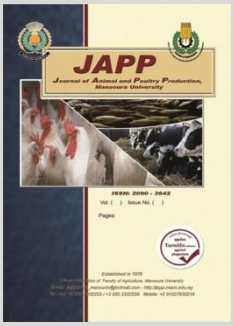
Journal of Animal and Poultry Production

Journal homepage & Available online at: www.jappmu.journals.ekb.eg

Isin Ovoinjectionuseful for Aged Broiler Breeders?

Kalaba, Z. M.; Hayam M. Abo ElMaaty*; E. A. El-gendy and Tork M. Dorra

Poultry Production Department, Faculty of Agriculture, Mansoura University



ABSTRACT

The aimof this study was to assess the effect of *in ovo* injection with saline, vitamins (D_3 and B_{12}) and zinc and L-carnitine on the hatching rate and blood constituents in newly hatched chicks. A total of 1170 eggs from broiler breeders were divided into sixtreatmentgroupsof eggs:a control group without injectionwhich served as sham-operatedor a negative control group and five groups were injected with saline, vitamin D_3, zinc, vitamin B_{12}or L-carnitine, respectively. All eggs were set at a temperaturerange between 24-26°C for 6 hours before exposure to the incubation temperature. Then the injection process occurred at the 18thday and 12 hours of the embryonicdevelopment by depositing the test materials into the air sac at the wide end of the eggs, then the hole was closed with wax. The highest value of fertile hatchability was recorded in eggs injected with vitamin D_3 and zinc, respectively, followed by vitamin B_{12} and L-carnitine. The injected test materials (vitamin D_3, zinc, vitamin $B_{12}$and L-carnitine) had a positive effect on the percentage of late dead embryos compared to negative control group. All injected materials except zinc led to an increase in plasma levels of cholesterol and low-density lipoprotein but levels of glucose, triglyceride, high-density lipoprotein, total protein, albumin and globulin were not affected. In conclusion, *in ovo* injection of vitamins (D_3 and B_{12}), zincand L-carnitine may be suggested as an effective technique for increasing hatchabilityand profitability in aged broiler breeders.

***Keywords*: *In ovo* injection, Broiler breeder eggs, Fertile hatchability, Late deadembryos, vitamins (D_3, B_{12}), Zinc and L-carnitine.**

INTRODUCTION

The incubation period for chicken eggs persists 21 days, and represents about 37.5% of their life cycle. If we consider the period necessary to transfer the sound chicks from the hatchery when their hatchability reach 95%,along with the period required to transferthem to the farm, we can get a possibility of reducing the water and feed consumption of chicks for 2-3 days. This economic managerial procedure has prompted the application of the early feeding techniqueof the embryos through piercing the eggshellto allow injecting a nutrient or nutrients to pass through to the developing embryo (El-Sabrout*et al.*, 2019).

Also, the hatch windowis an important factor affecting the quality of the chicks, and in most cases the period required to transfer the chicks to the breeding farms ranges between 48and 72 hours (Kadam*et al*., 2013). During this period, the only source of feeding for the continuationof the embryo life and its growth is the fats (lipids) and proteins found in the residual egg yolk (Sklan*et al*., 2000). Duringthefasting period (which may last 72 hours)the hatched chicks can rely on the componentsof the residual egg yolk to meet theirnutrient requirements, but it may be insufficient for optimal growth rate. Therefore, the early feeding techniques were adopted, which had proved to be effective in supporting growth and improving the quality characteristics of the resultant chicks (Ferket, 2012).To enhance poultry growth and productivity, several methods were used. Such methods can be divided based on the target siteof *in ovo*injection into five sites: the air cell,the embryo's body itself, the amniotic fluid, the allantoic membrane, and the yolk sac (Saeed *et al*., 2019).Therefore, the aim of this study wasto investigate the effect of *in ovo* injection with saline, vitamins (D_3 and B_{12}), zinc and L-carnitine on hatchability characteristics and some blood constituents of newly hatched chicks.

