Research Article

Impact of Ova Injection with Zinc Methionine on Some Blood Parameters and Glycogen Level of Broiler Chickens' Exposed to Feed Fasting

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Abstract | This experiment was conducted at the Babel Government from February 5, 2020, to February 25, 2020. Three hundred eggs were split into four experimental treatments, 75 eggs each. Four treatments were used for the hatching egg treatments. They were as follows: T1: a 0.3 ml injection of NaCl, the T2, T3, and T4 treatments egg was treated with a 60, 80, and 100 ppm zinc-methionine solution, respectively. After that, 15 chicks from each treatment were selected and given a 48-hour fast. The results were: At six hours, the cholesterol levels dropped dramatically ($P \leq 0.05$) in T3 and T4 compared to T1 and T2. Triglyceride concentrations for T3 were significantly lower at 6 hours than for T1 across all exposure durations. When comparing the injectable treatments to T1, the same phenomenon occurred at 12 and 48 hours. At 6 hours, the glucose concentration at T3 and T4 was considerably ($P<0.05$) lower than at T1, and at 12 hours, all injection parameters were lower than at T1. At 24 o'clock, the glutathione concentration in T3 increased significantly ($P \leq 0.05$) compared to the other treatments, while at 48 o'clock, the glutathione concentration in T4 increased compared to the other treatments. After 48 hours of exposure, the AST enzyme in all injectable treatments was significantly ($P \leq 0.05$) lower than that of T1. The liver glycogen in treatment T4 was substantially more significant at 6 and 12 o'clock than in treatment T1 and the other treatments. Treatment T1 had a considerably lower concentration of liver glycogen at 24 o'clock than the other treatments, while treatments T3 and T4 had significantly lower concentrations of the same substance at 48 o'clock. Heart glycogen levels in T3 and T4 were considerably more significant in T1 and T2 at 6 and 12 hours compared to T1 and the other treatments. T4 had a more significant amount of cardiac glycogen after 24 hours, and in terms of this feature, T3 had the most outstanding value after 48 hours. The value of muscle glycogen increased significantly ($P \leq 0.05$) in T3 and T4 when compared to T1 and T2.

Keywords | Zinc, Methionine, Glycogen level, Blood parameters, Feed fasting, Broiler

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INTRODUCTION

The fact that the chicks remain in the hatchery until their completion is a significant problem that must be addressed, as the chicks are exposed to tremendous pressure throughout the sorting and counting process, which lasts for a day or two without food or water, which leads to weight loss and weak immunity, and in order to improve growth after hatching, With live body weight, weight gain, and reduced embryo mortality, early feeding which includes injecting hatching eggs with a nutrient solution is believed to be critical (Dalouha et al., 2008). In Edens (2000), external feeding has improved the young's hatchability, gastrointestinal development, body weight, and nutritional status (Uni and Verkt, 2004). Vitamins and trace elements, which are antioxidant components, are essential for protecting embryo tissues throughout their growth and development (Eid et al., 2003). In addition, because of the embryo's increased metabolic rate, the embryo's stores of nutrients are insufficient during the Pre-hatching stage (Yair et al., 2013). As a result, methods of introducing nutrients and nutritional supplements before hatching have been explored (Oliveira et al., 2015); one of these methods, the egg injection method, effectively intro-duces additional nutrients required for embryonic development (Foye et al., 2007; Kadam et al., 2008; Dlouha, 2008), as well according to Prasad and Kucuk (2002), Shaheen et al. (2009), and Salem et al. (2011), zinc is an essential trace element involved in more than 300 enzymes involved in carbohydrate and energy metabolism, protein synthesis and degradation, DNA synthesis, carbon dioxide transport, and many other reactions, zinc can be used as organic zinc (com-plexes comprising proteins and amino acids), inorganic zinc, or as a component of carbohydrates. Due to the higher bioavailability of organic zinc, organic sources of zinc have been gradually introduced in ova injection or broiler diets (Salim et al., 2011). Zinc methionine (ZnM) is organic zinc that is not chelated in the intestinal lumen by phytic acid because it contains no free divalent cations (Zaki and Al-Jebory, 2021; Al-Saeedi et al., 2022). Thus, it undergoes distinct metabolic pathways, improving zinc uptake (Burrell et al., 2004). Thus, this study aimed to ascertain how the injection of zinc and thief of hatching eggs affects glycogen levels and some blood markers in broiler chicks subjected to dietary fasting.

