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ORIGINAL ARTICLE

The Effect of Dietary Silver Nanoparticles and Inorganic Selenium Supplementation on Performance and Digestive Organs of Broilers during Starter Period

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ABSTRACT
This trial was carried out to investigate the effect of combination silver nanoparticles (SNPs) and inorganic selenium (ISe) on performance traits, digestive and visceral organs of broilers during starter stage (from 1 to 21 days of broiler ages). A total of 300 one-day male broiler (Ross-308) were distributed in five groups 75 birds with four times any treatment and 15 birds in each pen. Experimental diets were: T1- control (basal diet); T2- 25 mg SNPs+ 0.2 mg ISe; T3- 25 mg SNPs+ 0.4 mg ISe; T4- 50 mg SNPs + 0.2 mg ISe and T5- 50 mg SNPs + 0.4 mg ISe. Birds accessed to feed and water throughout study. Results indicated the combination of SNPs and ISe had not significantly effected on performance traits such as live body weight (P>0.05), feed intake (P>0.05) and feed conversion rate (G/F) (P>0.05) compared with control. As well as the highest body weight observed in T1 birds (control group) at the end of study (21 d). Relative weight of liver and small intestine were higher (P<0.05) in birds fed diet inclusion of SNPs and ISe than control. In conclusion, finding current research suggested that none of combination levels of SNPs and ISe not only no improve growth performance but also may be to have some negative effects on the overall health of broiler chickens.
Key words: *Broiler, silver nanoparticles, selenium, performance, organs*

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INTRODUCTION

Nanotechnology is one of the branches of science that defied it as an innovative technology which is deal to different element and finally produced create materials and change structure, enhanced quality and texture of foodstuffs at the molecular level [1]. This technology has a major impact on production, processing, transportation, storage, traceability, safety and security of food [2]. Many reports indicated that silver nano particles was cased induced oxidative stress and may be potential toxic [3, 4], and this condition may be resulted negative effect on performance [5]. Sawosa *et al*. [6] reported that silver nanoparticles no affected on gastrointestinal micro flora and morphology quails enterocytes. Selenium is one of the important trace elements that are a dietary essential nutrient in poultry [7]. It is a part of oxidative enzymes of over 30 separate selenoproteins, especially oxidative enzymes such as glutathione peroxidase (GSH-Px) which contains this micro element in its active place [8].

The activity of glutathione peroxidase depend on present adequate Se in diet till defend body cell from damages induced different factors (thermal stress, disease, toxin and so on) that stimulate oxidative stress condition and produced free oxygen and radical [9, 10]. Therefore, to preserve optimum oxidative stability of quality carcass and meat, we have to supply different antioxidants such as selenium, vitamin E in diet of poultry and animal farms animals [11]. A few reports published that silver nanoparticles had cased negative effect on the quality carcass, performance traits blood parameters and serum lipid [5] of broilers etc, and also had demonstrated that silver nanoparticles induced oxidative stress and impair oxidative enzymes function in mice and broilers [12, 13], Therefore, Therefore, the objectives of this experiment were to investigate the ameliorate selenium effect on negative effect of Silver nanoparticles by using two levels of inorganic selenium (ISe) on carcass traits and some serum lipids with presence silver nanoparticles in diet of broiler chickens.

MATERIALS AND METHODS

Birds, housing and diet

Three hundred one-day-old mail broilers (Ross 308) were randomly assigned in a completely randomized design (CRD) involving 5 dietary experimental group including 75 chicks and each dietary treatment was replicated four times and 15 birds per pen. The basal diet Ingredients and composition fed as control treatment presented in Table 1. Other dietary treatments were supplemented with different combination sodium selenite (ISe; Na2SeO3) and silver nanoparticles per kg of feed. Experimental diets were following:

T1) control (basal diet, without additive)
T2) 0.2 mg ISe + 25 mg SNP
T3) 0.4 mg ISe + 25 mg SNP
T4) 0.2 mg ISe + 50 mg SNP
T5) 0.4 m g ISe + 50 mg SNP

The purity stock powder of silver nanoparticles was 0.3 % (Table 2) therefore, the amount need based on experimental diet removed. To increase precession, the first removed ISe and silver nanoparticles mixed with 5 kg of basal diet, and then completely mixing with experimental diets. This research was lasted 21 day (starter period). Birds were accessed as *ad libitum* to feed and water throughout study. Birds were allocated in a poultry farm including 20 pens with 1.5m×1m×0.75 dimension, and 15 birds in each experimental pen on wooden shavings with 23L-1D lighting schedule.

