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The Effect of Different Levels of Nano Silver on Performance and Retention of Silver in Edible Tissues of Broilers

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Abstract: This research was carried out to investigate effects of colloidal Nano Silver (Nano particles) on the growth performance and retention of silver in edible carcasses, feces and liver. 240 one-day-old male (Ross 308) broiler allocated in completely randomized design (CRD) consisting of 4 treatment groups with the levels of 0 ppm (Control), 4 ppm, 8 ppm and 12 ppm nano silver that was added to water intake. Each treatment included 4 replicates and 15 birds in each pen. Body weight, feed intake, feed conversion rate measured at 42 days of age. At the end of research 16 chicks were randomly selected and slaughtered. Abdominal fat, liver, gizzard and small intestine were separated, weighted and expressed as percentage of body weight. The results showed that Nano silver had significantly negative effect on Body weight, Feed intake and Feed conversion rate ($p<0.05$) in comparison with control treatment. Also nano silver had significant effects on weight of Small intestine and Abdominal fat ($P<0.01$). Nano Silver had significant effects on rate of retention of silver in Breast, femur muscle, liver and feces ($P<0.01$). Silver retention showed a trend increasing parallel to increase of Nano silver in treatment. Overall the results from this research suggested that the use of Nano silver decreased growth Performance and economic traits in broiler. Also this component can contamination effects for environment, therefore for understanding complete mode of action of nano silver on growth performance in broiler chicks and other side effete we need to do further research in this background.

Key words: Broiler · Nano particle Silver · Performance · Edible tissues · Silver retention

INTRODUCTION

Nanotechnology is a most promising field for generating new applications in the most of science branches. Silver is known for its medicinal properties, especially as an anti-microbial agent, but it may be toxic when it is in ionic state. However, the toxicity of Ag can be eliminated, when used in Nano particle form. Nanotechnology involves the study and use of materials at Nano scale dimensions (nono material sizes of =100 nm and contain 20–15,000 silver atoms). Nanotechnology is being demonstrated to have a large impact on many aspects of food and agricultural systems, from the development of new food packing materials to Nano-delivery systems, including the analytical control of the whole food chain. Nanotechnology is one way to achieve these goals that is rapidly expanding and is used in various areas, such as health care food, environmental health and agriculture [1]. Nano-silver is an effective killing agent against a broad spectrum of Gram-negative and Gram-positive bacteria [2, 3], including antibiotic-resistant strains [4]. Gram-negative bacteria include genera such as *Acinetobacter*, *Escherichia*, *Pseudomonas*, *Salmonella* and *Vibrio*. Gram-positive bacteria include many well-known genera such as *Bacillus*, *Clostridium*, *Enterococcus*, *Listeria*, *Staphylococcus* and *Streptococcus*. Antibiotic-resistant bacteria include strains such as methicillin-resistant, vancomycin-resistant *Staphylococcus aurous* and *Enterococcus fascism*. The results of research have showed that silver nanoparticles (diameter 5-32 nm, average diameter 22.5 nm) enhance the antibacterial activity of various antibiotics. Investigation to the use of silver nanoparticles in poultry production and its effects on gastrointestinal micro flora, morphology of entrecotes. Colloidal silver Nano particles (5ppm) in the in vitro experiments, had showed strong antimicrobial properties against *Salmonella entertains* and *Escherichia coli* [5, 6].

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Colloidal silver nanoparticles (10 ppm) injected into fertilized eggs on days 5, 11 and 17 of incubation did not influence the development of embryos, but decreased the number and size of lymph follicles in the bursa of Fabricius [5]. In the first study that we carried out on broiler chicks, Ag nanoparticle had caused the repletion of lymphoid cell from the follicles of Fabricius bursa [7]. The aim of the present research was: 1) Evaluation the effect of colloidal silver nanoparticles on the growth Performance and retention of silver in parts of edible Carcasses and feces in Broiler.2) to study the application of Nano silver as an alternative antibiotic in poultry production.