MATERIALS AND METHODS

From February 5, 2020, to February 25, 2020, this experiment was carried out in the hatchery of Al-Shaflawi Poultry Company in the Al-Mahaweli Governorate, Babylon. Using a computerized electronic scale type SF-400, I weighed 300 eggs and found their average weight was 53±1 grams. They were injected with a zinc methionine solution in varying amounts on the eighteenth day of incubation. Following hatching, 15 chicks from each treatment were removed and fasted for 48 hours. One hour, Four treatments were used for the hatching egg treatments. They were as follows: T1: Injection 0.3 ml/ egg NaCl solution as a control treatment, T2, T3, and T4 injection 0.3 ml/ egg from zinc-methionine solution with levels (60, 80, 100 ppm). These concentrations were used by previous studies and in a manner consistent with the toxicity of zinc and methionine to embryos.

Solutions for injecting eggs

The egg injection solution was made using distilled water, and zinc-methionine powder was purchased from Zinpro, a US business.

Studied traits

Physiological traits

Following hatching, blood samples were taken from chicks exposed to different food designs (6, 12, 24, and 48), and certain physiological traits were assessed. The levels of glucose, cholesterol, and the enzymes ALT and AST were measured in the chicks' blood serum. Franey and Elias (1968) disclosed a method for assessing cholesterol levels using measurement equipment (Kit) from the German company Roche. The German business Roche provided the measuring instrument (Kit), which was used to assess the glucose levels. The concentration of triglycerides was estimated using the equation given by Grudy et al. (2004) in the method (Reitman and Frankel, 1957), and the enzymes ALT and AST were estimated using a measuring device (Kit) from the German company Roche. The anthrone technique calculates glycogen in the muscles, liver, and heart (Havenstein et al., 2007).

Statistical analysis

Multiple range tests were employed to analyze the significant differences between means, and a fully randomized design (CRD) was utilized to examine the impact of various treatments on all attributes (Duncan, 1955). The statistical analysis system (SAS, 2012) was used.

RESULTS AND DISCUSSION

Table 1 displays the results of injecting zinc methionine into hatching eggs. T3 and T4 had lower cholesterol concentrations at six o'clock than T1 and T2; at 12, 24, and 48 hours, the T2, T3, and T4 treatments decreased significantly more than the T1 treatment.

Table 2 shows the effect of the study on triglyceride; at six hours, the T2 treatments had heights significantly ($P \leq 0.05$) compared to other treatments, and T1 increased in the T3 treatment, as well at 12 hours, the T1 and T2 treatments came heights ($P \leq 0.05$) respectively compared to T3 and, T4. Meanwhile, in 24 hours, there was no significant difference between treatments; in 48 hours, the T1 had a significant ($P \leq 0.05$) increase compared to T3 and T4 treatments, and at the same time, the T3 treatment increased to the T4 treatment.

Table 3 shows the effect of treatments on glucose level at six hours of the T1 treatment had the heights ($P \leq 0.05$) on T3 and T4 while T3 increased on T4 treatment, in 12 hours to the T1 increase significantly ($P \leq 0.05$) compared other treatments at the same time the T3 and T4 treatments increase on T2 treatment.

Table 1: Impact of Ova Injection with zinc methionine on the cholesterol concentration of chicks exposed to fasting. (mean ± standard error).

Mean±stander error				Treatments
Cholesterol				
48 h	**24 h**	**12 h**	**Six h**	**Time**
92.92±2.95 a	100.28±0.71 a	136.33±0.66 a	129.80±1.74 a	T1
82.06±1.47 b	67.91±2.87 c	123.47±2.10 b	128.72±1.85 a	T2
63.37±2.50 c	87.50±0.30 b	118.59±2.75 b	134.09±1.10 b	T3
79.21±1.76 b	84.12±1.00 b	105.62±1.84 c	107.90±1.16 c	T4
*	*	*	*	Significant

A significant difference was shown with different letters at 0.05*; T1 was the control treatment that injected NaCl, T2, T3, and T4 injected 0.3 ml of zinc-methionine solution per egg, with 60, 80, and 100 ppm, respectively.

