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Effect of using nano silicon carbonate ($SiCo_4$) in feed on some hematological, biochemical of broiler chickens

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ABSTRACT

The present study was investigated to evaluate the effect of added nano silicon carbonate ($SiCo_4$) in determine some physiological effects on broiler chickens. The experimental treatments were arranged as follows; Group T1 received standard diet without any addition, group T2, T3, and T4 received standard diet supplemented with $SiCo_4$ (100,200 ,300 mg/kg) respectively from (10-35) day of age. The results revealed a significant increase the RBC count, PCV% and hemoglobin levels in the $SiCo_4$ supplemented groups. In addition a decreasing the level of glucose and triglyceride in the groups of $SiCo_4$ addition. No significant variation detected in the level of cholesterol, total protein, albumin, globulin, GOT, GPT, or the weights of liver and heart. This is a clear indication about the role of nano silicon carbonate to maintaining the stability of vital organs and the body fluids.

Keywords: *Carbonate; Experiment; Supplemented*

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INTRODUCTION

Nanotechnology offers a significant advantage in feed supplementation can act as a carrier for precise and targeted delivery, enhancing bioavailability and nutrient absorption (Wang *et al*., 2018). Nanoparticles as feed additives, showing a clear evidence of their potential as growth promoter of all that is can reduce the cost of animal production (Almeida *et al*., 2024). Among the various nanomaterials silicon has gained considerable interest because of its essential biological functions and its potential applications in poultry nutrition. Silicon is the second most abundant element in the Earth's crust and is naturally distributed throughout animal tissues, with particularly high concentrations in bones, connective tissues, skin, feathers, and blood vessels (Faryadi and Sheikhahmadi., 2017) Recent evidence suggests that nanoscale silicon compounds possess greater biological activity than their conventional counterparts due to their extremely small particle size and larger surface area, characteristics that significantly enhance their absorption and physiological availability (Swain *et al.*, 2016). It has been suggested that silicate minerals enhance the digestibility of feed and performance in broiler chickens through stimulation of the gastrointestinal tract (Safaeikatouli *et al*., 2012). Previous studies conducted by Katouli *et al*. (2012) obtained that the inclusion of silicate minerals in the diets of broiler chickens improved the weight gain, and they explained that this improvement may be due to the action of silicate minerals. As a result, increasing the digestibility According to some studies, by improving nutrient utilization, reducing feed wastage, increasing feed conversion, improving animal immunity and disease resistance, and reducing the use of antibiotics and other chemicals, the use of nano-based feed products.(Nile *et al*.,

2020). Based on the progress, the current study focused on investigating the Effect of using nano silicon carbonate supplementing broiler feed on physiological , biochemical parameters of blood, , and vital organs weights.

MATERIALS AND METHODS

Design and management of birds

The experiment was conducted in the fields of the College of Agriculture, Tikrit University, from the period of 18/2 - 24/3/2025. Unsexed 1 day broiler chicks (ROSS-308) weighed and randomly collocated to four treatments, each one consisting of three replicates with 15 chicks per replicate

The treatments were arranged as follows

T1: Basal diet standards (Control)

T2: supplemented with (100 mg/kg) $SiCo_4$

T3: supplemented with (200 mg/kg) $SiCo_4$

T4: supplemented with (300 mg/kg) $SiCo_4$

The birds were reared on the floor pens under standard management conditions. Feed and water were provided a limited throughout the experiment. All diets were formulated to meet the nutrient requirements were recommended by National Research Council (NRC, 1994). Data were statistically analyzed using the Statistical Analysis System (SAS, 2001). Data were analyzed through one-way ANOVA and differences among treatments were evaluated using Duncan's Multiple Range Test ($P<0.05$).

Blood collection and hematology analysis

Blood samples were collected at the end of the experiment period. The samples were collected in two types of tubes: one set contained an anticoagulant for the determination of blood hematology variables (RBC, PCV, and Hb), assessed according to the procedures described by (Campbell, 1995). The other tubes, without anticoagulant, were centrifuged at 3000 rpm to obtain serum, which was stored at −20°C until analysis. Serum samples were then analyzed for biochemical parameters, including cholesterol, glucose, GOT, GPT, uric acid, triglyceride, albumin, globulin, and total protein.

Statistical Analysis

The general linear model procedures in SAS (2001) were used to analyze the data means were compared using Duncan's multiple range tests at a significance level of 5%.

RESULTS AND DISCUSSION

Hematology

The results of the present experiment are shown in Table 1, which illustrates the changes in the number of red blood cells following the addition of silica to the feed. Based on these results, the RBC values in the silicate treatments were significantly higher than those of the control. The results also show a significant increase in hemoglobin in favor of the silica treatment, as well as a significant superiority in PCV, which indicates the positive role of silicates in

affecting physiological blood characteristics. The hematological profile in animals is an important indicator of the physiological or pathophysiological status of the body (Khan and Zafar, 2005). From the findings of this study, it is evident that silicates have a clear effect on blood characteristics, which may be reflected by an increase in the number of red blood cells. These results are consistent with (Dosoky *et al*., 2021), who reported that silicates have no negative effects on the hematological, biochemical, and oxidative parameters of birds. However, these results do not agree with what was reported by (Dosoky *et al*., 2021), which indicates that RBCs, Hb, and PCV% were not significantly affected by silica treatment.