Table 1: Ingredients and composition of basal diet (as-fed basis) during starter period (1-21d)

Ingredients (g/kg)	value
Corn	613.30
Soybean meal (48% CP)	327.03
Soybean oil	22.00
Salt (Nacl)	3.00
Limestone	14.00
Dicalcium phosphate (DCP)	14.00
Vitamin premix[1]	3.00
Mineral premix2	3.00
DL-Methionine	0.21
L-Lysine HCL	0.05
Threonine	0.41
Total	100
Calculated nutrients	
ME (kcal/kg)	3143
Crude Protein (%)	22.47
Ca (%)	1.01
Available phosphorus (%)	0.47
Met+ cys (%)	0.78
Lysine (%)	1.31
Arginine (%)	1.25

[1]Supplied per kilogram of diet respectively: 37.5 mg of ZnSO4·H2O, 37.5 mg of MnO, 37.5 mg of FeSO4·7H2O, 3.75 mg of CuSO4·5H2O, 0.83 mg of KI, and 0.23 mg of NaSeO3.

[2]Provided per kilogram of starter diets, respectively: I, 0.7, 0.6 mg; Se, 0.3, 0.3 mg; vitamin A, 8,000, 6,000 IU; vitamin D3, 1,000, 500 IU; vitamin E, 30, 20 IU; menadione, 0.5, 0.5 mg; thiamine, 2.0, 2.0 mg; flavin, 8.0, 5.0 mg; niacin, 35, 30 mg; pyridoxine, 3.5, 3.0 mg; vitamin B12, 0.01, 0.01 mg; pantothenic acid, 10.0, 10.0 mg; folic acid, 0.55, 0.55 mg; biotin, 0.18, 0.15mg; choline chloride, 1, 1 g; flavomucin, 0.1, 0 g; antioxidant, 0.4, 0.5g

Table 2: Composition of silver nanoparticles of stock powder

Items	Properties				
Appearance	White powder				
Ag 0.15, Na 0.45, H 0.4, $Zr_2(PO_4)_3$	99.99%				
Composition (%)	Ag	Na	H	Zn	PO_4
	0.3	7.2	6	20	66
PH	7.2				
Melting point (Centigrade)	250				
Size (nm)	30-50nm; mean=40nm				
Dentisify (g/cm&sup3)	D50≤2.0				

Sample Collections

On d 21, following a 12-h feed withdrawal period to decrease the effects of feeding on performance parameters of the birds, four birds from each group (one bird per replicate) were selected according to closest weight to mean weight of treatment. Birds immediately slaughtered according to the welfare of animal slaughter regulations of organization of veterinary of Iran country. After open cavity of the birds, feather, heads, necks, and feet removed from the birds, and then viscera organs such as liver, gizzard abdominal fat, small intestinal (SI), proventriculus, pancreas and heart removed and calculated those relative weight based on the percentage of live body weight by following formula:

(Weight of organs÷ live body weight)×100.

Statistical Analysis

A general linear model was used to assess the effects of dietary combination of nano-Ag and ISe with SAS software [14]. All data presented as percentages were transformed to their arcsine square root before statistical analysis, and the non transformed data are presented in the tables. Differences were considered significant at $P<0.05$. Significant differences among the means were determined by using Duncan's Multiple-Range test at $P<0.05$.

RESULTS AND DISCUSSION

Carcass parameters

As showed in table 3, dietary combination of silver nanoparticles and inorganic selenium had not significantly affected on broilers performance at 21 days of age. Also, the highest body weight and feed intake observed in control birds group at the overall rearing period ($P>0.05$). This finding is in contrast Ahmadi and Rahimi [12] report that body weight and feed intake increased ($P<0.05$) compared to control in broilers that fed diets supplementation with different levels of nanoparticles at the find of study. Lane Pineda et al. [15] reported that broiler after hatch supplementation of silver nanoparticles at 10 and 20 mg/kg no effect on feed intake, BW and FCR. Also no difference significance with regard to LBW between the nanosilver treated groups and the control ($P>0.05$). None of the combination of SNP and ISe had not significantly ($P>0.05$) affected on feed conversion ratio (FCR). Of course some reports indicated that adding silver alone had a numerical increased in daily gain compared with control, but this effect was not generally significant [8] In a study that carried out on rat, results indicated that silver nanoparticles no significance effect on growth performance such as body weight [16]. Also, finding present study is agreement with sawosa *et al*. [6] they reported that nano-Ag had not affected on growth development, or DNA oxidative damage in chicken embryos.

Sondi *et al*. [17] and Hoet *et al*. [18] had demonstrated that silver nano particles had induced oxidative stress and this situation cased that decreased health, immune system, apoptosis and over all decreasing growth performance and quality carcasse. Therefore, one of the reason that probably explain this results this is that many researches indicated that silver nanoparticles induced oxidative stress and this condition may be had negative effect on performance and over all healthy of broilers.