Table 2: Impact of Ova Injection with zinc methionine on the triglyceride concentration of chicks exposed to fasting (mean ± standard error).

Mean±stander error				Treatments
Triglyceride				
48 h	**24 h**	**12 h**	**Six h**	**Time**
70.83±1.87 a	57.42±2.28	97.13±2.01 a	70.67±1.25 b	T1
60.76±2.06 bc	55.29±1.48	83.60±0.94 b	75.55±2.18 a	T2
65.77±1.61 b	56.02±0.20	72.10±1.98 c	60.26±0.29 c	T3
55.40±0.45 c	57.58±1.99	73.92±1.75 c	66.65±1.50 bc	T4
*	NS	*	*	Significant

A significant difference was shown by means with different letters at the level 0.05*, NS not significant. T1 was the control treatment that injected NaCl, T2, T3, and T4 injected 0.3 ml of zinc-methionine solution per egg, with 60, 80, and 100 ppm, respectively.

Table 3: Impact of Ova injection with zinc methionine on the glucose concentration of chicks exposed to fasting (mean ± standard error).

Mean±stander error				Treatments
Glucose				
48 h	**24 h**	**12 h**	**Six h**	**Time**
162.60±2.95	179.38±2.93	198.83±2.05 a	215.48±3.20 a	T1
160.53±1.01	178.11±1.89	151.24±1.99 c	208.62±1.24 ab	T2
166.62±1.37	179.48±2.79	182.33±1.44 b	198.63±1.36 b	T3
160.05±2.17	172.49±3.16	181.57±1.68 b	172.29±1.21 c	T4
NS	NS	*	*	Significant

A significant difference was shown by means with different letters at the level 0.05*, NS not significant. T1 was the control treatment that injected NaCl, T2, T3, and T4 injected 0.3 ml of zinc-methionine solution per egg, with 60, 80, and 100 ppm, respectively.

The zinc methionine treatments had the most excellent value GSH-px compared to the control treatment, and the T3 and T4 treatments were the best in 24 and 48 hours, respectively. Meanwhile, there was no significant difference among treatments in MDA.

Table 5 shows the effect of the study on the liver enzymes; there was no significant difference at 24 hours in AST enzyme and all time for ALT enzyme. As well as at 48 hours in AST enzyme, the T1 and T2 treatments were the heights ($P \leq 0.05$), respectively on T3 and T4 treatments.

Table 6 shows the effect of the treatments on liver glycogen; at six and 24 hours, there was a significant increase ($P \leq 0.05$) for T4 treatment on other treatments at the same time significant increase for the T2 and T3 treatments compared T1, at 12 hours the T4, and T3 were the heights significantly ($P \leq 0.05$) on T1, and T2 respectively, while at 48 hours the T3, and T4 had increase ($P \leq 0.01$) compared T1, and T2 treatments, the T1 increase on T2 treatment.

Table 7 shows that at hours 6 and 12, heart glycogen in T3 and T4 was significantly higher than in T1 and T2. Similarly, at hour 24, T3 and T4 had higher heart glycogen values than T1 and T2, with the T4 treatment having the most significant effect. T3 and T4 performed better than T1 and T2 after 48 hours, with T3 having the highest value for this trait.

Table 4: Impact of Ova Injection with zinc methionine on the concentration of some triglyceride antioxidants in chicks exposed to fasting (mean ± standard error).

Mean±stander error				Treatments
MDA		GSH-px		
48 h	**24 h**	**48 h**	**24 h**	**Time**
2.27±0.14	3.42±0.22	42.27±0.89 c	50.76±1.01 c	T1
2.36±0.31	2.98±0.75	50.21±0.50 ab	57.14±0.58 b	T2
2.31±0.24	3.15±0.18	48.37±0.28 b	63.09±0.55 a	T3
2.11±0.15	3.35±0.89	53.84±1.00 a	59.18±0.25 b	T4
NS	NS	*	*	Significant

A significant difference was shown by means with different letters at the level 0.05*, NS not significant. T1 was the control treatment that injected NaCl, T2, T3, and T4 injected 0.3 ml of zinc-methionine solution per egg, with 60, 80, and 100 ppm, respectively.