MATERIALS AND METHODS

Injecting eggs with minerals; vitamins and amino acids was carried out in the commercial Matroh El-Wataniaincubator (it is a single-stage incubator equipped with a system of automatic turning for eggs), Matroh El-Watania Companyfor poultry, Matroh Governorate, Egypt. The laboratory analyses were performed at the Faculty of Agriculture; Mansoura University, Egypt.

Egg Injection and Incubation:

A total of 1170 eggs with an average weightof 67to 70g were obtained from a commercial Matroh El-Watania broiler breeder flock (Cobb-500) at 67 weeks of age. In this study, eggs were injected with five test solutions of saline (0.9%NaCl); vitamin D_3; Zinc; vitamin B_{12} or L-carnitine*vs.* sham-operated eggs (a negative control group). Injections were made at the 18th day and 12hours of incubation. TheTest materials were prepared as follows: 1.5mg/100µl sterile saline and L-carnitine (8mg/100µl sterile saline), vitamin D_3(100,000IU/100µl sterile saline), zinc gluconate (72.9mg/100µl sterile saline), B_{12} (1000mg/ 100µl sterile saline). Extreme care was taken into account when performing the injection process for all treated eggs, as the test materials were injected into the air sac at a depth of 0.28 mm in the wide end of the egg under the supervision of specialists

* **Corresponding author.**
E-mail address: hayam151@yahoo.com
DOI: 10.21608/jappmu.2023.220100.1080

in the injection process with extensive experience. The injection process was organized as follows: 195 eggs were sham-operated and served as a negative control (NC) group, 195 eggs were injected with sterile saline (0.9%) and served as a positive control (PC) group, 195 eggs were injected with vitamin $D_3$and served as treatment three, 195 eggs were injected with zinc gluconateand served as treatment four, 195 eggs were injected with vitamin B_{12} and served as treatment five, 195 eggs were injected with L-carnitineand served as treatment six. In this study, in order to avoid infections and contaminationsamong eggs of the injected groups, insulin syringes were changed constantly, and ethyl alcohol 70% was used to prevent the spread of infection among eggs, and it was deposited again in the hatchery to complete the embryonic development process.

Environmental Description of Incubator and Hatchery:

The characterization of temperature, relative humidity (RH), and carbon dioxide values in both incubator and hatchery are shown in Tables 1 and 2, respectively. Incubator temperature was variable in single-stage incubator (EMKA); relative humidity (RH) and percent of CO_2were estimated from day one to 18 days of incubation. To our knowledge we must be aware that a large amount of eggs enter the incubator simultaneouslyand thus their embryonic development occurin one phase. So that a high level of managerial control is recommended to supply the optimal conditions of embryonic development and this development is inferred by sensing the heat of the egg from ***ovo scan***compartment of the incubator.

The hatching percentage was estimated by considering the number of hatched chicks relative to the number of fertile eggs. It is also known as scientific or fertile hatchability (FH) , and can be computed as follows:

$$\textbf{Fertile Hatchability} = \frac{no\,of\,hatched\,chicks}{no\,of\,fertile\,eggs}$$

Table 1. Program of single-stage incubator.

Age D: H	Eggshell Temp. (°F)	Incubator Temp. (°F)	Vent %	RH (%)	CO_2 %	Cool
00 : 00	100.4	100.4	00	90	0.25	Water till day 16,followed by air flow ten seconds thereafter.
01 : 00	100.4	100.3	00	90	0.25	
02 : 00	100.3	100.2	00	90	0.25	
03 : 00	100	100	10-15	90	0.35	
07 : 00	100	99.9	10-15	90	0.60	
09 : 00	100	99.8	10-15	88	0.60	
10 : 00	99.9	99.7	10-15	88	0.45	
11 : 00	99.9	99.6	30-50	86	0.45	
11 : 18	99.8	99.5	30-50	86	0.45	
12 : 00	99.7	99.4	30-50	86	0.45	
13 : 00	99.7	99.3	40-65	84	0.45	
14 : 00	99.7	99.2	40-65	84	0.45	
15 : 00	99.7	99.0	40-65	84	0.45	
18 : 00	99.7	98.8	60-85	84	0.30	

D: Day. H: Hours. RH: Relative humidity.

Table 2. Program of single-stage hatchery.