MATERIALS AND METHODS

A total of 240 one-old-day broiler chicks with average 40 ± 1g were divided into four treatments in a completely randomized design (CRD) with 4 replicates and 15 birds in each pen. The chicks were reared in floor pens (150× 100×75cm) with wood-shaving. Birds were fed as *ad libitum* diets and free access to drinking water that supplied with four levels of Nano particles of silver (nano-Ag) from 1 to 42 days. The concentrations of nano -Ag were 0 (control), 4, 8 and 12 ppm/Lit water intake. The Diet was formulated according to the recommendations of the National Research Council [8]. Dietary ingredients and chemical composition are demonstrated in Table1. Body weight gain (BWG), Feed intake (FI) and Feed conversion ratio (FCR) was measured throughout study at the 42 days. To determine weight of heart, liver, abdominal fat, gizzard and small intestine, one bird from each treatment with closest body weight within ± SD of the mean treatment weight was randomly selected in the 42 days of age and slaughtered. The organs removed, weighted and calculated as percentage of live body weight. Samples of breast and femur muscle and feces were removed and stored in -20°C for investigating the amount of silver by spectrophotometer method.

RESULTS AND DISCUSSION

Feed intake (FI), Live body weight (LBW), Feed conversion ratio (FCR) and mortality of birds are shown in Table 2. The results showed that Nano silver had significant negative effect on FI, LBW, FCR and mortality in comparison with control (without nano-Ag) ($P<0.05$). This negative effect may be related to the antimicrobial effects of nano-Ag on useful gut micro biota. Average concentration of coliform and lactobacilli for the different levels of maternal silver was linearly reduced [9, 10]. Ag-nano in this research had significantly negative effects on mortality percentage among treatments in comparison with control ($P<0.05$). The high percentage mortality related to treatment 4.We saw an increasing trend in mortality parallel with increasing concentration of nano silver. The reason of this situation may be decreasing of immune system in birds. The results of research showed that different levels of colloidal Nano silver caused the repletion of lymphoid cell from follicles of fabricius bursa [7].

Table 1: Dietary ingredients and chemical composition[1]

Ingredients	Starter (1-21)	Grower (22- 42)
Corn grain	59.000	57.500
Soybean meal	39.200	33.200
DCP(Di calcium phosphate)	2.150	1.800
Limestone meal	0.950	0.900
Dl-Meth (98%)	0.130	0.130
Vitamin premix	0.020	0.020
Salt	0.200	0.250
Calculated nutrient		
ME (MJ/kg)	12.610	12.980
CP	21.200	19.270
Ca	0.862	0.784
Met + cys	0.890	0.740
Lys	1.599	1.599

[1]Supplies (per kg of diet): VA 5512 IU, VD3 2200 IU, VE 64 mg, VK3 1.5 mg, VB1 4 mg,VB2 5 mg, VB12 50 lg, folic acid 0.6 mg, nicotinic acid 20 mg, pantothenic acid 15 mg, Cu 12 mg, Fe 80 mg, Mn 120 mg, Zn 100 mg, Se 0.25 mg, I 0.5 mg. (ME) = Metabolizable Energy. (CP) = Crude Protein. (AP) =Available phosphorus

Table 2: Effect of different levels of nano silver on means of FI (g), LBW (g) FCR and mortality (%) at 42 days*

Treatment (ppm)	LBW	FI	FCR	Mortality (%)
Control (without nano-silver)	2660a	5200a	2.02b	1.80c
4	1920b	4300b	2.30a	2.80b
8	1810b	4112b	2.15a	3.39a
12	1810b	3990b	2.24a	3.98a
Mean ± SE	2057.75± 385.4	4400.05± 154.34	2.17± 0.29	2.99± 0.56

*Means with different superscripts within the same column differ significantly (P<0.05) (FI)= Feed intake, (LBW) =Live Body Weight, (FCR) =Feed Conversion Rate, (SE) = Standard error

Table 3: Effect of different levels of Nano silver on means of visceral organs weight (%LBW) at 42 days 1

