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EFFECT OF IN OVO INJECTION WITH COENZYME Q10 WITHIN INCUBATION PERIOD ON HATCHING, PHYSIOLOGICAL TRAITS AND SUBSEQUENT GROWTH FOR HATCHED CHICKS

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ABSTRACT: This research was done to find out the effect of in ovo injection of Coenzyme Q10 (CoQ10) at various incubation ages on the physiological and immunity performance of Mamora chickens. A total of 630 hatching eggs were divided into 7 equal treatments (90 eggs per each). The first group was as a negative control, the second group was as a positive control (injected in air sac with 0.3 ml/egg of distilled water at day 1 of incubation), the third and fourth groups were injected with 0.3 ml/egg of distilled water contained 0.1 and 0.2 ml coenzyme Q10 / egg respectively at day1 of incubation, the fifth group was as a second positive control (injected in air sac with 0.3 ml/egg of distilled water at day18), the six and seven groups were injected with 0.3 mL/egg solution of sterile distilled water contained 0.1 and 0.2 mL coenzyme Q10 / egg, respectively at day18 of incubation, Hatched chicks of each treatment were reared till 28 days of age. Results obtained could be summarized as follow: improving the hatchability percentage and decreasing embryonic mortality by in ovo CoQ10 at the 1st and the 18th day of incubation period as compared with negative control group. In ovo injection with CoQ10 led to improve the subsequent growth traits after hatch within the period of 1-28 day of age. Lymphocytes (L, %) was elevated, while heterophils (H, %) was decreased for chicks hatched from eggs injected with 0.2 ml CoQ10 / egg at the 1st day of incubation. All chicks produced from injected eggs with CoQ10 had higher serum catalase enzyme value and lower liver enzymes (AST & ALT) compared with those of negative or positive control. Therefore, in ovo CoQ10 (0.1 or 0.2 ml/egg) injection improve hatchability, post-hatch chick development, and physiological response of hatched Mamora.

Key Words: in ovo injection, Coenzyme Q10, physiology, immunity, performance, Mamora chickens

INTRODUCTION

Due to the high caloric need to support the hatching process and basal metabolism, the pre- and post-hatch period is a crucial stage in the development of the chick embryo (Ferket and Uni, 2006). In ovo injection technology has become a “hot spot” in research today. Beyond vaccines, any number of nutrients or components can provide to the developing embryo via this route of administration. In ovo injection have created new opportunities to improve the health and development of broiler chickens. Each and every living cell contains the natural lipophilic molecules known as coenzyme Q10 (CoQ10; due to its ubiquitou occurrence in nature they are also called Ubiquinone (Haas 2007). Coenzyme Q10 is 2, 3-dimethoxy, 5-methyl, 6-polyisoprene Para benzoquinone. Coenzyme Q10was distributed into all membranes throughout the cell (Kalen et al., 1987). Coenzyme Q10 is mostly located in the body's most active organs, such as the heart, kidney, and liver, where a higher reduction with ageing can be seen (Kalen et al., 1989). However, the mitochondria of cells contain relatively large levels of CoQ10 and play a crucial role in energy production (Ernster et al., 1995). Coenzyme Q10 is good sources as effective antioxidant (Bentinger et al., 2007), protecting against lipid peroxidation, DNA, and protein oxidation and is able to work in harmony with other antioxidants (Challem, 2005). The physiological activity of coenzyme Q10 or ubiquinone is a vitamin-like substance which is the coenzyme for mitochondrial enzymes (complexes I, II, and III) through the inner membrane (Lenaz, et al., 2007). As a vital element of oxidative phosphorylation in the mitochondria and the generation of the high energy phosphate molecule, mitochondrial enzymes are necessary to oxidise nutrients (ATP), upon it promotes all cellular activities (Rauchov et al., 1995, Littarru and Tiano, 2007). In addition to its role in the mitochondrial respiratory chain's bioenergetics, CoQ10 is also found in a number of subcellular fractions or in plasma lipoproteins, where it functions as a powerful lipid-soluble antioxidant. (Rauchov et al.1995, Bentinger et al., 2007). The yolk's ability to store nutrients has an impact on how broiler chicken embryos and newly hatched birds develop. The yolk is the egg's major source of lipids, which provide energy for the embryo's early development through oxidative phosphorylation. (Uni and Ferket 2004). Rapid oxidative metabolism during the embryo's early development produces a significant amount of free radicals, which can be harmful to the developing embryo. (Cherian and Sim, 1997). Freshly produced eggs, particularly those from birds fed low-quality diets, were shown to contain low antioxidant contents, despite the fact that antioxidants are an essential defense against free radicals. Consequently, in ovo injection of antioxidants during incubation may improve the chicken embryo's antioxidant qualification (Salary et al., 2014). The embryo uses more energy during the last period of incubation, particularly during the mature stage Keralapurath et al., 2010). A limiting factor for the βoxidation of fatty acids after emerging from the

