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RESEARCH ARTICLE

EFFECT OF NANO SILVER ON PERFORMANCE AND SOME PHYSIOLOGICAL PARAMETERS OF BROILER CHICKS UNDER SOUTH SINAI CONDITION.

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Abstract

A total number of 250 one day-old broiler cobb500™ chicks were used to study effect of nano silver on performance of growth and some physiological parameters of broiler chicks in the diet or drinking water under south Sinai condition. Chicks were randomly distributed into 5 equal experimental treatments of 50 chicks each. Every treatment was sub-divided into 5 replicates (10 chicks/ replicates), the chicks were housed in cages from hatch up to 5 weeks of age. The first group was fed the basal diet as a control(C), while, the other four treatments were fed diets containing either 10 and 15 mg/liter of drinking water silver (Ag NPs) for T1 and T2, respectively, while T3 and T4 treatments were fed on 10 and 15 mg / kg diets, respectively.

Results obtained could be summarized as follows:

Live body weight was increased significantly varied (P<0.01) among the different experimental treatment with the Ag NPs in drinking water and diets more than that of the control diet**.** Live body weight was improved with the Ag NPs level in the drinking water at 10 mg/ liter of drinking water and 10 mg/kg diets. Feed conversion ratio was better when given via the drinking water**.** Results on different growing period for clicks recorded significant differences in all carcass traits. Body weight and feed consumption were significant increase, synchronous with the increasing in thyroid hormone, total protein, IGG and AIGM. The same enhanced were in decrease of total lipid and cholesterol in blood, synchronous with the increasing in thyroid hormone; total protein; IGG and AIGM. The same enhanced were in decrease of total lipid and cholesterol in blood. The effect of the material used harmless to the birds and it is clear from the liver and kidney function means no side effects of the substance under study.

In conclusion, View, the nano form of silver with 10 ppm/ liter of drinking water can be used on growth improve or some physiological parameters for broiler chicks under semiarid condition.

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Introduction:-

In the recent years, nanotechnology had rapid progress in the most of different scientific branches and showed the effects on all parts of human, animal, environmental, and industrial life. One of the substances used in nano-formulation is silver nano-particle (Ag NPs). This technology has a major impact on production, processing, transportation, safety and security of food (Otles and Yalcin, 2008). Unfortunately there is a little work on MNs dissected the daily intake of diets combined with expected distributions of chemicals or biological hazards in food. Consumers and workers worry about the risks of non-intended uptake and its residual effect in animal and humane after using nano nanomaterials (NMs). NMs are involved in many products to improve handling, stability and efficacy of these products. Major materials used in these products are silver, zinc and titanium (Hansen *et al.*, 2008). Nanoparticles of silver (Ag NPs) is an emerging alternative feed supplement for poultry. As a result of nano silver special characteristic of killing bacteria, antimicrobial materials containing nanosilver are becoming increasingly.

These effects are known to influence oral bioavailability of conventional drugs but are even more important for the effects of NMs because NMs readily adsorb proteins, the absorption is estimated to be about 15–250 times higher for nanoparticles (Desai et al., 1996, Cedervall *et al.*, 2007; Lynch *et al.*,2009). Few data published regarding the permeation through diseased barriers. In broiler chicken which were treated with doses below 250 mg/kg AgNPs (Ahmadi and Kurdestany, 2010; Ahmadi, 2009; Ahmadi *et al.*, 2009), adverse effects were already detected at these low concentrations. The higher toxicity of the silver nanoparticles may be due to interspecies differences or to the low age of the chicks. Loeschner *et al.* (2011) on organ distribution of 60 nm Ag NPs great inter-individual variations were noticed although all animals were fed the same diet and differences in the diet are important. Alternatively, Ag NPs can increase activity of cell's immunity by stimulating heat shock protein (HSP) synthesis. Therefore, the ultimate objective of using Ag NPs in poultry production research is to evaluate the potential of N-Ag as an alternative growth-promoting supplement for chicken. Navarro *et al.*, (2008). (Spruill, 2006) have shown that silver nanoparticles can be successfully used as an antimicrobial agent against various organisms. Silver nanoparticles (Ag NPs) can destroy bacteria, viruses and fungi; therefore, it is recommended as a disinfectant and can be used as a drug in the treatment of some non-curable viral disease in livestock (Akradi Loghman1 *et al.*, 2012).

