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Application of Different Levels of Silver Nanoparticles in Food on the Performance and Some Blood Parameters of Broiler Chickens

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Abstract: This study was carried out on 240 broiler chickens in a completely randomized design in four treatments at 0, 300, 600 and 900 pmm levels of silver nanoparticles with four repetitions within 16 separate cages. The chickens were individually weighed and recorded at the end of every week of experiment. Increase in the amount of food intake and weight, was recorded every week and finally the food conversion ratio (FCR) was calculated; Also blood sampling was carried out to determine blood cells and parameters such as, WBC and some blood Enzymes (ALP, ALT and AST). The effect of different levels of silver nanoparticles had not significant on the number of white blood cells (WBC) and no significant on the blood enzymes at different levels. The effect of the treatment of 900 ppm of nanoparticle has more significant than the others on the weight of living chickens and also there was a significant difference in the food conversion ratio among all treatments at $p<0.05$. Finally the amount of FCR in 900 ppm showed lesser effect than other treatments.

Key words: Broiler chickens, Blood sampling, White blood cells, Blood parameters, Blood conversion ratio

INTRODUCTION

In the recent years, nanotechnology had rapid progress and had the most effect on all parts of human, animal, environmental and industrial life. Some material such as silver nanoparticles have been considered as antibacterials made by human and could be used as an additive instead of antibiotics due to their antibacterial properties and their adaptability to biological systems [1-6]. Sawosza *et al*. studied the effect of different treatments (0, 5, 15 and 25 mg/kg) of silver nanoparticles on the performance of intestinal microbial flora and morphological assessment of duodenal Antrosyt in Quail. The result of this study showed that the effect of silver nanoparticles on the number of *E. coli* and other intestinal bacteria were not significant and no significant effect on the number of white blood cells [2].

Grodzik and Sawosza evaluated the effect of silver nanoparticles on the fetal growth and morphology of bursa of fabricius. They showed that Silver nanoparticles concentration in 10 ppm treatment, had no effect on the growth of chicken embryos and also the number and size of the lymph follicles decreased [3].

The effect of silver nanoparticles on the gram-negative bacteria such as *E.coli*, *Vibriocolira*, *Salmonella*, *Pseudomonas tiphy Aorejinoza* has been studied by some researchers and it is indicated that *Pseudomonas Vibriocolira Aorejinoza* has more resistance to silver nanoparticles than *Escherichia coli* and *Salmonella tiphy* [1]. The aim of this study is to examine the pathological effects of different levels of silver nanoparticles on chicken meat health.

MATERIALS AND METHODS

This research was carried out with 240 broiler chickens (Ross 380) at different concentration of silver nanoparticles (0, 300, 600 and 900 ppm) within 16 cages. In each cage 15 chickens were kept with the average weight of 39± 1 gr. Each cage was completely randomly divided to four treatments and all experiments repeated four times. In the duration of experiment, all the chickens were individually weighted and recorded every week. The increase in food intake and the weight were recorded every week and finally the food conversion ratio was calculated. The rate of the dietary energy at all stages

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such as the initial and final development has been equal to 2900 kcal per kg. In the whole duration of experiment, the chickens received the food and water freely. This experiment has carried out over 56 days in the April to July of 2009. For determination of some blood parameters, the blood sampling was carried out two times in the experiment duration. In the first blood sampling, one chicken separated randomly from each cage and 2 mg blood was taken away from the wing vein. Immediately the blood was centrifuged at 3000 rpm and for 10 minutes to specify serum parameters. In the second blood sampling again one chicken was separated from each cage and the blood was inserted into pipes containing corporeal anticoagulation (Ethylene diamine tetra acetic acid) to determine immunity factors [3-4].

RESULTS AND DISCUSSION

According to Table 2 and the variance analysis showed that different levels of silver nanoparticles had no significant effect on WBC, ALP, ALT and AST.

The Rate of White Blood Cells (WBC): According to Table 2, the number of white cells, has been 8925 cells in treatment 1(without silver nanoparticles), 9300 in treatment 2 (containing 300 pmm silver nanoparticles), 7475 in treatment 3 (containing 600 silver nanoparticles) and 8025 in treatment 4 (containing 900 ppm silver nanoparticle). Thus the minimum amount of white blood cells pertains to treatment 3 and the maximum amount pertains was for treatment 2.

The Rate of Blood Enzyme Alkaline Phosphatase (ALP): According to Table 2, the rate of ALP in the blood, assessed as 2746 unit) in treatment 1, 3673 in treatment 2, 2150 in treatment 3 and 2983 in treatment 4, thus the minimum ALP is related to treatment 3 and the maximum is for treatment 2 (Figure1).

The Rate of Alanine Amino Transferase (ALT): According to Table 2, the rate of ALT enzyme in blood has been 5 unit) in treatment 1, 2.75 in treatment 2, 3 in treatment 3 and 2 in treatment 4 thus the maximum amount of ALT assessed for treatment 2 (Fig. 1).

The Rate of Aspartate Amino Transferase (AST): According to Table 2, the rate of the AST in the blood of chickens assessed as 476 units in treatment 1, 309.25 in treatment 2, 322.25 in treatment 3 and 292.5 in treatment 4. Based on results the minimum amount of AST measured in the blood samples for treatment 4 and the maximum amount was for treatment 1 (Fig. 1).