eggshell could therefore be the egg CoQ10 content. Exogenous CoQ10 supplementation may be helpful at these occasions. In order to improve the growth and develop the immune system of newly hatched chickens as well as prevent oxidative damage to the hatching eggs, in ovo injection of CoQ10 is necessary. Therefore, the objective of this study was to investigate the effect of in ovo injection of CoQ10 into eggs on the hatching performance, physiological and immunological parameters, and post hatch growth of the young chickens.

MATERIALS AND METHODS

This experimental was carried out at El-Serw Poultry Research Station, Agricultural Research Center. The experiment was started in April 2022 and terminated in May 2022. This study conducted to investigate the effect of in ovo injection of Coenzyme Q10 at different incubational stages on, physiological and immunity performance of Mamora chickens. A total of 630 hatching eggs were produced from Mamora breeder hens at 50 wks of age, all eggs were collected from the same breeder flock and eggs from each group was labeled, and then weighed at the beginning of incubation to estimate chick body weight / egg weight ratio. At hatch, eggs were incubated at 37.8 °C and 63% relative humidity (RH) %, on the 18th day of the incubation, before the transfer of eggs from the setter to the hatcher, candled eggs was scanned for detection of fertilized eggs. Eggs were distributed into 7 equal treatments each group spliced into equal 3 replicates. At the 1st day of incubation period the first group of eggs was set as a negative control (un-injected, N.C), the second group was set as a positive control (P.C.1) which injected with 0.3 ml/egg of sterile distilled water in air sac, while the third and fourth groups were injected with 0.3 ml/egg sterile distilled water contained 0.1 and 0.2 ml coenzyme Q10 / egg (Q10a &Q10b) respectively in air sac. At 18th day of the incubation period, the fifth group was set as a second positive control (P.C.2) which injected with 0.3 ml/egg sterile distilled water in air sac, while, the sixth and seventh groups were injected with 0.3 mL/egg sterile distilled water contained 0.1 and 0.2 mL coenzyme Q10 / egg (Q10c & Q10d) respectively in air sac. The injection whole area was disinfected with an ethyl alcohol; the pinhole site was sealed with sterile paraffin wax immediately after injection .The injected eggs were transferred to the hatcher after the injection. At the 21th day of incubation, hatched chicks of each treatment were weighted and fed a starter diet. Composition and calculated analysis of the basal starter diet are shown in Table (1). Embryonic mortality (%) was calculated a number of dead embryos as a percentage of fertile eggs, whereas, hatchability (%) was estimated a number of healthy hatched chicks as a percent of set eggs.

All hatched chicks were reared till 28 days of age under similar hygienic and managerial conditions. Chicks live body weight (LBW) and feed intake (FI) were recorded for replicates then were averaged and expressed in grams per chick/ period throughout the experimental periods: 1-14, 15-28 day and the overall experimental period (1-28 days of age). Body weight gain (BWG) and feed conversion ratio (FCR) were calculated during the same periods. At 28 days of age 3 birds were randomly taken from each treatment group to slaughter. Blood samples were

collected from jugular vein (3-ml) into two tubs, the first in heparinized tubes, while another non- heparinized blood was centrifuged (3500 rpm) for 15 minutes to obtain blood serum. . The following biochemical measurements were assayed in blood serum: AlT, AST, SOD and Catalase enzyme. Heamatogical parameters like red blood cells (RBCs), total white blood cells (WBCs) counts, heterophils (H) and lymphocytes (L). After slaughter and complete bleeding, the birds were dressed and the carcass and some other organs (liver, gizzard, heart, bursa of Fabricius and spleen) were weighed. Relative organ weights were calculated as percentages of body weight. The relative organ weight = [(Organ weight/Body weight) × 100].