Age D : H	Temp (°F)	RH (%)	CO_2 %	Vent	Cool
18 : 12	98.5	85	0.6	25-50	Water till 14 hours post-the 20th day, followed by air flow ten seconds thereafter.
19 : 12	98.2	87	0.8	25-65	
20 : 00	98.0	91	1.0	25-90	
20 : 10	97.8	90	0.9	35-100	
20 : 12	97.5	89	0.75	35-100	
20 : 14	97.0	89	0.50	35-100	
20 : 16	96.8	89	0.50	50-100	
20 : 18	96.5	88	0.50	50-100	
20 : 20	96.0	88	0.50	70-100	
21 : 00	95.8	85	0.40	70-100	

Embryonic Mortality:

The stages of mortality were divided according to the timing of their occurrence during the incubation period as it was given in Table 3.

Plasma Blood Parametersof Hatched Chicks:

After complete hatching, random sample of 9 chicks was chosen from each treatment to blood sampling in heparinized test tubes, and the blood sampleswere immediately centrifuged at 3000 rpm for 15 minutes to separate the plasma. Plasma concentrations of glucose(Glu), cholesterol (Cho), triglyceride(Tri), low-density lipoprotein (LDL)high-density lipoprotein (HDL), total protein (TP)and albumin (Alb), as well as activity of plasma aspartate aminotransferase (AST) and alanine aminotransferase(ALT) were measured by commercial kits **(**Spectrum Diagnostic Kits S.A.E., Egyptian Company of Biotechnology, 2022). Plasma globulin (Glo)concentration was also calculated.

Table 3. Embryonic mortality categories.

Category	Time of occurrence from incubation period (days)
Early DeadEmbryos	0 – 7
Mid Dead Embryos	8 – 14
Late Dead Embryos	15 – 21
Infertile eggs	11
Pipped eggs	19-21
Live pipped chicks	21
Dead pipped chicks	21

Statistical Analysis:

The statistical analysis of results was performed by using one-way analysis of variance of the GLM procedure of the Statistical Analysis System (SAS, 2006). Significant differences between means of different estimated variables were identified by Duncan's new multiple range test at $P \leq 0.05$ (Duncan, 1955). The following statistical model was used:

$$Yij = \mu + Ei + eij.$$ **Where:**

Yij = observed trait; μ = the overall mean;
Ei = Effect of injected material; and eij = experimental random error.

RESULTS AND DISCUSSION

Reproductive Performance:

Data summarized in Table (4) showed some characteristics of hatchabilityin aged broiler breedersas influenced by *in ovo* injection with saline, vitamin D_3, Zinc, vitamin B_{12} and L-carnitine. The highest value of fertile hatchability (FH) was achieved by the groups injected with vitamin D_3, Zincand vitamin B_{12}, respectively. The group of eggs treated with L-carnitine also achieved better mean of FH but was not significantly different from As was expected, fertility rate (%) was not significantly affected by the injection of test materials. Likewise, the hatch weight of chicks was not affected by the injected materials. Our results are in agreement with those of Stevens *et al*.(1984), who found that vitamin D_3 deficiency led to a decrease in the hatching rate and an increase in the late embryonic mortality. A similar trend of response was also observed by Bello *et al*.(2013).

In an early report, Narbaitz*et al*. (1987) also attributed the effectiveness of vitamin D_3 in improving the hatching rate to its role in the growth and development of the poultry embryo and its regulation of calcium metabolism which enhances the vitality of the embryo in the period between the internal pippingof the shell to the completion of the hatching process. Recently, El-Fiky*et al*. (2022) reported a positive