Table 5: Impact of Ova Injection with zinc methionine on the concentration of some liver enzymes in chicks exposed to fasting. (mean ± standard error).

Mean±stander error				Treatments
ALT		AST		
48 h	**24 h**	**48 h**	**24 h**	**Time**
2.28±0.01	4.51±0.09	65.19±0.50 a	44.51±0.13	T1
2.21±0.04	4.33±0.10	56.36±0.24 b	45.17±0.51	T2
2.19±0.05	3.95±0.02	51.63±1.00 c	43.22±0.81	T3
2.30±0.08	4.45±0.06	53.71±0.62 c	44.36±0.95	T4
NS	NS	*	NS	Significant

A significant difference was shown by means with different letters at the level 0.05*, NS not significant. T1 was the control treatment that injected NaCl, T2, T3, and T4 injected 0.3 ml of zinc-methionine solution per egg, with 60, 80, and 100 ppm, respectively.

Table 6: Impact of Ova Injection with zinc methionine on the liver glycogen concentration of chicks exposed to fasting. (mean ± standard error).

Mean±stander error				Treatments
Liver glycogen				
48 h	**24 h**	**12 h**	**Six h**	**Time**
10.19±0.55 b	8.94±0.02 d	10.73±0.12 c	10.37±0.97 c	T1
8.98±0.20 c	11.91±0.39 c	11.00±1.52 c	14.55±1.30 b	T2
15.94±0.24 a	14.27±0.72 b	15.66±0.66 b	16.45±0.54 b	T3
16.87±0.83 a	19.17±0.48 a	19.28±0.29 a	20.67±0.58 a	T4
**	**	*	*	Significant

A significant difference was shown using different letters at 0.05* and 0.01**. T1 was the control treatment that injected NaCl, while T2, T3, and T4 injected 0.3 ml of zinc-methionine solution per egg, with 60, 80, and 100 ppm, respectively.

Table 7: Impact of in Ova Injection with zinc methionine on Heart glycogen concentration of chicks exposed to fasting. (mean ± standard error).

Mean±stander error				Treatments
Heart glycogen				
48 h	**24 h**	**12 h**	**Six h**	**Time**
12.38±1.01 c	10.72±1.49 c	10.67±1.70 b	12.49±0.93 b	T1
12.78±0.17 c	10.94±0.29 c	11.66±0.88 b	13.24±1.16 b	T2
16.87±0.92 a	16.33±0.51 b	17.65±0.67 a	18.35±0.39 a	T3
14.90±0.44 b	19.23±1.58 a	17.69±1.46 a	18.00±0.52 a	T4
*	*	*	*	Significant

A significant difference was shown using different letters at the level 0.05*. T1 was the control treatment that injected NaCl, T2, T3, and T4 injected 0.3 ml of zinc-methionine solution per egg, with 60, 80, and 100 ppm, respectively.

Table 8: Impact of in Ova Injection with zinc methionine on the concentration of triceps muscle glycogen in chicks exposed to fasting. (mean ± standard error).

Mean±stander error				Treatments
Muscles glycogen				
48 h	**24 h**	**12 h**	**Six h**	**Time**
15.28±1.07 c	19.80±1.23 b	17.24±1.30	16.91±1.54	T1
15.10±0.35 c	18.16±1.15 b	15.92±2.06	17.57±1.18	T2
19.31±1.98 a	21.95±2.04 a	16.92±2.92	18.27±2.75	T3
17.73±0.36 b	20.64±1.36 a	16.25±1.80	17.83±1.83	T4
**	*	NS	NS	Significant

A significant difference was shown by means with different letters at 0.05*,0.01**, and NS, which were insignificant. T1 was the control treatment that injected NaCl, while T2, T3, and T4 injected 0.3 ml of zinc-methionine solution per egg, with 60, 80, and 100 ppm, respectively.