The potential for the use of Ag NPs in poultry production is promising; thus, the main objective of this paper was to clarify the effect of nano silver on performance and some physiological parameters of broiler chicks in the diet or drinking water under south Sinai condition.

Materials And Methods:-

A total number of 250 one day-old broiler cobb500™ chicks were used to study the effect of nano silver (AgNPs) on performance and some physiological parameters of broiler chicks in the diet or drinking water under south Sinai condition. The present work was carried out South Sinai Experimental Research Station (Ras-Suder City), which belongs to the Desert Research Center. Chicks were randomly distributed into 5 equal experimental treatments of 50 chicks each. Every treatment was sub-divided into 5 replicates (10 chicks/ replicates). The first group was fed the basal diet as a control(C), while, the other four treatments were fed diets containing either 10 and 15 mg/liter of drinking water sliver (Ag NPs for T1 and T2, respectively, while T3 and T4 treatments were fed on 10 and 15 mg / kg diets, respectively.

The hydrocolloid of Ag-Nano was obtained from Naqaa comp. and was produced by a non-explosive high voltage patented method (Polish Patent 3883399) from high purity metals and high purity demineralized water. The concentration of nanoparticles in the hydrocolloids was 10, 15 ppm and the particle size ranged from 20 to 35 nm for Nano-Ag based on the transmission electron microscope (TEM) evaluation as previously described (Chwalibog *et al.*, 2010). Glutamine solutions Pure L-Glutamine was dissolved in ultra-pure water at a concentration of 25 mg/ml. The self-organisation process using sonification for 30 min at 30˚C in an ultrasonic bath prepared a hydrocolloid of Ag nanoparticles conjugated with glutamine. The concentration of glutamine in the solution was 25 mg/ml.

Experimental chicks were kept under similar managerial, hygienic and environmental conditions. The chicks were housed in cages from hatch up to 5 weeks of age. Feed was offered *ad libitum* that met NRC (1994) recommendations and fresh water was available all time. The body weight (BW), feed consumption and water intake of the broilers were recorded each week. The average body weight gain (WBG) was calculated from the initial and final weights of the chicks. Feed intake (FI) was calculated from the difference between the amount of feed offered and the amount refused. Feed conversion ratio (FCR) (gm feed intake / gm weight gain) were calculated.

On day 35 of age, 25 chicks were selected randomly (5 from each treatment) and slaughtered by scaling vain to record the immediately, blood was collected in heparinised tubes. After centrifugation at 3000 g for 15 min, blood plasma was obtained and stored until further analysis. Total protein (TP), albumin (Al), while globulin (G) and albumin ratio (A/G ratio) (Globulin (G) was calculated by the difference between total protein and albumin). Alkaline Phosphatase (AP), lipid metabolism (total lipids (TL), Triglycerides (Tg) and total cholesterol (TC)); liver enzymes (AST and ALT); kidney function (ceartain (C) and urea) plasma immunoglobulin IgG and IgM concentration and mineral in blood (calcium (Ca) and phosphor (PH)) and thyroid hormone (T3). All samples were determined calorimetrically by using kits By BioSystems S.A. Costa Brava 30, Barcelona (Spain, Barcelona) kits. Thyroid hormones (Tri-iodothronine) were measured by ELISA method using IMMUNOSPEC kits supplied by Immunospec Corporation, 7018 Owensmounth Ave. Suite 103 Canoga Park, CA 91303, USA.

Statistical analysis was carried out using General Linear Model (GLM) procedures by SAS (2010) using simple one-way analysis of variance according to this model: $Y_{ij} = \mu + T_i + e_{ij}$
Where: Y_{ij}= Any observation of i^{th} chicks within j^{th} treatment, μ = Overall mean, T_i= Effect of i^{th} treatment (i: 1-5), e_{ij}= Experimental error. Significant differences among treatment means were tested by Duncan's multiple range tests (Duncan, 1955).

Results And Discussion:-

Growth performance:-

The effect of supplementation broiler with different levels of Ag NPs on live body weighs, body weight gain and feed efficiency ratio during the experimental period (5 weeks of age) are summarized in Table 1. Live body weight was increased significantly varied (P<0.01) among the different experimental treatment with the Ag NPs in drinking water and diets more than that of the control diet. It is worthy that live body weight was improved with the Ag NPs level in the drinking water at 10 mg/ liter of drinking water and 10 mg/kg diets. It is gradually decreased with elevating it up to 15 mg with diets or drinking water. It is noting that live body weight gain was improved with supplemented 10 mg/liter of drinking water sliver (Ag NPs) by T1 recorded 5.61% while, supplemented 10mg/kg diets recorded 3.06% higher than that of the control treatment.

