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Effects of Feed Type With/Without Nanosil on Cumulative Performance, Relative Organ Weight and Some Blood Parameters of Broilers

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Abstract: In a 2 × 2 factorial design, the effect of Nanosil [ionic silver and H_2O_2] in broiler diet on cumulative performance, relative organs weight [liver, spleen and bursa of fabricius] and blood uric acid, serum-glutamate–oxaloacetate transaminase (SGOT) and serum-glutamic pyrovic transaminase (SGPT) were investigated. The first factor was feed type (mash or pellet) and the second was Nanosil (with or without). Main effect of feed type on weight gain was significant ($p \leq 0.05$). Main effects of Nanosil on weight gain, in days of 1-35 and 1-42, were significant ($p \leq 0.05$). Interaction effects of feed type and Nanosil on feed intak, in days of 1-7 and 1-42, were significant ($p \leq 0.05$). Main effects of feed type on feed intak, in days of 1-14 and 1-35, were significant ($p \leq 0.05$). Interaction effect of feed type and Nanosil on feed conversion ratio in total period (days of 1-42), was significant ($p \leq 0.05$). Main effects of feed type on feed conversion ratio, in days of 1-7, 1-14, 1-35 and 1-42, were significant ($p \leq 0.05$). Interaction effects of feed type and Nanosil on relative weights of liver, spleen and bursa of fabricius were significant ($p \leq 0.05$). Treatments had no effects on SGOT and SGPT activity. Main effect of Nanosil on blood uric acid was significan ($p \leq 0.05$). Based on the results of this investigation, pellet had suitable effects on broiler performance and it seems that Nanosil in this case had negative effects on relative organ weight and blood uric acid and may be used in lower concentration in the broiler's diet.

Key words: Nanosil · Feed Type · Broiler · Cumulative Performancs · Relative Organ Weight And Blood Parameters

INTRODUCTION

At this time, the poultry are very susceptible to pathogens [1]. Under such conditions, antimicrobial additives such as antibiotics are often used to suppress or eliminate harmful microorganisms in the intestine and to develop growth and efficiency of feed [2]. It has been shown that the continuous usage of antimicrobials (especially antibiotics) as growth promoters encourage the retention in animal tissues and that the human consumption of such animal products would potentially increase processes of antibiotic resistance, movements of social pressure towards food security were claiming for a strict control and against their usage in animal nutrition, reaching the banning of using antibiotics as growth promoters from 2006 in the European Community (CE 1831/2003). Then, because of the public concern over possible antibiotic residual effects and the development of drug resistant bacteria, using of antibiotics as routine feed additives has been banned in the recent years [3]. This subject has led to the application of non-antibiotics substances [4] and among the alternative replacement are silver compounds in the forms of ionic and nanoparticles [5].

Compounds of silver have been historically used to inhibit microbial proliferation [6]. The inhibitory effect of ionic silver is due to several biological events such as attachment to cell membranes, its adsorption to the negatively charged bacterial cell wall, changes of membrane permeability, generating reactive oxygen species (ROS) and de-activating cellular enzymes [7].

Traditionally, silver has been applied as salts (ionic form), mainly nitrate, sulphate or chloride. Cation of silver, however, is converted into the less effective silver chloride in the stomach or bloodstream and can make complexes with various ligands. Unstable silver nitrate can be toxic to tissues [7]. These features may be having negative effects on health and leading to high toxicity of silver [8].

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Therefore, the purpose of the present investigation is to evaluate the effects of Nanosil (solution contaning silver nitrate and H_2O_2) in pellet or mash diet on cumulative performance, relative organ weight and some blood parameters of broiler.

MATERIALS AND METHODS

Management of Birds and Experimental Design: One hundred and sixty Ross Unsexed day old 308 strain chicks were purchased from a commercial hatchery and were randomly divided into four groups with 4 replicates (1.5 m × 1.0 m, floor pen) in each treatment on equal body weight (42±0.3 g) basis having 10 chicks. Chicks were fed corn soybean meal based diet (with sunflower oil) as per standards of nutritional requirement recommended by NRC [9]. Ingredients and chemical composition of basal diet were presented in Table 1. All factors such as temperature, light, water, ventilation and vaccination were similar for all treatments.

In a 2 × 2 factorial design (based on completely randomized design (CRD)), the effect of Nanosil in broiler diet on cumulative performance, relative organ weight and blood uric acid, SGOT and SGPT were investigated. The first factor was feed type (pellet or mash) and the second was Nanosil (with or without). Birds and feeds were weighed weekly. Feed conversion ratio was calculated by dividing feed consumed to weight gain in each cunulative period.