Treatment (ppm)*	Small intestine	Abdominal fat	Gizzard	Liver
Control (without Nan silver)	2.71b	1.79c	1.80	2.11
4	3.11a	1.80b	1.71	2.20
8	3.17a	2.01a	2.01	2.10
12	3.02a	2.04a	1.90	2.27
Mean ±SE	2.24±2.74	1.91±2.88	1.85±4.01	2.15±4.65

[1]Means with different superscripts within the same column differ significantly (P<0.01)

*Parts Per Million

Table 4: Means of weight retention rate of Nano silver in parts of edible carcasses and feces (ppb) 1

Treatment (ppb)*	Breast muscle	Femur muscle	Liver	Feces
Control (without nano-Ag)	0d	0d	0d	0d
4	97.76c	74.09c	93.91b	2.02c
8	98.64b	82.42b	111.01a	2.60b
12	102.10a	86.54a	124.12a	3.05a
Mean ± SE	99.50 ±0.90	81.01± 0.86	109.67±1.94	2.55±0.07

[1]Means with different superscripts within the same column differ significantly (P<0.01)

*Parts per billion

Visceral Organs Weight: The results in Table 3. showed that the relative organs weight among treatments affected by consumption of nano-Ag. Nano-Ag had significant effects on small intestine and abdominal fat weight in comparison with control treatment (P<0.01).

Silver retention: The results of investigation of the rate of nano-Ag in the parts of edible carcass (Breast and femur muscle) and feces are showed in Table4. The results indicated that retention of silver in the parts of edible carcass may be a reason of systematic absorption of nano-Ag from gut of broilers. Retention rate was significant among 2, 3 and 4 experimental treatments in comparison with control (P<0.01). Investigation for deposition of silver in feces has showed that excretion of silver from feces had a significant increasing in the muscles of body and feces parallel to increase in the water intake (P<0.01). This situation can be harmful for environment and human population health.

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REFERENCES

1. Roszek, B., W.H. de Jong and R.E. Geertsma, 2005. Nanotechnology in medical applications: State-of-the-art in materials and devices. RIVM report 265001001.
2. Bhol, K.C. and P.J. Schechter, 2005. Topical nanocrystaline silver cream suppresses inflammatory cytokines and induces apoptosis of inflammatory cells in a murine model of allergic contact dermatitis. Brit. J. Dermatol., 6: 1235-1242
3. Yin, H.Q., R. Langford and R.E. Burrell, 1999. Comparative evaluation of the antimicrobial activity of ACTICOAT antimicrobial barrier dressing. J. Burn. Care Rehabil., 20: 195-200.

4. Wright, J.B., K. Lam, D. Hansen and R.E. Burrell, 1999. Efficacy of topical silver against fungal burn wound pathogens. Is J. Infecting Control., 27: 344-350.
5. Ewa Sawosz, Marian Binek, Marta Grodzik, Marlena Zieliñska, Pawel Sysa, Maciej Szmidt, Tomasz Niemiec and André Chwalibog, 2007. Influence of hydrocolloid silver Nano particles on gastrointestinal micro flora and morphology of enterocytes of quails. Archives of Anim. Nutrition, 61(6): 444-451.
6. Bouwmeester, H., S. Dekkers, M. Noordam, W. Hagens, A Bulder, C. De Heer, S. Ten Voorde, S. Wijnhoven and A. Sips, 2007. Health impact of nanotechnologies in food production. RIKILT/ RIVM Report 2007.014.
7. Akrami, M.A., 2008. Evaluation of the effects of different levels of nanosilver on fabricius bursa of development and histopathological lesions in broiler chicks. Acta Agraria Kaposvariensis, 3(2): 353-360.
8. Research Council, 1994. Nutrient Requirements of Poultry. 9th rev. ed. Natl. Acad. Press, Washington, DC.
9. Burrell, R.E., J.P. Heggers, G.J. Davis and J.B. Wright, 1999. Efficacy of silver-coated dressings as bacterial barriers in a rodent burn sepsis model. Wounds, 11: 64-71.
10. Fondevila, M., *et al.*, 2009. Silver Nano particles as a potential antimicrobial additive for weaned pigs. Anim. Feed Sci. Technol., 150: 259-269.