effect of vitamin D_3on the hatching rate of poultry eggs. In addition, Hamza*et al*. (2022) indicated that the effect of zinc on the hatching rate of poultry egg depends primarily on the source of zinc. In this regard, Sogunle *et al*. (2018) observed that when the eggs were injected with zinc at a level of 80 µgper egg, the hatching rate increased in the treated eggs. Also, Uni and Ferket (2004) pointed out that the effect of vitamin B_{12} in improving the hatching ratio appears when the injection process occurs on the eighteenth day of incubation. They attributed to the fact that at this age the embryo has completed its development and is able to be exposed to a change in temperature in the injection environment, which is less than the temperature of the hatching machine. This viewpoint was supported by Teymouri*et al*. (2020) as the eggs were injected with vitamin B_{12} on the thirteenth and fifteenth days at a concentration of 20-40 µg, and it did not exert a beneficial effect on the hatching rate. Furthermore, Momeneh and Torki(2018) mentioned that the percentage of hatching in eggs treated with vitamin B_{12} improved to 70.83%, compared to that of the control group (58.33%) when the injection process occurred on the eighteenth day of incubation and this is in harmony with the results of Lillie *et al*. (1949), who noticed an improvement in the hatching rate in eggs treated with vitamin B_{12}.

Table 4. Effects of *in ovo* injection of saline, vitamins, zinc and L-carnitineon hatchability characteristics in aged broiler breeders.

Treatments	No. of Eggs.	Infertility %	Fertility %	FH %	Chick weight at hatch (g)
NC	195	17.95	82.05	53.84^{c}	41.58
PC	195	17.44	82.56	58.97^{bc}	45.76
Vitamin D_3	195	15.38	84.62	76.41^{a}	42.91
Zinc	195	16.42	83.58	73.33^{a}	42.68
Vitamin B_{12}	195	16.93	83.07	69.74^{ab}	42.21
L-carnitine	195	17.44	82.56	66.66^{abc}	42.84
SEM	-	2.69	2.69	3.34	1.43
Significance	-	NS	NS	**	NS

Means with different superscripts in the same column differ significantly at P≤0.05.NS: Not significant, **: Significant at P≤0.05,NC: Negative control, PC: Positive control, SEM: Standard error of the means.

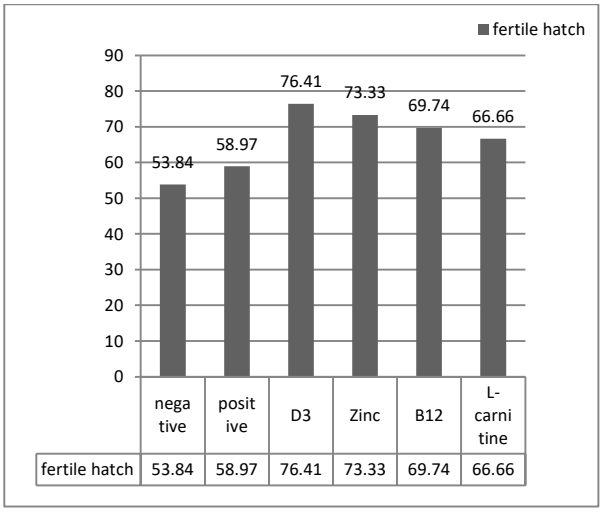


Figure 1. Effects ofthe test materials on fertile hatchability compared with the negative control

On the other hand, Dooley *et al*.(2011)detected a limited significant effect of in ovoL-carnitine injection on the hatching rate of poultry eggs.While Zahi*et al* (2008) stated that when L-carnitine injection was performed at the age of 18 days of the embryonic development, there was no positive effect on the hatching rate, which confirms that the absence of a beneficial effect to injecting L-carnitineinto the hatching eggs is not due to the timing of the injection process, but to the effect of the L-carnitine itself. A similar trend of response was also observed by Keralapurath*et al*. (2010).