Statistical analysis: Data obtained were statistically analyzed using the General Liner Model of SPSS, (2011).The following model was used: $Yij = \mu + Ti + eij$ where: Yij = an observation, μ = overall mean, Ti = effect of treatment (i=1, 2, 3,4,5,6 and 7) and eij = experimental random error. Significant differences among means were tested by Duncan's Multiple Range Test Duncan (1955) at 5% level of significance.

RESULTS AND DISCUSSION

Hatching traits:

As shown in Table 2, hatchability percentage was significantly increased by in ovo injection with 0.1 and 0.2 mL Co Q10 per egg at the 1st and the 18th day of incubation period (Q10a, Q10b, Q10c and Q10d) compared to un-injected and positive controls (P=0.002) (N.C, P.C.1 and P.C.2). The highest hatchability % was obtained for eggs injected with CoQ10 by 0.10 ml/egg at the 18th day of incubation period, while the lowest group was the positive control that was injected at the 1st day of incubation period. The embryonic mortality % was (P=0.002) decreased by in ovo Q10 injection at the 18th day of incubation (Q10c & Q10d) than negative or positive controls (N.C.&P.C.1) at the 1st day of incubation. Hatched chick weight recorded a heavier (P=0.001) weight for group Q10a flowed by Q10b and Q10c than other groups, the same trend was induced for relative chick weight. Recently, in ovo injection has been employed to improve the traits of fertile eggs' hatching and subsequent growth performance by reducing the loss of glycogen stores and enhancing antioxidant capacity (Peebles 2018). The hatcheries resort to using in ovo injection to supply hatching eggs by some essential nutrients and or vaccines which it becoming an important technique of hatching industry (Bello et al., 2013). For this, in ovo antioxidants injection could enhance embryo development and can protect oxidative damage (Salary *et al*., 2014). In ovo CoQ10 injection could depress fatty acid oxidation and prevent the production of free radicals that seriously harm the cellular membranes of developing embryos during the incubation phase. (Noh et al.,2013), as well as enhance lipid utilization for energy production to maximize hatchability (Gopi et al., 2015). Therefore, improving hatchability percentage in this study could relate to in ovo CoQ10 injection that improved antioxidant status of hatching eggs or prevent oxidation stresses against. These findings are consistent with those of Tangara et al. (2010) and Surai et al. (2016), who discovered that in ovo antioxidant injection increased

hatchability and decreased embryonic mortality rate. Kalantar et al. (2019) who found that in ovo CoQ10 injection by 0.1 and 0.2 mL/egg improved hatchability (%). Also, Naeem et al. (2022) found that the in ovo injection with antioxidants increased hatchability percentage. The amount of CoQ10 in an egg may be a limiting factor for the -oxidation of fatty acids during the late phases of incubation, particularly when the embryo is maturing and requires a greater amount of energy. (Keralapurath et al., 2010), so exogenous coQ10 supplementation may therefore be beneficial. In-ovo antioxidant injections during incubation may improve the chicken embryo's antioxidant capacity to prevent any stresses because short-chain fatty acids are most abundant in the tissues of avian embryos on day 18 of incubation, indicating the importance of fatty acid oxidation for energy production in embryo (Salary et al., 2014). Coenzyme Q10 is a powerful antioxidant that acts on scavenging (ROS), protecting the embryo against oxidative damage because the embryo's initial growth is associated with a rapid oxidative metabolism that produces a large amount of free radicals that could be harmful to the embryo during the incubation period. (Cherian and Sim, 1997). This finding was consistent with that of Naeem et al. (2022), who discovered that the in ovo injection of antioxidants reduced the proportion of embryonic mortality. Increased body weight of newly hatched chicks in the current study may be related to in ovo CoQ10 injection which acts the fatty acids prevention from hydro-peroxidation as well as more energy uptake that enhance the embryonic growth (Eslami et al., 2014). These findings are agreed with Uni et al. (2005) , El-Senousey et al. (2018) and Naeem et al. (2022) who found that the in ovo injection with antioxidants increased hatched chicks weight and relative chicks weight with incubated eggs weight.

Results of Table 3 showed some subsequent growth traits after hatch for chicks produced from treated eggs throughout the incubation period. Daily feed intake of hatched chicks was (P=0.001) differed among treatments throughout 1-14, 15-28 and 1-28 days of age, daily FI amount was significantly increased for group Q10b chicks that produced from injected eggs with 0.20 mL Co Q10 / egg at the 1st day of incubation period, while chicks produced from injected eggs with 0.20 Co Q10 / egg (Q10d) at the 18th day of incubation period recorded the lowest daily FI amount than other treated group through the overall period (1-28 day old).