Table3: Effect of blend SNPs and ISe on growth performance of broilers at 21 days of age[1]

Experimental Treatments	Growth performance[2]		
	LBW (g)	FI (g)	FCR (G/F)
T_1. Control (no additive)	915	1234	1.34
T_2. 0.2 ISe mg + 25 mg SNP/kg diet	908	1242	1.36
T_3. 0.2 ISe mg + 50 mg SNP/kg diet	891	1213	1.36
T_4. 0.4 ISe mg + 25 mg SNP/kg diet	887	1183	1.33
T_5. 0.4 ISe mg + 50 mg SNP/kg diet	901	1208	1.34
SEM	21.4	36.11	0.12

[1]Means with different superscripts in the same column differ ($P<0.05$).

[2]The Means represent 4 pens per treatment group.

Digestive and visceral organs

As shown in table 4. These results indicated that relative weight of liver and small intestine (SI) had significantly ($P<0.05$) increased in comparison with control treatment. The highest relative weight of mention organs observed in T3 (50mg SNPs+0.2mg ISe) and T5 (50mg SNPs+o.4mg ISe) groups. Kim et al. [16] reported that silver nanoparticles dad not significantly altered organs weight in rat. As well, scientific report [16] had indicated the content or retention of silver element in different organs such as

liver, kidneys, testis, lung and stomach increased with increasing levels of nanosilver. Of course, one of the reason to explain of result with regard to results of current research may be due to binding of Ag+ ion to other macromolecules (i.e. lipoproteins) trace or macro element after absorption from GIT and than by means of circulating blood transferred to liver and retention Ag in those tissues. A nanoemulsion is obtained by the milling of a drug to nanometer particle size and suspension in appropriate solvents to improve drug metabolism and pharmacokinetic properties. Therefore mention reason may be cased increasing relative liver weight compared control treatment. Chronic ingestion of silver compounds may lead to its retention in skin, eyes and other organs such as liver [19]. Ahmadi and Rahimi [12] indicated that had retained silver (Ag) in some of edible parts of carcasse broiler chickens such as liver and breast muscle based on ppb concentration.

Also, small intestine in birds that fed diet supplementation with bend of SNPs and ISe had significantly increased compared control treatment, as well an increasing trend in relative weight of small intestine observed with increasing concentration of silver nanoparticles in diet. It is well demonstrated that silver compounds have been historically used to control microbial proliferation [20). Silver nanoparticles had used in much lasted time as extend antimicrobial event against antibiotic-resistant bacteria [21]. Therefore, this may be assumed this silver nano particles property affected on gut profile micro flora and then this condition increased relative weight of small intestine of broiler. Although, sawosa *et al*. [6] reported that silver nanoparticles no affected on gastrointestinal micro flora and morphology quails enterocytes. But, it is likely shown that under the stress conditions of commercial farms the concentration of pathogenic bacteria increased and thus the effect of silver would be more manifested [22].

Table 4: Effect of combination SNP and ISe on the mean digestive and visceral organs weight at 21 days of broilers age[1]

Experimental Treatments	Digestive and visceral organs (% LBW[2])						
	Liver	Heart	Gizzard	Pancreas	Abdominal fat pad	Proventriculus	SI
T_1. Control (no additive)	1.90^{c}	1.08	1.23	0.43	1.35	1.13	1.34^{d}
T_2. 0.2 ISe mg +25 mg SNPs/kg diet	2.13^{b}	1.07	1.24	0.42	1.38	1.10	1.72^{c}
T_3. 0.2 ISe mg + 50 mg SNPs/kg diet	2.10^{b}	1.09	1.21	0.44	1.44	1.13	2.05^{ab}
T_4. 0.4 ISe mg + 25 mg SNPs/kg diet	2.26^{a}	1.08	1.19	0.42	1.45	1.09	2.34^{a}
T_5. 0.4 ISe mg + 50 mg SNPs/kg diet	2.29^{a}	1.09	1.21	0.45	1.46	1,12	2.36^{a}
SEM	0. 04	0.12	0.26	0.11	0.31	0.17	0.44

[1]Means with different superscripts in the same column differ (P<0.05).

