Effects of Nano-Selenium Supplementation on Productive Performance of Ross 308 Broiler Chickens

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Abstract:

This experiment was carried out at the field of the Department of Animal Production, College of Agriculture/University of Kufa for 35 days, starting from 10/28 until 12/1/2025. 135 unsexed broiler chicks (Ross 308), were distributed into three treatments with three replicates for each with 45 chicks per replicate. Fed and water were provided ad-libitum in the three standard diets with the addition of Nano-selenium according to the ratios of 0.0 for the first treatment, 0.07 for the second treatment, and 0.15 for the third treatment, and the lighting program was used for 24 hours. To improve the average productive performance including weight gain and live body weight. analysis showed a significant increase for the third treatment in average live body weight (1227.7 and 1816.7 gm, respectively) during the fourth and fifth weeks of rearing. The third treatment also showed a significant increase in average weight gain (589 and 594.4 gm, respectively) during the fourth and fifth weeks of rearing. This study concluded that adding Nano-selenium at these levels can improve the productive performance of broiler (Ross308) .

Keywords: Selenium Nanoparticles, Average live body weight, Average weight gain, broiler .

Introduction:

performance and sustainability [5]. The increasing population leads to a greater demand for food, feed, and other agricultural resources. However, with the application of nanotechnology, resource utilization can be improved, animal health enhanced, and environmental impacts mitigated in livestock production [28].

Nanotechnology is a scientific field that utilizes materials at the Nanoscale. It has emerged as a practical solution to address problems and obstacles in livestock production programs. Nanotechnology applied to nutrients at the atomic and molecular levels to enhance biological activity, contributing to productive

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various nanoparticles of rare mineral elements in poultry diet [17]. Nanotechnology is an advanced scientific method, a future technology, and an eco-friendly approach in the poultry industry. The stability of nanoparticles contributes to reducing the side effects of nanomaterials manufactured by chemical or physical methods [7]. Therefore, modern feeding technologies have adopted the approach of not adding mineral elements in the form of salts, which are difficult for fully utilize, as most of them discarded as waste and pollutants to the environment, but rather they provided as Nano-additives [36]. The aim of this study is to determine the effect of supplementing broiler diets with different levels of Nano-selenium onsome productive performance 33 of Ross308 broiler chickens.

Nano-selenium is a stable, black, soluble material with a large surface area, high surface activity, and high catalytic efficiency. Nano-selenium has received considerable attention as a feed additive to prevent its deficiency and support poultry's selenium needs, and as a therapeutic agent without significant side effects [24]. In recent years, Nano-selenium (Nano-Se) has gained increasing attention as an innovative feed supplement due to its unique properties and low toxicity. This interest attributed to the physical and chemical advantages of selenium in its Nano form, namely its high specific surface area, increased surface

Due to their Nanoscale size and unique physical and chemical properties, metal nanoparticles have garnered significant attention in poultry nutrition for their potential to enhance physiological responses [27]. Unlike traditional mineral supplements, nanoparticles exhibit superior bioavailability, stability, and targeted delivery, which can significantly influence nutrient metabolism and animal productivity [26]. Livestock production systems face challenges such as nutrient deficiencies, environmental conditions, and disease exposure, all of which negatively affect productivity and sustainability [9, 30]. Nutrient Nanoparticles seem characterized by their so much bioavailability in poultry diets, facing the impact of these challenges by modulating molecular pathways associated with growth, immunity and adaptation to stress conditions. Selenium Nanoparticles and nanoparticles, in particular, have demonstrated the potential to enhance antioxidant defenses involved in metabolic homeostasis and immune responses. [25, 15].

Necessary these properties of Nanoparticles can compete with added mineral elements in feed formulations and support the necessary nutritional needs of farm animals, especially poultry. This attributed to the high performance efficiency of nanocrystal forms of metals and other inorganic salts [33]. Several researchers have pointed to the importance of using

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their unique properties, such as large surface area, high surface activity, high catalytic efficiency, high adsorption capacity, and low toxicity [40, 41]. Research indicates that selenium nanoparticles have similar efficacy to both selenite and selenium methyl selenocysteine in promoting the regulation of selenium enzymes, with the notable distinction of significantly lower toxicity [41].