Accumulative body weight gain (BWG) of hatched chicks was (P=0.001) varied among treatments throughout tested growth intervals periods, BWG was significantly elevated for group Q10c chicks that produced from injected eggs with 0.10 mL Co Q10 / egg at the 18th day of incubation period, while chicks produced from non-injected eggs (NC) at the 1st day of incubation period recorded the lowest BWG than other treated group through the overall period (1-28 days old.

Feed conversion ratio (FCR) of hatched chicks was (P=0.001) affected due to treated the hatching eggs through incubation period at 1-14, 15-28 and 1-28 days of age after hatch. Chicks FCR was significantly improved for chicks produced from injected eggs with Co

Q10 at the 18th day of incubation period (Q10c and Q10d), but chicks of group Q10b recorded the bad FCR value than other groups through 1-28 day of age.

Generally, the suppression of the immune system caused on by vaccination failure, the prevalence of infectious diseases, and unusual antibiotic use result in impressive immune responses. (Chen et al., 2003), while reduced hatchability and subsequent performances are caused by an antioxidant system breakdown inside the egg or in the chicken's body. (Niu et al., 2009). The CoQ10 is important cofactor for a variety of body enzymatic; it does various roles in the body such as an electron carrier in respiratory chain, antioxidant (Kaikkonen et al., 1997) and cell signaling and gene expression. Coenzyme Q10 provides health benefits (Ramasarma, 2012), keeps membranes flexible and guards membranous phospholipid against oxidation (Marriage et al., 2004). Also, CoQ10 increased feed efficiency by decreasing mitochondrial electron leakage and increasing total antioxidant capacity. (Gopi et al., 2015) and increased final body weight, body weight gain and cumulative feed intake (Bayril1 et al., 2020). Some studies cleared the positive effects of the CoQ10 on growth performance (Fathi, 2015; Nemati et al., 2017; Kalantar et al., 2019), but others reported that CoQ10 did not effect on feed intake of broilers exposed to cold stress (Nemati et al., 2017). Our findings are in line with those of Vlaicu et al. (2020), who demonstrated that raising the immune level of newly hatched chicks increases their performance over the duration of the rearing period. Additionally, Naeem et al. (2022) came to the conclusion that the weight gain, feed intake, and conversion ratio of the chickens hatched from the antioxidant solution-injected eggs were significantly better than those of the non-injected group during both the starter period (1-21 days) and the entire rearing period (1-42 days). Relative carcass and organs weights:

According to the results of Table 4, relative carcass weight was significantly lowered (P=0.007) for groups Q10c and Q10d that injected with 0.20 mL Q10 per egg at the 1st and 18th day of incubation period , respectively than the groups of N.C., P.C.1 and Q10a. The highest (P=0.002) heart weight % was obtained for groups Q10a and Q10c that injected with 0.10 ml Q10 per egg at the 1st and the 18th day of incubation period than groups of Q10b and Q10d which were recorded the lowest value. Also, the groups of Q10a, Q10b and Q10c produced the heavier (P=0.011) liver weight (%) than groups N.C. and P.C.1, while the relative weight of bursa of Fabricius, was P >0.05) higher at 28 days of age by injected of Q10 (CoQ10) compared with N.C., P.C.1 and P.C.2. On the other hand, both gizzard and spleen weight (%) not significantly affected due to treatment. Similar findings were reported by Nemati et al. (2017), who hypothesised that coQ10, either alone or in combination with vitamin E, can increase the weight of immunological organs such as the spleen and bursa of Fabricius, particularly when exposed to cold stress. According to one theory, CoQ10's antioxidant qualities help to fend off free radicals and prevent lipid peroxidation, which is a critical step in suppressing immune systems so they can produce normal immunological products (Fathi, 2015) .Also results

could due to coenzyme Q10 (CoQ10) plays a physiological role as coenzyme for mitochondrial enzymes through the inner membrane (Lenaz et al., 2007), which are essential to oxidize nutrients by oxidative phosphorylation within mitochondria for the high energy phosphate compound (ATP) production to facilitate all cellular functions (Littarru et al., 2007), besides it acts as a powerful lipid-soluble antioxidant (Bentinger et al., 2007).