The FI was significantly between treatments. It is clear that nano form of Ag NPs with the T2 increased significantly feed intake by 2.22 % than that of the control treatment that synchronized in FCR by 3.01 %. Results of feed conversion ratio (FCR) revealed a significant difference (P<0.05) among the experimental treatments. It is noting that feed conversion ratio was better when given via the drinking water.

The increase in body weight gain reflected may be due to the increase in feed intake and the improvement in nutrients of diets. This positive effect may be attributed to the biological function of Ag NPs components on harmful bacteria in intestine and resulted in healthy hindgut due to better absorption of nutrients that have been essential for growth. Andi *et al.*, (2011) recorded a significant improvement in performance of broiler fed nano silver, this action due to the effect of ionic silver on harmful bacteria in intestine and resulted in healthy hindgut and better absorption of nutrients. In vitro conditions the antifungal and antibacterial effect of silver nanoparticles; even against antibiotic-resistant bacteria (Wright *et al*., 1994 and 1999). On the other hand, Ahmad and Rahimi (2011) found decreased growth of chicks on nano silver treatments. Chauke and Siebrits (2012) demonstrate that administering silver-nano particles to the drinking water of broilers did not affect their growth performance, though it may kill coccidia in broiler intestines in terms of oocysts excreted. The results suggest that silver-nano particles may be used as an alternative for antibiotic (ionophor) coccidiostats.

Carcass traits:-

Results on carcass traits are summarized in table (2). Results on different growing period for clicks recorded a significant differences in all carcass traits. It is noting that the T1 recorded highest values of dressing percentage, while T3, T4, T2 and C recorded lowest values, respectively. Liver, gizzard and heart % recorded differ statistically among the experimental treatments, the possible effects of metallic silver and silver ions over microorganisms from the digestive tract are scarcely documented.

Blood analysis:-

Date showering in table (3) clear the significant increasing in TP in T3 and T4 Comparison with other treatment. That flowing by syncorsince resulted in Al or G or A/G ratio. That may be concludethat the formation of protein goes to immune response and building the muscles for the abdominal parts of chickens (as showed in table 2). Date showed in table (4) that there was non-significant different between C, T2 and T3, while there was significant deferent between C and T3 or T4 in creatinine. The same sequence in urea in blood that misnaming there was little improvement in recreation by kidney function (the effect of the Ag NPs harmless to the birds and it is clear from the liver and kidney function means no side effects of the substance under study). That clearest the same by decreasing in Ca or Ph. in blood meaning there was increasing excretion of minerals in fesses (data not showing). That was synchronous between the increasing in T3 and BW and BG, while in table significant increase was recorded in blood glucose contrasted with significant increase in IGG and IGM. This explained that adding Ag NPs either in diet or water in two levels increasing T3 goes to formed the protein in muscles and immuneprotein's for the conceits for lipid ether the harmful lipids. Delivery method (water vs diet) via which Ag NPs was administered Ag NPs was given in the colloidal form via the drinking water, while in other it was added to the diet. It is possible that because Ag NPs is less stable in the colloidal form (Monteiro *et al.* 2009), it loses efficiency when given via the drinking water.

This define by Katao *et al*. (2011) who adding 9.75 mg/kg for 5 d little and found no effect on protein expression. Also, Trouiller *et al*. (2009) who adding 62.5–125–250 mg/kg for 30 d found that DNA-damage in various tissues. That contrasted with Dhar *et al.*, (2010) who adding 75–150–300 ppm for 28 d and reported no changes in blood chemistry, body weight and organ histology. Supplemented with 300–600–900 ppm for 56 d No effect on blood chemistry and blood count, weight reduced at 900 ppm, no change in organ histology Ahmadi (2009), Ahmadi *et al.*, (2009). The same result found whine adding 75–150–300 ppm for 28 d there was no changes in blood chemistry, body weight and organ histology (Dhar *et al*., 2010). On the other hand, Ag NPs is expected to improve the health and immunological status of the animal, physiological and productive purposes (Fondevila 2010). While supplement 5–15–25 ppm for 42 d Indication for oxidative stress in blood and for decreased immune, function by Ahmadi and Kurdestany (2010). Contrasted with this result (Cha *et al.*, 2008) adding 2.5 mg/kg for 3 d note Local inflammation of the stomach.