Selected Parameters of Hatchability in Aged Broiler Breeders

The effects of *in ovo* injection with saline, vitamin D_3, Zinc, vitamin B_{12} and L-carnitine on selected parameters of hatchability and stages of embryonic mortality are presented in Table 5. The results showed that no significant alternations in live pipped and mid dead embryosdue to *inovo*injection with saline, vitamin D_3, zinc, vitamin B_{12} and L-carnitine, and contamination could be detected from captured eggs classification. However, capturing eggs from the NC group displayed significantly (P≤0.01) higher mean (28.20%) of culled eggsthan those injected with vitamin D_3(8.20%), vitamin B_{12} (13.33%), L-carnitine (15.89%) and zinc (10.25%). The mean of culled eggs in the PC group (23.58%) was slightly lower than that of the NC group but significantly higher (P≤0.01)than those injected with vitamin D_3or zinc, and insignificantly different from those injected with vitamin B_{12}orL-carnitine.Based on data obtained from capturedeggs classification, the rate of pippedembryos (%)was significantly lower (P≤0.01)ingroups of eggs injected with vitamin D_3or zinc compared with the NC group but comparable to those of the PC and other treated groups. Our results indicated also that the groups of eggs injected with vitamin D_3, zinc or vitamin B_{12} recorded significantly lower percentages of dead pipped embryos compared with the NC groupbut were insignificantly different from those of the PC and other treated groups. Also, early- and late-dead embryos significantly decreased (P≤0.01) by using *in ovo* injection of the test materialsas comparedto the NC group.

In this respect,Han *et al*. (2016) observed a beneficial linear effect tosupplemental dietary vitamin D_3 on the mortality rateof broiler chicks from one to three weeks of age. In line with our results, Wang *et al*. (2016) found a positive effect of vitamin D_3 on the mortality rateof broiler chicks fed Ca- and P-deficient diets during the first three weeks of life.In accordance with the current findings, embryonic mortality increased when hatching eggs were low in their contents of vitamin D_3(Sunde*et al*., 1978; Steven *et al*., 1984; Elaroussi*et al*., 1993). On the other hand, El-Fiky*et al*. (2022) attributed the absence of a significant effect of vitamin D_3 on the late mortality rate to the error resulting from the manual injection method.It is notable that the significant effect of vitamin B_{12} in reducing the rate of late mortality is due to its effect on various physiological processes in which cell division occurred(Momeneh and Torki, 2018). They clarified that such processes involve synthesis of tissues producing red blood cells, which in turn help in the transfer of oxygen from the lungs to the rest of the body tissues, especially during this critical stage of the embryonic development because the embryo transits from water respiration for aerobic respiration, resulting in enhancement of the embryonic viability andreducing the rate of late mortality.Sogunle*et al*.(2018) attributed the role of zinc in reducing the latemortality to its role in reducing cases of dead-in-shellembryos during the last stage of hatching, *via*its direct effect in enhancing the blood and cellular immunity of the embryo.The studies conducted

by Zahi*et al*. (2008)and Shafey*et al*.(2010)separately indicated that neither the in ovo injected dose of L-carnitine nor the timing of its injection during the embryonic development had a positive effect on the rate of late embryonic mortality.

Table 5. Effects of *in ovo* injection of saline, vitamins, zinc and L-carnitineon selected parameters of hatchability in aged broiler breeders.

Treatments	Culled eggs (%)	Pipped Embryos (%)	LivePipped (%)	DeadPipped (%)	EarlyDead (%)	Mid Dead (%)	Late Dead (%)	Cont. %
NC	28.20^{a}	15.38^{a}	5.13	10.25^{a}	4.10^{a}	1.53	5.64^{a}	1.53
PC	23.58^{ab}	12.82^{ab}	5.13	7.69^{ab}	1.53^{ab}	2.56	5.12^{ab}	1.53
Vitamin D_3	8.20^{c}	5.12^{b}	3.58	1.54^{b}	1.53^{ab}	0.00	1.53^{ab}	0.00
Zinc	10.25^{c}	5.12^{b}	3.07	2.05^{b}	1.01^{b}	1.02	1.53^{ab}	1.02
Vitamin B_{12}	13.33^{bc}	7.69^{ab}	4.62	3.07^{b}	2.05^{ab}	0.00	2.56^{ab}	1.02
L-carnitine	15.89^{bc}	12.30^{ab}	4.61	7.69^{ab}	2.05^{ab}	0.00	0.51^{b}	1.02
SEM	2.62	2.10	1.46	1.60	0.97	0.65	1.18	0.72
Significance	**	**	NS	**	**	NS	**	N.S

Means with different superscripts in the same column differ significantly at P≤0.05.NS: Not significant, **: Significant at P≤0.05,NC: Negative control, PC: Positive control, SEM: Standard error of the means.