Physiological parameters: Data of Table 5, showed that red blood cells count was (P=0.014) decreased for chicks in groups Q10b, P.C.2 and Q10d as compared with N.C. while white blood cells count was elevated (P≤0.011) for group Q10c chicks than other groups. On the other hand, heterophils (H %) recorded the lowest (P=0.000) value for the group Q10b which recorded the higher (P=0.000) Lymphocytes (L, %) in comparison with other groups.

The CoQ10 is a strong antioxidant properties that prevent or reduce the negative effects of oxidative stress (Konieczka et al., 2015). Also, its can effectively inhibit the oxidation of lipids, proteins and DNA by electron and proton transport through oxidative phosphorylation process (de Barcelos and Haas, 2019). In birds, the blood H/L ratio has been regarded as a reliable indicator of stress. (Vleck et al., 2000). Similar to this, Crule et al. (2012) showed that heat stress raises the H/L ratio index by raising the heterophils count and lowering the lymphocyte count in broiler chickens. The present results of H/L ratio and counts of heterophils and lymphocytes indicate that in ovo CoQ10 injection could potentially ameliorate the harmful effects of heat stress in broilers during incubation period, which that agreed with Raeisi-Zeydabad et al. (2017.

Data of Table 6, showed that blood serum enzymes activity were significantly affected. Liver enzyme AST activity was reduced for the groups of P.C.2 and Q10c flowed by Q10a, Q10b and Q10d as compared with N.C. and P.C.1 , however the groups of Q10a, Q10b,Q10c and Q10d were recorded the lowest liver ALT enzyme than other groups. On the other hand, all chicks produced from treated groups with Co Q10 (Q10a, Q10b , Q10c and Q10d) had higher (P=0.001) value of catalase enzyme and SOD enzyme in their blood serum as compared with the those came from negative or positive controls (N.C. and P.C.1), These findings could due to CoQ10 plays a major role in energy production from carbohydrates and lipids in cells and in lowering the serum total cholesterol level by inhibiting the synthesis of this steroid in the liver which related with decreasing AST and ALT enzymes (Modi et al., 2006). Moreover, CoQ10 plays as antioxidants that reduce free radical generation process and increases total antioxidant capacity Armanfar et al., 2015). The present results cleared that in ovo CoQ10 injection during incubation period reduced the oxidative stresses and liver enzymes (AST & ALT), which that agreed with Feher et al. (2007). Also, According to Fatemi et al. (2018), the in ovo injection of antioxidants into broiler embryonic tissues can enhance the chickens' total antioxidant capacity over the duration of their entire rearing period. Naeem et al. (2022) concluded that catalase concentration was significantly increased in the chickens hatched from the in ovo injection with antioxidants.

In contrary, Huang et al. (2011) found that superoxide dismutase (SOD) activity was increase by CoQ10 treatment in broilers. Also, CoQ10 supplementation had no effect on liver total antioxidant status and serum superoxide dismutase (SOD) activity, according to Bayril1 et al. (2020). Superoxide dismutase concentration significantly increased in chickens that were hatched from in ovo antioxidant injection, according to Naeem et al. (2022

CONCLUSION

According to this study's findings, in ovo injection of CoQ10 (0.1 or 0.2 ml/egg) into the incubated eggs of Mamora breeders within incubation period could lead to significant improvement in the percentages of hatchability and relative chick weight at hatch and decreasing embryonic mortality percentage as well as improving subsequent growth performance .

Table (1): Composition and calculated analysis of the basal diet Starter (0-4wks.)

Ingredients %	**Starter (0-4wks)**
Yellow Corn	64.00
Soybean meal (44 %)	32.10
Di-calcium phosphate	1.80
Limestone	1.40
Vit. & Min. premix1	0.30
NaCl	0.30
DL. Methionine	0.10
Total	100
Calculated Analysis 2	
Crude protein %	19.11
Metabolizable energy ME (Kcal / kg)	2863
Ether extract. %	2.91
Crude fiber %	3.82
Calcium (%)	1.06
Available phosphorus (%)	0.47
Lysine %	1.10
Methionine %	0.43
Methionine + Cystine %	0.75
Sodium	0.13

1-Each 3 kg of the Vit and Min. premix manufactured by Agri-Vit Company, Egypt contains: Vitamin A 10 MIU, Vit. D 2 MIU, Vit E 10 g, Vit. K 2 g, Thiamin 1 g, Riboflavin 5 g, Pyridoxine 1.5 g, Niacin 30 g, Vit. B12 10 mg, Pantothenic acid 10 g, Folic acid 1.5 g, Biotin 50
2-According to Feed Composition Tables for animal and poultry feedstuffs used in Egypt (2001).