Materials and Methods:

The experiment was conducted at the poultry farm of the Animal Production Department, College of Agriculture, University of Kufa, for 35 days, from 28/10- 1/12/ 2025. The experiment included 135 unsexed, one-day-old broiler chicks with an average initial weight of 41 gm. obtained from Al-Anwar Private Hatchery in Al- Muradiya district, Babylon Province. The chicks divided into 3 treatments, with 45 chicks in each treatment, and 3 replicates per treatment and each replicate containing 15 chicks. The treatments were as follows:

The preventive program and veterinary healthcare system implemented during the rearing period from one-day old, including vaccination in the hatchery and completion of the preventive program in the rearing room. The following health program followed:

First treatment (T1): Standard diet without any additives. Second treatment (T2): Standard diet supplemented with 0.07 mg/kg of selenium Nanoparticles. Third treatment (T3): Standard diet supplemented with 0.15 mg/kg of selenium Nanoparticles.

activity, and high catalytic efficiency [38].

The biological properties of selenium nanoparticles depend mainly on their size; their biological activity increases with increasing size [37]. Selenium nanoparticles play an important role in food metabolism mechanisms due to their ability to enhance bioavailability as an essential nutrient, in addition to the possibility of modifying the properties of high acid resistance and digestive enzyme activity [40]. Furthermore, selenium nanoparticles are inherently unstable and tend to easily transition to an inactive state. To overcome this problem, their stability and improved by coating them with bioactive compounds such as chitosan, which helps protect the Nanoparticles from degradation and enhances their bioavailability [42]. Selenium nanoparticles can be added to animal feed at concentrations between 0.3 and 0.5 parts per million (ppm), without exceeding this limit to ensure safety and avoid toxic effects [11]. Selenium nanoparticles (Nano-Se) have garnered widespread attention due to

Table 1 - The health and preventative program implemented during the trial period

Age/ Day	Vaccination	Method
1	Oil-based vaccine (Avian Influenza + Newcastle) in the hatchery	ntramuscular injection in the neck
7	Italian Vatro vaccine, a mixture of Newcastle + (IB),	ophthalmic instillation
14	Newcastle + (IB) vaccine (infectious bronchitis)	n drinking water
20	Newcastle vaccine	n drinking water

Studied Traits

SAS program (2012) with Complete Randomized Design (CRD) was used for this study. Duncan's test was used to measure the significant differences between means at probability level of 0.05 [16]. The statistical model for this experiment was as follow:

$$Yij = \mu + ti + eij$$

Where:

Yij = observational value j for treatment i

μ = overall mean for the studied trait

ti = effect of treatment i (four treatments in the experiment)

eij = random error

: Average Live Body Weight (g/bird)

The weight of one day-old chicks was measured using an electronic scale in groups. The chicks then distributed among the treatments, and their live body weight was measured at the end of each week for a period of (1-5) weeks according to the following equation:

$$\text{Average Live Body Weight (g/bird)} = \frac{\text{Total live body weight chicks}}{\text{Number of chicks per Replication}}$$ [7]

Average weekly weight gain (g/bird) [2]

Statistical Analysis:

Results and Discussion

Average Live Body Weight

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of stress (high temperatures, high chick-to-pound ratio per unit area, delayed feeding, and light intensity). It activates the enzyme glutathione peroxidase, thus reducing heat stress [13]. These results are consistent with those results of [10], who suggested that the improvement in live body weight may be due to Nano-selenium binding to proteins within the body. These proteins possess antioxidant properties, thereby reducing lipid peroxidation, which improves metabolic processes within the bird and alleviates stress.