[2] LBW=live Body Weight

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REFERENCE

1. Usama, T. M. (2012). Silver Nanoparticles in Poultry Production. *Journal of Advanced Veterinary Research,* 2: 303-306.
2. Otles, S., Yalcin, B. (2008). Smart food psckaging. Elektroniczne czasopismo naukowe z dziedziny logistyki. 4:1-7. http://www.logforum.net
3. Braydich-Stolle, L., Hussain, S., Schlager, J. J., Hofmann, M. C. (2005). In vitro cytotoxicity of nanoparticles in mammalian germline stem cells. *Toxicol Sci,* 88: 412-419.
4. Gan, X., Liu, T., Zhong, J., Liu, X., Li, G. (2004). Effect of silver nanoparticles on the electron transfer reactivity and the catalytic activity of myoglobin. *Chem Bio Chem,* 5:1686-1691.
5. Ahmadi, F., Kordistany, A. H. (2011). The impact of silver nano particles on growth performance, lymphoid organs and oxidative stress indicators in broiler chicks. *Global Veterinaria,* 5: 366-370.
6. Sawosa, E., Marian, B., Marta G., Marlena, Z., Pawel, S., Maciej, S., Tomasz, N., Andre, C. (2007). Influence of hydrocolloidal silver nanoparticles on gastrointestinal micro flora and morphology of enterocytes of quails. *Archives of Animal Nutrition,* 61: 444–451.
7. National Research Council. (1994). Nutrition requirements of poultry. 9th Ed. National Academy Press, Washington, DC.

8. Fondevila., H., Casallas, M., Abecia, M. C., Ducha, J. J. (2009). Silver nanoparticles as a potential antimicrobial additive for weaned pigs. Animal *Feed Science and Technology,* 150: 259-269.
9. Takahashi, K., Cohen, H. J. (1986). Selenium-dependant glutathione peroxidase protein and activity: immunological investigations on cellular and plasma enzymes. *Blood*, 68:640-645.
10. Arthur, J. R. (2000). The glutathione peroxidases. *Cell. Mol. Life Sci,* 57:1825-1835.
11. Mahan, D. C. Clone, T. R. Richert, B. (1999). Effects of dietary levels of Seen riched yeast and sodium selenite as Se source fed to growing-finishing pigs on performance, tissue glutathione peroxidase activity, carcass characteristics and loin quality. *Journal of Animal Science*, 77: 2172–2179.
12. Ahmadi, F., Rahimi, F. (2010). The effect of silver nano particles on performance, and retention silver in edible tissue e of broiler chicks. *World Applied Science Journal,* 12: (1) 1-4.
13. Hussein, S. M., Hess, K. L., Gearhart, J. M., Geiss, K. T., Schlager, J. J. (2005). In vitro toxicity of nanoparticles in BRL 3A rat liver cells. *Toxicol in vitro,* 19:975-983.
14. SAS Institute. (1998). User's Guide: Statistic. SAS Institute Inc., Cary, North Carolina.
15. Lane, P., Andrè, C., Ewa, S., Charlotte, L., Ricarda, E., Jan, E., Anna, H., Filip, S., Yuhong, G., Abdalla, A., Heshmat, S. M. (2012). Effect of silver nanoparticles on growth performance, metabolism and microbial profile of broiler chickens. *Archives of Animal Nutrition,* 66: 5, 416-429.
16. Kim, Y. S., Kim, J. S., Cho, H. S., Rha, D. S., Kim, J. M., Park, J. D., Choi, B. S., Lim, R., Chang, H. K., Chung, Y. H., Kwon, I. H., Jeong, J., Han, B. S., Yu, I. J. (2008). Twenty eight day oral toxicity, genotoxicity, and gender related issue distribution of silver nanoparticles in Sprague-Dawley rats. *Inhal Toxicol,* 20:575-583.
17. Sondi, I., Salopek-Sondi, B. (2004). Silver nanoparticles as antimicrobial agent: A case study on E. coli as a model for Gram-negative bacteria. *J Colloid Interface Sci,* 275:177–182.
18. Hoet, P. H., Bruske-Hohlfeld, I., Salata, O. V. (2004). Nanoparticles–known and unknown health risks. *J Nanobiotechnol,* 2:12.
19. Lansdowne, A. B. (2006). Silver in health care: antimicrobial effects and safety in use. *Current Problems in Dermatology*, 33, 17-34.
20. Wadhera, A., Fung, M. (2005). Systemic argyria associated with ingestion of colloidal silver. *Dermatology Online Journal,* 11, 12. http://dermatology.cdlib.org/111
21. Wright, J. B., Lam, K., Hansen, D., Burrell, R. E. (1999). Efficacy of topical silver against fungal burn wound pathogens. *American Journal of Infection Control*, 27, 344-350.
22. Cromwell, G. L. (2006). Rendered products in swine nutrition. In: Essential Rendering (D. L. Meeker, Editor), *National Renderers Assoc,* Alexandria, VA. pp. 141-157.

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