Table (2): Effect of *in ovo* injection with Co Q10 at the 1st and the 18th day of incubation period on hatchability and embryonic mortality (%), hatched chick weight and relative chick weight to egg weight at hatch.

Treatments		Hatching traits			
		Hatchability of set eggs. %	**Embryonic Mortality %**	**Hatched Chick weight, g**	**Relative chick weight to egg weight, %**
N.C.		78.79^{b}	7.78^{a}	33.17^{d}	59.69^{cd}
Injection At 1 days	**P.C.1**	76.46^{b}	5.85^{ab}	34.1^{bc}	61.80^{abc}
	Q10a	84.22^{a}	5.22^{ab}	35.17^{a}	63.3^{a}
	Q10b	86.04^{a}	4.00^{bc}	34.64^{ab}	61.93^{ab}
Injection At 18 days	**P.C.2**	78.52^{b}	3.51^{bc}	33.52^{cd}	60.64^{bcd}
	Q10c	87.94^{a}	2.00^{c}	34.65^{ab}	62.87^{a}
	Q10d	87.58^{a}	2.08^{c}	33.33^{d}	58.53^{d}
SEM		1.08	0.50	0.172	0.41
Sig.		**	**	**	**
P-value		0.002	0.002	0.001	0.001

a,b,cd,..: means in the same column bearing different superscripts are significantly different $p \leq 0.05$ N.C.: negative control (un-injected); P.C.1 + P.C.2 : positive control which injected with distilled water at the 1st and the 18th day respectively; Q10a+Q10b: injected with 0.1 or 0.2 ml Q10/egg at the 1st day respectively; Q10c +Q10d : injected with 0.1 or 0.2 ml Q10/egg at the 18th day respectively .

Table (3): Effect of *in ovo* injection with Co Q10 at the 1st and the 18th day of incubation period on feed intake (FI), accumulative body weight gain (BWG), and feed conversion ratio (FCR) of chickens at different growth intervals**.**

Treatments		1-14 days			15-28 days			1-28 days		
		FI,g	**BWG, g**	**FCR**	**FI,g**	**BWG, g**	**FCR**	**FI, g**	**BWG,g**	**FCR**
N.C.		13.07^{d}	94.58^{b}	2.02^{d}	23.33^{bc}	143.4^{c}	2.27^{a}	37.0^{c}	238.0^{d}	2.17^{b}
Injection At 1 days	**P.C.1**	15.92^{b}	102.02^{a}	2.18^{c}	23.18^{bc}	155.3^{b}	2.08^{c}	39.10^{b}	257.3^{b}	2.12^{b}
	Q10a	14.93^{c}	90.07^{b}	2.32^{b}	23.85^{b}	159.5^{b}	2.09^{c}	38.8^{b}	249.5^{c}	2.17^{b}
	Q10b	17.01^{a}	92.76^{b}	2.56^{a}	24.04^{b}	155.1^{b}	2.17^{b}	41.05^{a}	247.8^{c}	2.31^{a}
Injection At 18 days	**P.C.2**	10.74^{g}	83.06^{c}	1.81^{e}	24.95^{a}	168.4^{a}	2.07^{c}	35.69^{d}	251.4^{c}	1.98^{c}
	Q10c	13.08^{e}	100.86^{a}	1.81^{e}	22.79^{c}	165.6^{a}	1.92^{d}	35.87^{d}	266.5^{a}	1.88^{d}
	Q10d	11.95^{f}	90.53^{b}	1.84^{e}	21.17^{d}	167.6^{a}	1.76^{e}	33.12^{e}	258.1^{b}	1.79^{e}
SEM		0.46	1.47	0.06	0.25	1.91	0.035	0.55	1.94	0.038
Sig.		**	**	**	**	**	**	**	**	**
P-value		0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

a,b,c,.d.: means in the same column bearing different superscripts are significantly different $p \leq 0.05$ N.C.: negative control (un-injected); P.C.1 + P.C.2 : positive control which injected with distilled water at the 1st and the 18th day respectively; Q10a+Q10b: injected with 0.1 or 0.2 ml Q10/egg at the 1st day respectively; Q10c +Q10d : injected with 0.1 or 0.2 ml Q10/egg at the 18th day respectively

Table (4): Effect of *in ovo* injection with Co Q10 at the 1st and the 18th day of incubation period on carcass and organ weight of Mamora chickens at 28 days of age