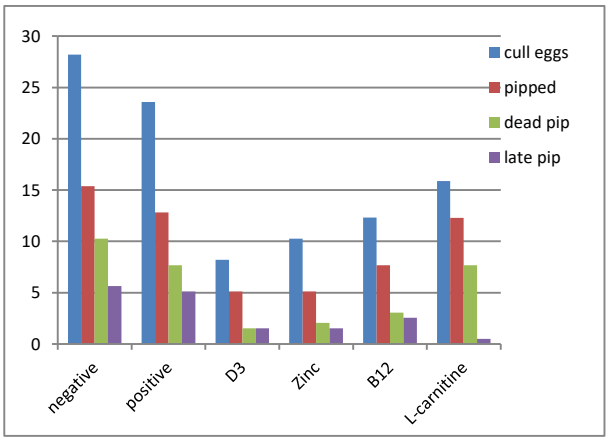


Figure 2. Effects of test materials on selected parameters of hatchabilityin aged broiler breeders.

Blood Plasma Lipid Profile Parameters of Cobb-500 Broiler Chicks:

Data on blood plasma components (Glu, Cho, Tri, HDL and LDL) of day-old broiler chicks as affected by injecting eggs with saline, vitamin D_3, zinc, vitamin B_{12} and L-carnitineare shown in Table 6. The obtaineddata showed a lack of significant effect of the injected test materials on the plasma concentrations of Glu, Tri and HDL of broiler chicks. The plasma levels of Cho were significantly higher (P≤0.05) in chicks hatched from eggs injected with vitamins (D_3 and B_{12}), L-carnitine and saline (PC group)than those hatched from eggs injected with zinc or the NC group, with no significant differences between them. Also, there were significant increases(P≤0.01) in plasma concentrations of LDL in chicks hatched from eggs injected with vitamins (D_3 and B_{12}), L-carnitine and saline compared with those hatched from eggs injected with zinc or the NC group. No clear reason could be suggested for such observed increase in plasma levels of LDL of chicks of these treated groups in comparison to those injected with Zn or the NC group.

Blood Plasma Protein Profile and Liver Function of Cobb-500 Broiler Chicks:

Data on blood plasma protein fractions and liver function enzymes (TP, Alb, Glo, AST and ALT) of day-old broiler chicks as affected by injecting eggs with saline, vitamin D_3, zinc, vitamin B_{12} and L-carnitine are given in Table 7. The injected test materials did not significantly affect the plasma concentrations of TP, Alb and Glo of broiler chicks. As presented in Table 7, the injected test materials produced slight erratic differences in plasma activity of AST and ALT of broiler chicks, with no clear-cut trend. Interestingly, broilers hatched from eggs injected with l-carnitine exhibited significantly higher ((P≤0.05) plasma AST activity than the PC group but comparable to other treated groups and the NC group. Also, broilers hatched from eggs treated with L-carnitine displayed significantly higher ((P≤0.05) plasma ALT activity than those of chicks hatched from eggs treated with vitamin D_3 and zinc but comparable to the NC group and other treated groups.

Table 6. Blood plasma lipid profile parameters of day-old broilers as affected by injecting eggs with saline, vitamin D_3, zinc, vitamin B_{12} and L-carnitine.

Treatments	Glu mg/dl	Cho mg/dl	Tri mg/dl	LDL mg/dl	HDL mg/dl
NC	230.60	79.00^{b}	65.20	47.62^{d}	23.80
PC	240.60	135.00^{a}	66.80	93.52^{a}	27.00
Vitamin D_3	248.60	139.80^{a}	74.40	87.96^{ab}	24.40
Zinc	244.00	86.40^{b}	68.80	59.20^{cd}	38.00
Vitamin B_{12}	249.60	156.60^{a}	68.60	74.80^{bc}	32.60
L-carnitine	236.80	126.00^{a}	71.20	71.40^{bc}	35.40
SEM	5.84	7.91	4.53	3.82	3.28
Significance	NS	*	NS	**	NS

Means with different superscripts in the same column differ significantly at P≤0.05. NS: Not significant, *: Significant at P≤0.05, **: Significant at P≤0.05, NC: Negative control, PC: Positive control, and SEM: Standard error of the means.

