by Research Affairs of Kurdistan University. I would like to thank Dr Amir Rashidi, and all my colleagues for their active participation in this study.

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