Feed Preparation: Tow litters of Nanosil solution stock (from Kimia Faam Co, Ltd. Iran, contain 500 ppm ionic silver as silver nitrate and 50% H_2O_2) were dissolved in 98 litters of water and twenty litters of later solution mixed with 1 ton of mash diet. Next, this mash diet was pelleted or not. This process applied to starter and grower diet.

Biochemical Analysis: At days of 42, all male birds from each replicate were selected for blood samples collection for estimate the serum uric acid, SGOT and SGPT. After blood collection, samples were placed in a room temperature and then serum was separated and centrifuged at 3000 rpm for 15 min in centrifuge machine. Serum samples were frozen and stored at -20°C and analyzed subsequently. Serum uric acid, SGOT and SGPT analyzed by using appropriate laboratory kits (Pars Azmon Co, Ltd. Tehran, Iran).

Table 1: Composition of experimental diets (% diet).

Ingredient	Starter (0-21)	Grower (22-42)
Corn	59.17	63.81
Soybean meal	35.97	30.24
Sunflower oil	1.25	2.5
DCP	1.42	1.38
dl-methionine	0.11	0.07
Oyster	1.26	1.25
Salt	0.32	0.25
Vitamin/mineral premix ≠	0.5	0.5
Calculated composition ≠≠		
ME (kcal/kg diet)	2900	3000
CP	20.84	18.52
CF	2.7	2.3
Ca	0.9	0.88
P (available)	0.41	0.4
Na	0.18	0.18
Lys	1.12	1.10
Met+Cys	0.81	0.75
Analyzed coposition		
CP	20.52	18.33
Ca	0.92	0.89
P (total)	0.52	0.49

≠ Provided per kg of diet: vitamin A, 8000 IU; cholecalciferol, 2000 ICU; vitamin E, 30 mg; manadione, 2 mg; riboflavin, 5.5 mg; pantothenic acid, 13 mg; niacin, 36 mg; choline, 500 mg; vitamin B12, 0.02 mg; folic acid, 0.5 mg; thiamin, 1 mg; pyridoxine, 2.2 mg; biotin, 0.05 mg; ethoxiquin, 125 mg; Mn, 65 mg; Fe, 55 mg; Cu, 6 mg; Zn; 55 mg.

≠≠ Based on NRC [9]

Relative Organ Wieght: At 42 days of age, four birds per replicate (2 male and 2 female), were slaughtered and liver, spleen and bursa of fabricius were separated and weighed.

Statistical Analysis: All data were analyzed using GLM model of SAS [10] for analysis of variance. Significant differences among the treatments were identified at 5% level by Duncan's multiple range tests.

RESULTS AND DISCUSSION

Performance: In Table 2, the effects of treatments on weight gain, feed intake and feed conversion rate were shown. There were no interaction effects of feed type and Nanosil on gain. Main effect of feed type on weight gain was significant ($p \leq 0.05$), except in the period of 1-21 days. Advantages of using of pellet diet in broiler nutrition were discussed in previous investigations [11, 12]. Main effects of Nanosil on weight gain, in days of 1-35 and 1-42, were significant ($p \leq 0.05$).

Table 2: Effects of feed type and nanosil (and their interactions) in broiler diet on cumulative performance.

	Feed Type							
	Pellete	Pellete	Mash	Mash		ANOVA (probability)		
	Nanosil							
Trait	+	-	+	-	SEM	Feed Type	Nanosil	Feed Type* Nanosil
Weight Gain, (g)								
Days 1-7	109[a]	119[a]	94[b]	86[b]	5.1	0.0005	ns	ns
Days 1-14	350[a]	329[a]	268[b]	269[b]	11.9	≤0.0001	ns	ns
Days 1-21	592	552	577	542	19.1	ns	ns	ns
Days 1-28	789[a]	759[ab]	753[ab]	728[b]	13.4	0.02	ns	ns
Days 1-35	1533[a]	1468[b]	1381[c]	1350[c]	15.3	≤0.0001	0.008	ns
Days 1-42	2342[a]	2189[b]	1690[c]	1654[c]	38.9	≤0.0001	0.03	ns
Feed Intake, (g)								
Days 1-7	117[a]	119[a]	111[b]	103[c]	1.6	≤0.0001	ns	0.007
Days 1-14	373[a]	377[a]	354[b]	338[b]	5.3	0.0002	ns	ns
Days 1-21	736	731	724	704	9.9	ns	ns	ns
Days 1-28	1320	1312	1302	1298	14.3	ns	ns	ns
Days 1-35	2306[a]	2292[a]	2259[a]	2153[b]	29.9	0.008	ns	ns
Days 1-42	3558[a]	3564[a]	3517[a]	3382[b]	27.9	0.001	0.03	0.02
Feed Conversion Ratio, (g/g)								
Days 1-7	1.06	1.00	1.19	1.19	0.05	0.009	ns	ns
Days 1-14	1.07[c]	1.15[bc]	1.32[a]	1.25[ab]	0.04	0.003	ns	ns
Days 1-21	1.24	1.32	1.25	1.30	0.04	ns	ns	ns
Days 1-28	1.67	1.72	1.72	1.78	0.02	ns	ns	ns
Days 1-35	1.50[b]	1.56[ab]	1.63[a]	1.59[a]	0.02	0.009	ns	ns
Days 1-42	1.51[c]	1.63[b]	2.08[a]	2.04[a]	0.03	≤0.0001	ns	0.04