Table 7. Blood plasma protein profile and liver functionenzymes of day-old broilers as affected by injecting eggs with saline, vitamin D_3, zinc, vitamin B_{12} and L-carnitine.

Treatments	TP mg/dl	Alb mg/dl	Glo mg/dl	AST U/l	ALT U/l
NC	3.12	1.18	1.84	25.96^{ab}	33.07^{abc}
PC	3.08	1.16	1.98	23.39^{b}	33.26^{abc}
Vitamin D_3	3.56	1.28	2.28	27.20^{ab}	32.19^{c}
Zinc	3.54	1.38	2.16	26.36^{ab}	32.52^{bc}
Vitamin B_{12}	3.44	1.28	2.16	27.40^{ab}	38.40^{ab}
L-carnitine	3.60	1.30	2.30	30.00^{a}	38.80^{a}
SEM	0.1	0.09	0.137	1.05	1.35
Significance	NS	NS	NS	*	*

Means with different superscripts in the same column differ significantly at P≤0.05. NS: Not significant, *: Significant at P≤0.05, NC: Negative control, PC: Positive control, and SEM: Standard error of the means.

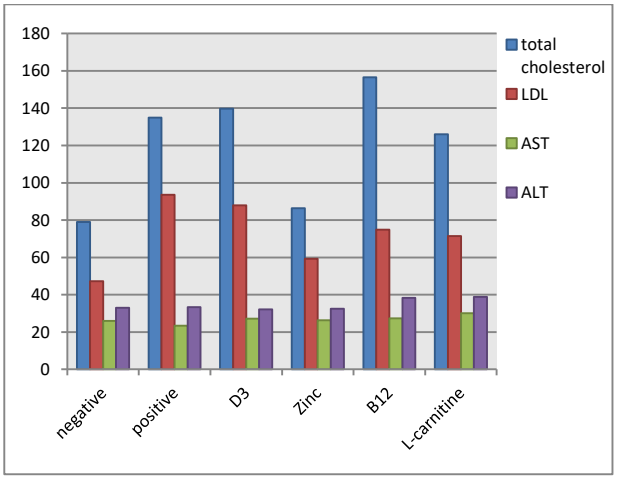


Figure 3. Effects of test materials on plasma levels of Cho, LDL, AST and ALT) of day-old broilers..

Our results are consistent withthose obtained by Kim and Kang (2022), whofoundthat *in ovo* Zn injection and dietary zinc supplementation did not significantly affectblood serum levels of TP, Alb or activity of AST and ALT in broiler chicks.In this regard, Biria*et al*. (2020)evaluated the effect of in ovo injection with Zn (zinc oxide nanoparticles) on blood serum parameters in broiler chicks, and found that the response depends of the applied dose of zinc (50, 75 or 100 ppm). They observed that in serum Tri concentration increased in broiler chicks (10 days of age) linearly with increasing the injected level of zinc while levels of Cho, LDL and HDL of 10-day-old broiler chicks hatched from eggs treated with 50 ppm zinc nanoparticles were lower than that of that control group; but were significantly higher than their control counterparts when the level of zinc administration reach 75 or 100 ppm. While Teymouri*et al*. (2020)found a significant effect of vitamin B_{12} injections on the levels of glucose and total protein in the blood of chicks on days 1and 21 post hatch.Wang *et al*. (2013)pointed out to the potential of L-carnitinein reducing the level of triglycerides in the blood of broilers it leads to a significant increase in the total protein and globulin.On the other hand, Arslan *et al*. (2003)concluded that the effect of carnitine on cholesterol and blood glucose was not significant,and this is supported by the findings of Parsaeimehr*et al*. (2014), whofound nosignificant effect of L-carnitine on blood concentrations of glucose, TP, Alb and Glo, Tri, Cho, LDL and HDL of broiler chicks. El-Fiky*etal*. (2022)detected a significant effect of vitamin D_3 injections at a rate of100µlon both ALT and AST.They also noticed that the effect of vitamin D_3 on blood components is based on the existence of an overlapping relationship between the level of vitamin D_3 transmitted from breeder to the embryo through blood plasma and the level of in ovo injection of vitamin D_3which increases its effectiveness and compensates for the percentage consumed by the chick from the yolk sac.