Abdel Rahman *et al***.,** (2000) suggested that the depression in the total serum protein could be attributed to the decline in the serum albumin rather than the serum globulin. This in turn may affect the active transport of the amino acids need for building albumin intracellularly in the hepatic tissues. It may be that drinking Ag NPs in water or diet might reduce hepatic synthesis of RNA, which in turn depressed the incorporation of amino acids for protein synthesis**.** In addition, the selective response of silver in such ecosystem, with a wide diversity of species that can exert either symbiotic (positive) or pathogen (negative) effects, deserves further attention. Silver compounds have been historically used to control microbial proliferation (Wadhera and Fung, 2005).Research clearly shows that nano-materials can be used to improve broiler chicks performance. However, further research is needed to further explore the beneficial and harmful effects of nanoparticles from metals.

In conclusion, View, the nano form of silver with 10 mg/ liter of drinking water can be used on growth improve or some physiological parameters for broiler chicks under semi-arid condition. The effect of using Ag NPs harmless to the birds and it is clear from the liver and kidney function means no side effects of the substance under study

Table 1:- Effect of Ag NPs supplementation on growth performance of broiler chicks

Items	C	T1	T2	T3	T4	Sig.
Chick Weight (g)	$48.50^{a} \pm 0.08$	$46.92^{c} \pm 0.10$	$48.13^{ab} \pm 0.13$	$48.37^{ab} \pm 0.13$	$47.08^{bc} \pm 0.13$	*
Final weight (g)	$1809.78^{ab} \pm 31.82$	$1901.60^{a} \pm 30.82$	$1826.73^{b} \pm 28.78$	$1864.13^{ab} \pm 29.78$	$1830.33^{ab} \pm 33.78$	*
W G (g period)	$1761.65^{ab} \pm 23.51$	$1854.33^{a} \pm 24.80$	$1778.60^{b} \pm 22.38$	$1815.63^{ab} \pm 25.78$	$1783.42^{ab} \pm 26.78$	*
FI (g period)	$2920.83^{b} \pm 29.98$	$2985.75^{a} \pm 32..81$	$2930.33^{b} \pm 33.78$	$2958.42^{a} \pm 29.78$	$2924.81^{a} \pm 30.78$	*
F C ratio	$1.66^{a} \pm 0.11$	$1.61^{b} \pm 0.08$	$1.65^{a} \pm 0.09$	$1.63^{ab} \pm 0.10$	$1.64^{a} \pm 0.07$	*

a, b: Means within a row with different superscripts are significantly different (P< 0.05).
Sig.= Significance, * (P< 0.01).

Table 2:- Effect of AgNPs supplementation on some carcass parameters of broiler chicks**.**

Items	C	T1	T2	T3	T4	Sig.
B W (g)	$1785.33^{c} \pm 7.90$	$1850.33^{cb} \pm 4.90$	$1880.33^{b} \pm 5.91$	$1970.67^{a} \pm 6.85$	$1848.33^{bc} \pm 5.90$	*
Dressing %	$67.95^{b} \pm 6.12$	$72.05^{a} \pm 5.12$	$69.05^{ab} \pm 6.02$	$70.24^{ab} \pm 4.02$	$69.30^{ab} \pm 3.02$	*
Liver %	$1.79^{a} \pm 0.97$	$1.74^{ab} \pm 1.02$	$1.72^{ab} \pm 0.95$	$1.68^{b} \pm 0.99$	$1.70^{ab} \pm 0.98$	*
Gizzard %	$1.83^{a} \pm 0.97$	$1.75^{a} \pm 1.00$	$1.80^{a} \pm 0.95$	$1.80^{a} \pm 1.02$	$1.78^{a} \pm 1.01$	*
Heart%	$0.51^{a} \pm 1.05$	$0.48^{ab} \pm 1.07$	$0.48^{ab} \pm 1.10$	$0.48^{ab} \pm 1.09$	$0.47^{b} \pm 1.15$	*

a, b: Means within a row with different superscripts are significantly different (P< 0.05).

Sig.= Significance, * (P< 0.01).

Table 3:- Effect of AgNPs supplementation on protein detractions of broiler chicks.