Essential Nano-Selenium element for metabolic and building muscles consistence in significant superiority ($P<0.05$) and meeting the birds' needs. The improvement in body weight of individuals in experimental treatments supplemented with Nano-selenium perhaps attributed to its role as a natural antioxidant that protects the intestinal mucosa and promotes intestinal flora [31]. Furthermore, the significant improvement in mean live body weight in the supplemented treatments may be due to the importance of Nano-selenium in reduces the effects

Table 2 - Effect of selenium Nanoparticles supplementation on the average live body weight g/week ± S. E

Weeks / Treatments	Wk1	Wk2	Wk3	Wk4	Wk5
T_1	131.2±3.83 NS	131.2±3.83 NS	590.3±4.09 B	1065.2±15.84 b	1544.3±6.18 B
T_2	131.1±4.06 NS	208.6±6.79 NS	631.8±11.31 A	1222.7±14.99 a	1814.7±24.34 A
T_3	132.8±3.27 NS	211.2±6.11 NS	633.3±8.20 A	1227.7±10.29 a	1816.7±38.57 A

NS means no significant differences, b, a means significant differences at a significance level of 0.05 (*), T1 is free of any addition, T2 contains 0.07% of Nano-selenium, T3 contains 0.15% of Nano-selenium.

The improvement in body weight of individuals in experimental treatments supplemented with Nano-

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may be due to Nano-selenium binding to proteins within the body. These proteins possess antioxidant properties, thereby reducing lipid peroxidation, which improves metabolic processes within the bird and alleviates stress. [18] Indicated that the use of Nano-selenium led to an improvement in the intestinal flora Colonies, and increase in beneficial bacteria and a decrease in harmful bacteria. As well as improving the length, number and depth of the shape of the intestinal villi, which helps to increase absorption and improve the productive performance of broiler chickens.

Weight gain (g/bird):

the fourth, and fifth weeks, indicating the superiority of birds in the second and third treatments over the birds in the first treatment.

selenium perhaps attributed to its role as a natural antioxidant that protects the intestinal mucosa and promotes intestinal flora [31]. Furthermore, the significant improvement in mean live body weight in the supplemented treatments may be due to the importance of Nano-selenium in reduces the effects of stress (high temperatures, high chick-to-pound ratio per unit area, delayed feeding, and light intensity). It activates the enzyme glutathione peroxidase, thus reducing heat stress [13]. These results are consistent with those results of [10], who suggested that the improvement in live body weight

Table 3: No significant differences were found in the first, second, and third weeks. However, significant differences (P<0.05) appeared in

Table -3 - Effect of selenium nanoparticles supplementation on the rate of weight gain (g/week) ± S.E

Week / Treatments	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5
T_1	78.4±5.75 NS	193.5±5.37 NS	380.7±6.81 NS	474.9±14.67 b	488.1±17.90 B
T_2	77.5±6.74 NS	193.8±7.15 NS	423.2±14.28 NS	590.9±18.53 a	592±31.38 A
T_3	78.4±6.74 NS	194.5±5.43 NS	422.1±12.46 NS	594.4±14.16 a	589±41.84 Ab

NS means no significant differences, b, a means significant differences at a significance level of 0.05 (*), T1 is free of any addition, T2 contains 0.07% of Nano-selenium, T3 contains 0.15% of Nano-selenium.

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and feed conversion efficiency. Nano-selenium also plays a role in enhancing intestinal immunity and reducing oxidative stress, which helps to provide a healthy intestinal environment that supports the growth of beneficial flora colonies and improves the integrity of the intestinal lining [15].

Conclusions

Addition of these supplements leading to an increase in average live body weight. 1_

2_ High level addition of Nano-selenium element increase in means weight gain in experiment flock broiler, especially at marking period.

3- This addition of Nano-selenium reduced mortality percentage with good healthy all-time experiment.

This improvement in gain weight perhaps attributed to the binding of Nano-selenium to proteins with antioxidant properties, which reduce lipid peroxidation and improve metabolism. Nano-selenium supplementation also contributes to enhanced intestinal digestion, acting as a stimulant for the secretion of digestive juices in the small intestine, liver, and pancreas [20]. [35] Observed that Nano-selenium is an important micronutrient added to poultry feed due to its role in improving digestive health and regulating the intestinal flora colonies in the small intestine. Studies indicate that adding Nano-selenium to broiler feed can improve the microbial balance in the gut by increasing the colonies of beneficial bacteria such as Lactobacillus and Bifidobacterium, while reducing the growth of pathogenic bacteria such as Salmonella and Escherichia coli. This balance contributes to improved digestion and nutrient absorption, positively influencing bird health

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