Table (1) Effect of addition SiCo4 on some hematology traits of broiler ROSS-308

Treatment	RBC	Hb	PCV%
T1	2.78±0.12 b	10.09±0.28 b	25.51±0.44 b
T2	3.15±0.10 a	11.77±0.36 a	28.98±0.35 a
T3	3.21±0.15 a	11.63±0.41 a	28.48±0.67 a
T4	3.27±0.11 a	11.41±0.22 a	29.47±0.56 a

a,b,c In each column, means with different superscripts are significantly different ($p<0.05$).

Biochemical Parameter of Blood

The numbers in the table 2 showed the results of the biochemical analysis of broiler blood. Based on the results of the current experiment a significant difference in glucose levels was observed campaign for the silica supplementation treatments. Additionally, triglyceride levels were significantly lower in the fourth treatment. No significant differences were recorded in the levels of uric acid or cholesterol protein, albumin and globulin. Plasma biochemical parameters are the main tools for assessment of health in many species and are used as markers of disease or disorders in organs such as liver kidneys, and biliary tract (Tran *et al.*, 2015) .The results of the current study were consistent with what was reached by Safaeikatouli *et al*. (2012), Who indicated no significant differences were noticed in the level of protein, albumin, and uric acid. A decrease in triglycerides was noted in the control group. These results confirm the role of silica in maintaining stable and normal levels of body proteins (albumine, globulin) It was not demolished., and it did not negatively effect of metabolic processes within the body, as uric acid levels remained within normal limits when silica was added, compared to the control group. Uric acid is considered the final product of protein metabolism in poultry (Sturkie, 2000). An increase in uric acid concentration in the blood reflects the extent of protein damage due to several reasons, such as protein use as an energy source or stress in birds.

Table (2) Effect of addition SiCo4 on biochemical indicators broiler ROSS-308

Treatment	Glucose	Triglyceride	Uric acid	Cholesterol	Total protein	Albumin	Globulin
T1	203.66a±7.12	67.65a±5.23	3.79±0.12	154.20±7.23	6.22±0.29	3.53±0.32	2.69±0.25
T2	148.71b±6.23	64.57ab±2.74	4.00±0.06	150.45±5.41	6.02±0.21	3.56±0.44	2.46±0.28
T3	144.87b±9.41	63.16ab±4.18	3.82±0.11	149.14±5.89	6.51±0.32	3.23±0.21	3.28±0.14
T4	140.14b±6.04	59.67b±3.77	3.88±0.25	148.63±6.04	6.26±0.41	3.70±0.29	2.56±0.18

a,b,c In each column, means with different superscripts are significantly different ($p<0.05$).

Liver enzymes activity and weight of liver and heart

From the results shown in the table 3, we note that there are no significant differences in the relative weight of the liver

and heart. The results of the experiment showed that no significant differences in liver enzyme levels, indicating that they were not leaking out of the liver. Elevated levels in the blood would suggest either leakage from cells or loss of selective membrane permeability, leading to leakage of cell contents (Olayinka *et al*., 2015). These results were consistent with those obtained by Ghazalah *et al*. (2021) which suggested no significant changes within the liver, heart and spleen weights by adding silicate to the cattle diet These effects confirm the activity of nanoparticles, that Nano-minerals cross the small, heart, comney and lungs. Has the ability to penetrate the spleen, liver, intestine and stomach (Swain *et al*., 2021). These effects came to show the importance of silicate in maintaining liver properties and its enzymes similar to what is shown by (Khafaga *et al*., 2022) who stated that adding silicate not negatively effects on the liver functions. We found a net effect on the health of vital organs like the heart and liver. This is in line with what was established by Samy and Elsherif, (2025) who justified the active effect of silicates carried in poultry feed on the health of vital organs (liver and coronary artery).

Table (3) Effect of adding SiCo4 on liver enzyme activity and weight of liver and heart

Treatment	AST	ALT	Liver	Heart
T1	160.72±2.51	33.17±1.25	2.16±.21	0.76±0.04
T2	158.55±4.21	31.96±0.56	2.09±0.05	0.70±0.08
T3	159.19±4.33	28.78±2.11	2.00±0.09	0.73±0.1
T4	160.10±5.41	29.69±1.55	1.96±1.08	0.66±0.08

CONCLUSIONS

In conclusion, supplementation of nano-silicates to broiler feed has noted positive effects on physiological blood parameters (RBC, Hb, and PCV) and In addition to its effects of biochemical parameters. There are no negative effects on the function of vital body systems have been recorded

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