[a-c:] Means in each row with different superscript are significant different (p≤0.05).

ns: Not significant.

Table 3: Effects of feed type and nanosil (and their interactions) in broiler diet on relative organ weight and blood uric acid, SGOT and SGPT.

	Feed Type							
	Pellete	Pellete	Mash	Mash		ANOVA (probability)		
	Nanosil							
Trait	+	-	+	-	SEM	Feed Type	Nanosil	Feed Type* Nanosil
Liver, (% BW)	2.36[b]	2.01[c]	2.51[a]	2.52[a]	0.07	<0.0001	<0.0001	<0.0001
Spleen, (% BW)	0.077[a]	0.071[b]	0.073[b]	0.052[c]	0.002	<0.0001	<0.0001	<0.0001
Bors, (% BW)	0.039[a]	0.042[a]	0.041[a]	0.028[b]	0.002	<0.0001	0.0007	<0.0001
Uric Acid, (mg/dl)	6.55[a]	3.65[ab]	5.17[ab]	3.01[b]	0.93	ns	0.03	ns
SGOT, (IU/L)	200.00	249.25	185.25	227.75	23.0	ns	ns	ns
SGPT, (IU/L)	5.00	3.25	1.75	2.75	2.02	ns	ns	ns

[a-c:] Means in each row with different superscript are significant different (p≤0.05).

ns: Not significant.

Contrary to the findings of the present study, Ahmadi, [13] and Ahmadi and Kurdestani [14] reported that silver in the form of nanoparticles had no effect on weight gain of broilers. However, in our investigation, ionic silver was used.

Interaction effects of feed type and Nanosil on feed intak, in days of 1-7 and 1-42, were significant (p≤0.05). Main effects of feed type on feed intak, in days of 1-14 and 1-35, were significant (p≤0.05). Interaction effect of feed type and Nanosil on feed conversion ratio in total period (days of 1-42), was significant (p≤0.05). Main effects of feed type on feed conversion ratio, in days of 1-7, 1-14, 1-35 and 1-42, were significant (p≤0.05). Birds consume more feed in pellet form than mash form [11, 12]. Broilers consuming pellet diet with Nanosil had better feed conversion ratio than other treatments and interaction was significant. Probably, this action is due to the effect of ionic silver on harmful bacteria in intestine

and resulted in healthy hindgut and better absorption of nutrients in broilers receiving pellet diet with Nanosil. It seems that all positive effects of silver on performance is related to recent action on gut microflora [15, 16] that encourages with H_2O_2 [17, 18].

Relative Organ Weight and Blood Parameters: Data of relative organs' weight and blood parameters were seen in Table 3. Treatments had negative effects on relative liver weight to live body weight. Absorbed silver ions from gastrointestinal tract enter liver through the portal vein and might have impact on the liver since the liver serves as the first checkpoint for everything absorbed before becoming systemic. Liver is able to actively remove compounds from the blood and transform them to chemical forms that can easily be excreted. It is a logical assumption that ingested silver nano-particles might have impact on the liver. Significant amounts of silver in the liver were observed after inhalation [19]. Its renal excretion via the urine has been detected [20]. The results of researches showed that silver (especially in the form of nano-particles) can damage to different organs and tissue such as liver cells [20, 21].

In our study pellet and ionic silver resulted in bigger bursa and spleen that are contrary with investigations of Ahmadi and Kurdestani [14], Grodzik and Sawosza [22] that used silver nanoparticles in their studies.

Nanosil had negative effects on serum uric acid but no effects on SGOT an SGPT (Table 3). This is a sign of kidney destruction since uric acid is a metabolite that synthsis in kidney. This finding is parallel with those of Drake and Hazelwood [23] and Susan et al [24]. It is showed that, even though silver nanoparticles and silver ions in form of silver nitrate have a similar action mechanism, their effective concentrations are at nanomolar and miromolar levels, respectively [25].

In conclusion, based on the findings of this investigation, diet of broiler chicks in the form of pellet had better effects on performance than mash diet and the concentration of silver with applying Nanosil in the broiler diet have to decreases.

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