Treatments		Relative organ weight of chick weight (%) at 28 days of age					
		Carcass	**Heart**	**Gizzared**	**Liver**	**Spleen**	**Bursa**
N.C.		61.28^{a}	0.62^{ab}	3.15	3.13^{b}	0.24	0.07^{b}
Injection At 1 days	**P.C.1**	58.92^{ab}	0.63^{ab}	3.11	3.06^{b}	0.24	0.09^{ab}
	Q10a	59.04^{ab}	0.68^{a}	3.22	3.78^{a}	0.27	0.11^{ab}
	Q10b	55.93^{c}	0.60^{b}	3.40	3.75^{a}	0.28	0.12^{a}
Injection At 18 days	**P.C.2**	56.97^{bc}	0.61^{ab}	3.34	3.13^{b}	0.24	0.10^{ab}
	Q10c	58.53^{abc}	0.67^{a}	3.76	4.05^{a}	0.29	0.13^{a}
	Q10d	55.89^{c}	0.52^{c}	3.43	3.58^{ab}	0.32	0.14^{a}
SEM		0.48	0.012	0.07	0.100	0.012	0.007
Sig.		**	**	NS	**	NS	**
P-value		0.007	0.002	0.40	0.011	0.518	0.053

a,b,c,d..: means in the same column bearing different superscripts are significantlydifferent $p \leq 0.05$) ; NS= non-significant ; N.C.: negative control (un-injected); P.C.1 + P.C.2 : positive control which injected with distilled water at the 1st and the 18th day respectively; Q10a+Q10b: injected with 0.1 or 0.2 ml Q10/egg at the 1st day respectively; Q10c +Q10d : injected with 0.1 or 0.2 ml Q10/egg at the 18th day respectively

Table (5): Effect of *in ovo* injection with Co Q10 at the 1st and the 18th day of incubation period on blood hematology of Mamora chicks at 28 day of age.

Treatments		**RBCs X10^{6}**	**WBCs X 10^{3}**	**%**		
				Heterophils	**Monocytes**	**Lymphocytes**
N.C.		3.8^{a}	28.00^{b}	43.00^{bc}	4.93^{bcd}	49.00^{bc}
Injection At 1 days	**P.C.1**	2.54^{ab}	23.67^{b}	54.00^{ab}	7.93^{bc}	36.50^{d}
	Q10a	2.88^{ab}	28.00^{b}	44.00^{bc}	12.45^{a}	40.50^{cd}
	Q10b	1.92^{b}	41.00^{a}	19.50^{d}	7.95^{bc}	72.46^{a}
Injection At 18 days	**P.C.2**	2.46^{b}	27.00^{b}	60.00^{a}	3.54^{d}	31.50^{d}
	Q10c	2.56^{ab}	45.00^{a}	36.50^{c}	8.39^{b}	52.50^{b}
	Q10d	2.34^{b}	28.00^{b}	52.50^{ab}	4.49^{cd}	37.02^{d}
SEM		0.17	2.07	3.07	0.7	3.11
Sig.		**	**	**	**	**
P. value		**0. 104**	**0.011**	**0.000**	**0.000**	**0.000**

a,b,cd,..: means in the same colum bearing different superscripts are significantly different $p \leq 0.05$); N.C.: negative control (un-injected); P.C.1 + P.C.2 : positive control which injected with distilled water at the 1st and the 18th day respectively; Q10a+Q10b: injected with 0.1 or 0.2 ml Q10/egg at the 1st day respectively; Q10c +Q10d : injected with 0.1 or 0.2 ml Q10/egg at the 18th day respectively

Table (6): Effect of *in ovo* injection with Co Q10 at the 1st and the 18th day of incubation period on liver enzymes and antioxidant activity of Mamora chicks at 28 days of age.