The Weight of Living Chicken: According to Table 3, the weight of the chicken was 2813.5 gr in treatment 1, 2955 in treatment 2, 2857 in treatment 3 and 3217.5 in treatment 4 respectively. Then the minimum live weight was seen in treatment 1 and the maximum for treatment 4. Results showed that, there was is significant difference among the means ($p<0.05$) and also significant difference seen between treatment 4 and others While there is no significant difference among treatments 1,2 and 3.

The Rate of Food Intake: According to Table 4, the food intake measured as 93.75 Kg in the treatment without silver nanoparticles, 97.5 in treatment containing 300ppm silver nanoparticles, 91.25 in treatment containing 600 ppm silver nanoparticles and 100 in treatment containing 900 ppm silver nano particles respectively. According to Table 4 different levels of silver nanoparticles showed statistical difference at $p<0.05$ level in food intake. There was statistical difference among all the treatments.

The Food Conversion Ratio: According to Table 5, the conversion ratio for the chicken measured 2.22 in treatment 1, 2.20, in treatment 2, 2.13 in treatment 3 and 2.07 in treatment 4 respectively. Thus, the minimum

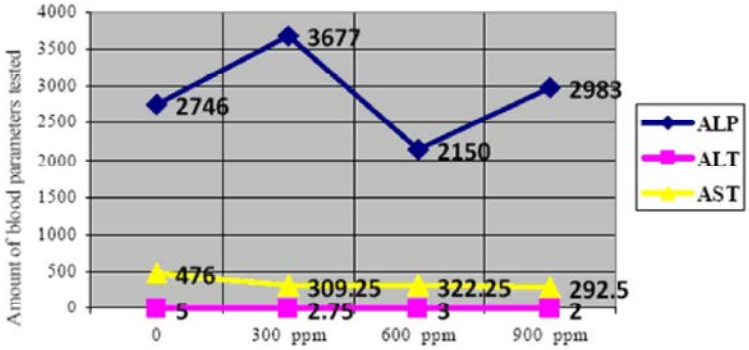

Fig. 1: Effect of different of Nanoparticles on ALP, ALT and AST enzymes.

Table 1: The composition of dietary materials in the different stages of development (Starter, grower and finisher stages)

In the existing food rationing (kg)	Starter (0-15 days)	Grower (16-35 days)	Finisher (36-56 days)
Corn	52.15	54.85	67.75
Soybean meal (44% CP)	40.00	38.20	27.80
Soybean oil	3.00	2.40	0.10
Dicalcium phosphate	1.78	1.45	1.34
Salt	0.36	0.34	0.33
Limestone	1.49	1.32	1.27
Vitamin premix	0.30	0.30	0.30
Mineral premix	0.30	0.30	0.30
DL- Lysine	0.13	0.00	0.00
L -Lysine	0.05	0.11	0.24
Vitamin B Complex	0.20	0.20	0.20
Vitamin C	0.15	0.20	0.15
Vitamin A	0.10	0.10	0.10
Vitamin D	0.20	0.10	0.00
Vitamin E	0.20	0.20	0.10

Energy Matabolizable	kcal/kg	2900	Kcal/kg	2900	Kcal/kg	2900	Kcal/kg
Crude protein	%	17.34	%	20.34	%	23.40	%
Methionine	%	0.50	%	0.43	%	0.50	%
Lysine	%	0.98	%	0.17	%	1.45	%
Ca	%	0.77	%	0.84	%	0.98	%
Getatable Phospher	%	0.38	%	0.42	%	0.48	%
Na	%	0.15	%	0.15	%	0.15	%
Arginine	%	1.23	%	1.41	%	1.45	%
Linleic - Asid	%	1.60	%	2.80	%	2.80	%

Table 2: Effect of different of Nanoparticles on WBC. ALP. ALT and AST

	Silver nano particles levels				
Charateristic	0	300 ppm	600 ppm	900 ppm	SE
WBC	8925	9300.00	7475.00	8025.0	814.2.0
ALP	2746	3673.00	2150.00	2983.0	713.7.0
ALT	5	2.75	3.00	2.0	1.007
AST	476	309.25	322.25	292.5	60.750

Table 3: Effect of different of Nanoparticles on live wight of the chickens (gr)

	Silver nano particles levels				
Charateristic	0	300 ppm	600 ppm	900 ppm	SE
Live weigh (gr)	2813.5^{b}	2955^{b}	2857^{b}	3217.5^{a}	57.79

^{a} and ^{b}: Significant at $p<0.05$

Table: Effect of different of Nanoparticles on the rate of food intake

	Silver nano particles levels				
Charateristic	0	300 ppm	600 ppm	900 ppm	SE
Food intake rate (kg)	93.75^{c}	97.5^{b}	91.25^{d}	100^{a}	0.796

^{a,b,c} and ^{d}: Significant at $p<0.05$

Table 5: Effect of different of Nanoparticles on the rate of food intake

	Silver nano particles				
Charateristic	0	300 ppm	600 ppm	900 ppm	SE
FCR	2.22^{a}	2.20^{a}	2.13^{ab}	2.07^{b}	0.039

^{a} and ^{b}: Significant at $p<0.05$

amount of conversion ratio pertains was for treatment 4 and the maximum for treatment 1. Based on Table 5, different levels of silver nanoparticles showed statistically significant difference among treatments ($p<0.05$). And also showed significant difference between treatment 1 &4 and 2 & 4.

CONCLUSION

There was no significant difference at different levels of silver nanoparticles in blood parameters. There is probable statistical difference among weight means between treatment 4 and other three treatments at $p<0.05$. There is statistical significant difference between the conversion ratio in treatment 1 and 4, also between treatment 2 and 4 at $p<0.05$.

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