Table 8 shows that at hours 6 and 12, there were no significant differences in muscle glycogen concentrations between the treatments; the quantity of muscle glycogen was increased at T3 and T4 than at T1 and T2, although there were significant differences ($P \leq 0.05$) at hour 24. There was a very significant increase ($P \leq 0.01$) at hour 48, as treatment T3 recorded the highest significance for this treatment; it was more significant in T3 and T4 compared to T1 and T2.

Injections and treatments containing methionine zinc have proven effective in controlling glucose, glycogen, triglycerides, and cholesterol levels; zinc is one of the essential microminerals needed for development and is involved in several metabolic pathways, which explains why (Ezzati et al., 2013). Because of its role in building physiological tissues, boosting the production of muscles, proteins, and enzymes, improving avian health, and increasing the quantity of This is because zinc is necessary for the skeleton's growth and for critical regulatory mechanisms that result in the synthesis of collagen, bone, and cartilage (Oliveira et al., 2015). By lessening the harm that oxidative stress produces, zinc also enhances the health of broiler chicks (Salami et al., 2015). This is because zinc stimulates the synthesis of metallothionine, a material abundant in p-glycoprotein. Zn binds and serves as a cofactor for superoxide dismutase and other antioxidants. According to Valko et al. (2016), it is connected to enzymes that preserve the integrity of cells connected to the immunological response, improving broiler chickens' physiological performance and productivity. Zinc can also be absorbed in the stomach and attach to the intestinal protein metallothionein; alternatively, albumin can carry it to the liver, according to Prasad (1993) and Oteiza (1996). By attaching to cell membranes, Zinc functions as a direct antioxidant in biological tissues by reducing the generation of free radicals and replacing certain metallic elements like iron (Fe) and copper (Cu) at their union sites (Powell, 2000; Prasad and Kucuk, 2002). In ova, injecting zn-me into the hatching eggs may have some impact because methionine is engaged in various metabolic pathways within the body (Chen et al., 1993). Zinc aids the body in avoiding oxidative stress by preventing lipid peroxidation and glutathione depletion (Prasad, 1997).

Zinc reduces oxidative stress and promotes antioxidants, so AST enzyme activity at T2, T3, and T4 is reduced in birds (Richard and Preston, 2006). Zinc may protect polyunsaturated fatty acids from oxidative damage by acting as an antioxidant in cell and liver membranes and maintaining the liver's selective permeability. This membrane prevents enzyme leakage from the cell's interior to the outside, it accomplishes this by scavenging free radicals, interrupting the cascade of free radical reactions, and preventing metal ions from exiting the tissues. Alternatively, methionine might be the reason since it promotes oxidation and helps produce the enzyme glutathione peroxidase. Zinc methionine injection has a high concentration of glutathione peroxidase enzyme since methionine is required to synthesize this enzyme. These prior findings align with the results of Shin et al. (2015) and our study.

CONCLUSIONS AND RECOMMENDATIONS

Based on previous results that showed an improvement in the levels of cholesterol, triglycerides, glucose, AST, and glycogen when zinc methionine was injected, this is because zinc has antioxidant properties, helps build body tissues, and stimulates the building of protein, muscles, glycogen, and enzymes. Zinc may have a positive role in enhancing the growth and digestion of nutrients, which is reflected positively in the performance and immunity of chicks; various types of stress, including food, also lead to a deterioration in the glycogen level, especially in the muscles, this is due to the hormone corticosterone, which causes the catabolism of glycogen, the results showed an improvement in the level of glycogen in the treatments compared to the control, this gives an idea of the importance of methionine and zinc in the processes of construction and catabolism within the cells, and that they are essential, in many metabolic pathways and the manufacture of antioxidant compounds, it could be a future study using nano-methionine-zinc, as they may have a more significant role in improving the performance of hatched chicks.

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NOVELTY STATEMENT

This study is the first in Iraqi/Babylonian government to use zinc-methionine to enhance chick growth.

AUTHOR'S CONTRIBUTION

Each contributor made an equal contribution to the paper.

Conflict of interest

The authors have declared no conflict of interest.

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