Treat.		AST	ALT	SOD	Catalase
N.C.		228.6[a]	25.5[a]	16.06[d]	1.76[e]
Injection At 1 days	P.C.1	220.0[a]	20.60[bc]	16.9[d]	2.16[d]
	Q10a	200.33[b]	18.73[cd]	19.26[c]	2.56[c]
	Q10b	192.33[b]	17.9[d]	21.83[b]	2.86[b]
Injection At 1 days	P.C.2	178.00[c]	21.1[b]	18.2[cd]	2.93[b]
	Q10c	178.33[c]	17.26[d]	23.6[ab]	3.23[a]
	Q10d	193.00[b]	17.73[d]	24.8[a]	3.33[a]
SEM		4.24	0.63	0.73	0.11
Sig.		**	**	**	**
P-value		0.001	0.001	0.001	0.001

a,b,c,.d.: means in the same column bearing different superscripts are significantly different $p \leq 0.05$); N.C.: negative control (un-injected); P.C.1 + P.C.2 : positive control which injected with distilled water at the 1st and the 18th day respectively; Q10a+Q10b: injected with 0.1 or 0.2 ml Q10/egg at the 1st day respectively; Q10c +Q10d : injected with 0.1 or 0.2 ml Q10/egg at the 18th day respectively

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الملخص العربى

تاثير حقن بيض التفريخ بمساعد الانزيم كيو 10 خلال فترة التفريخ على الصفات الفسيولوجية والفقس والنمو اللاحق للكتاكيت الفاقسة

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ه

أجريت هذه الدراسة لبحث تأثير حقن البيض بمساعد الانزيم كيو 10 خلال فترة التفريخ على الصفات الفسيولوجية والفقس والنمو اللاحق للكتاكيت الفاقسة . تم استخدام عدد 630 بيضة لدجاج المعمورة وتم تقسيمهم الى سبعة معاملات تجريبية بكل منها ثلاث مكررات حيث تم ترتيبهم فى نطام تام العشوائية بحيث وضعت المجموعة الأولى كمجموعة ضابطة سالبة (غير محقونه) ، اما المجموعة الثانية فتم حقنها ب 0.3 ملى ماء مقطر لكل بيضة فى الغرفة الهوائية عند اليم الأول من فترة التفريخ (مجموعة ضابطة موجبة-1)، بينما المجموعة الثالثة والرابعة تم حقن كل منهما ب 0.3 ماء مقطر يحتوى على 0.1 و 0.2 ملى مساعد انزيم كيو 10 لكل بيضة فى الغرفة الهوائية عند اليوم الأول من فترة التفريخ ، أما عند اليوم الثامن عشر من فترة التفريخ تم حقن المجموعة الخامسة ب 0.3 ملى ماء مقطر (مجموعة ضابطة موجبة -2) بينما تم حقن كل من المجموعة السادسة والسابعة ب 0.3 ملى ماء مقطر يحتوى على 0.1 و 0.2 ملى مساعد انزيم كيو 10 لكل بيضة فى الغرفة الهوائية على الترتيب ، عند الفقس تم عد ووزن الكتاكيت الفاقسة السليمة والميتة وكذلك تم نقل الكتاكيت السليمة لكل مجموعة وتربيتها حتى عمر 28 يوم بعد الفقس لمعرفة مدى تأثر صفات النمو اللاحق لها بالحقن خلال فترة التفريخ وكانت النتائج كالتالى :

تحسنت نسبة الفقس معنويا والوزن النسبى للكتاكيت الفاقسة بينما انخفضت نسبة النفوق الجنينى معنويا بحقن مساعد الانزيم كيو 10 عند اليوم الأول أو الثامن عشر من فترة التفريخ. كما أدى الحقن بمساعد الانزيم الى تحسن صفات النمو اللاحق للكتاكيت بعد الفقس وحتى عمر 28 يوم بالمقارنة بمجموعة المقارنة السالبة (غير المحقونة) . كما لوحظ زيادة نسبة الخلايا الليمفاوية وانخفاض نسبة الخلايا المتعادلة وكذلك انخفاض النسبة بين الخلايا الليمفاوية الى المتعادلة فى سيرم الدم للكتاكيت بحقن البيض ب 0.2 ملى كيو 10 لكل بيضة عند اليوم الأول من فترة التفريخ بالمقارنة بباقى المعاملات. لوحظ أيضا ارتفاع مستوى سيرم الدم معنويا من انزيم الكتاليزوسوبر اوكسيد دايسميوتز بينما اخفضت معنويا انزيمات الكبد لكل الكتاكيت الناتجة من حقن البيض بمساعد الانزيم كيو 10 خلال فترة التفريخ بالمقارنة بالمجموعات الضابطة المجموجبة والسالبة.

لذا تشير النتائج الى امكانية حقن بيض التفريخ بمساعد الانزيم كيو 10 (0.1 او 0.2 ملى / بيضه) خلال فترة التفريخ لتحسين صفات الفقس والحالة الفسيولوجية للكتاكيت فضلا عن النمو اللاحق لها بعد الفقس