Items	C	T1	T2	T3	T4	Sig.
T P (g/ dL)	5.57^{b} ±0.32	5.83^{ab} ±0.21	6.17^{a} ±0.27	6.30^{a} ±0.11	5.90^{ab} ±0.32	*
Al (g/ dL)	2.93^{bc} ±0.10	2.69^{c} ±0.11	3.13^{ab} ±0.13	3.40^{a} ±0.10	3.33^{ab} ±0.12	*
G (g/ dL)	2.64^{bc} ±0.22	3.14^{a} ±0.23	3.04^{ab} ±0.25	2.90^{ab} ±0.19	2.57^{c} ±0.22	*
A/G ratio	1.13^{ab} ±0.12	0.86^{c} ±0.13	1.04^{ab} ±0.10	1.17^{ab} ±0.09	1.31^{a} ±0.12	*
AST (U/ L)	184 ±2.28	199 ±1.33	207 ±2.32	198 ±1.33	189 ±2.32	n.s
ALT (U/ L)	20.80 ±1.33	18.40 ±1.90	24.40 ±2.32	23.60 ±1.33	20.70 ±1.90	n.s
IGG (U/ L)	27.27^{a} ±2.12	16.13^{b} ±2.22	16.57^{b} ±2.23	12.57^{c} ±2.19	11.30^{c} ±2.31	*
IGM (U/ L)	1.75^{cd} ±0.12	3.03^{c} ±0.20	4.59^{ab} ±0.15	4.07^{b} ±0.14	2.51^{c} ±0.15	*

a, b: Means within a row with different superscripts are significantly different (P< 0.05).
Sig.= Significance, * (P< 0.01).

Table 4:- Effect of AgNPs supplementation on Chemical blood qualities of broiler chicks.

Items	C	T1	T2	T3	T4	Sig.
C (mg/dL)	0.84^{a} ±0.05	0.66^{b} ±0.04	0.94^{a} ±0.05	1.12^{a} ±0.04	0.66^{c} ±0.05	*
Urea (mg/dL)	11.33^{b} ±1.77	14.67^{ab} ±1.70	14.67^{ab} ±1.63	12.33^{b} ±1.65	20.33^{a} ±1.73	*
Ca (mg/dL)	7.53^{d} ±0.39	8.83^{c} ±0.48	8.93^{c} ±0.51	9.30^{b} ±0.63	9.47^{a} ±0.65	*
Ph (mg/dL)	5.57^{a} ±0.18	4.33^{b} ±0.19	4.53^{b} ±0.20	4.13^{c} ±0.17	5.00^{b} ±0.21	*
Alk (mg/dL)	1624.33^{b}±29.21	1893.33^{d}±27.21	2324.00^{b}±28.11	1673.00^{c}±27.35	1818.00^{b}±29.21	*
T3 (nmol/ L)	1.10^{c} ±0.18	1.71^{a} ±0.19	1.15^{c} ±0.19	1.26^{c} ±0.18	1.39^{b} ±0.17	*

a, b: Means within a row with different superscripts are significantly different (P< 0.05).
Sig.= Significance, * (P< 0.01).

Table 5:- Effect of AgNPs supplementation on Chemical blood qualities of broiler chicks.

Items	C	T1	T2	T3	T4	Sig.
Glucose (mg/dL)	241.00^{a} ±16.29	150.33^{c} ±15.39	156.00^{c} ±15.49	175.67^{b} ±16.09	168.00^{b} ±15.49	*
TG (mg/dL)	94.67^{b} ±3.38	95.00^{b} ±4.37	79.67^{c} ±5.68	108.00^{a} ±6.68	106.67^{a} ±6 .49	*
Ch (mg/dL)	140.00^{b} ±5.29	141.67^{b} ±4.35	146.67^{b} ±3.17	174.00^{a} ±6.48	137.67^{c} ±5.29	*
TL (mg/dL)	318.00^{b} ±18.03	368.67^{a} ±13.54	306.00^{b} ±18.71	268.67^{c} ±7.21	301.33^{b} ±17.21	*
LDL (mg/dL)	81.00^{a} ±4.25	61.00^{b} ±3.70	66.00^{b} ±3.19	65.33^{b} ±3.07	62.00^{b} ±2.91	*
HDL (mg/dL)	52.83^{c} ±4.02	71.17^{b} ±4.58	68.00^{bc} ±2.02	86.00^{a} ±3.02	77.00^{b} ±2.02	*

a, b: Means within a row with different superscripts are significantly different (P< 0.05).
Sig.= Significance, * (P< 0.01).

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