CONCLUSION

The current study indicated that injecting eggs produced from aged older broiler breeders with vitamins (D_3, B_{12}) and Zinc can improve the hatchability characteristics and reduce the embryonic late dead ratio.When compared to the control, *in ovo*injection of vitamin D_3 and zinc enhanced plasma liver enzymes and lipid profile.

REFERENCES

Arslan, C.; M. Citil and M. Saatci (2003).Effects of L-carnitine administration on growth performance, carcass traits, blood serum parameters and abdominal fatty acid composition of ducks. Archives of Animal Nutrition 57(5):381-388.

Bello, A.; W. Zhai;P.D. Gerard and E.D. Peebles (2013).Effects of the commercial in ovo injection of 25-hydroxycholecalciferol on the hatchability and hatching chick quality of broilers.Poult.Sci., 92(10): 2551- 2559.

Biria, A.; B.Navidshad; F.M.Aghjehgheshlag and S. Nikbin(2020). The effect of in ovo supplementation of nano zinc oxide particles on hatchability and post-hatch immune system of broiler chicken. Iran. J. Appl. Anim. Sci., 10(3): 547–553.

Dooley, M.; E.D. Peebles; W. Zhai; L. Mejia; C.D. Zumwalt and A. Corzo (2011). Effects of L-carnitine via in ovo injection with or without L-carnitine feed supplementation on broiler hatchability and posthatch performance. J. Appl. Poult. Res., 20(4): 491-497.

Duncan,D.B.(1955).The multiple range and multiple Ftests.Biometrics,11(1):1-42.

Elaroussi,M.A.; H.F. Deluca; L.R. Forteand H.V. Biellier(1993).Survival of vitamin D-deficient embryos:Time and choice of cholecalciferol or its metabolites for treatment in ovo.Poult.Sci.,72(6):1118-1126.

El-Fiky, A.A.; F.H. Abdou; A.A.Enab; Yasmin S. Gad and Dina A. Selim (2022).Influence of in ovo injection with vitamin D_3on some physiological parameters and bone development of Norfachicks.Menoufia J. Anim.Poult. Fish Prod., 6(4):73-87.

El-Sabrout, K.; S.Ahmad and A. El-Deek(2019).The in ovo feeding technique as a recent aspect of poultry farming. J. Anim. Health Prod.,7(4): 126-130.

Ferket, P.R. (2012). Embryo epigenomicresponse to breeder management and nutrition.In Proceedings of XXIV World´s Poultry Congress 5-9 August, 2012: Salvador, Bahia, Brazil, pp. 1-11.

Hamza, O.A.; H.A. Hassan and K.Y. Farroh (2022).Effect of different sources of zinc in ovo injection on hatching traits, growth and some physiological parameters of broiler chicks.Fayoum J. Agric. Res. Dev., 36(2) 160-174.

Han, J.C.; G.H. Chen; J.G. Wang; J.L. Zhang; H.X. Qu; C.M. Zhang; Y.F. Yan and Y.H. Cheng (2016). Evaluation of relative bioavailability of 25-hydroxycholecalciferol to cholecalciferol for broiler chickens.Asian Australas. J. Anim. Sci., 29(8): 1145-1151.

Kadam, M.M; M.R.Barekatain; S.K Bhanjaand P.A. Iji (2013).Prospects of in ovo feeding and nutrient supplementation for poultry: the science and commercial applications-A review.J. Sci. Food Agric., 93(15): 3654-3661.

Keralapurath, M.M.; A. Corzo; R. Pulikanti; W. Zhaiand E.D. Peebles (2010).Effects of in ovo injection of L-carnitine on hatchability and subsequent broiler performance and slaughter yield. Poultry Sci., 89(7): 1497-1501.

Kim, H.J. and H.K. Kang (2022). Effects of in ovo injection of zinc or diet supplementation of zinc on performance, serum biochemical profiles and meat quality in broilers. Animals (Basel), 12(5): 630-640.

Lillie, R.J.; M.W. Olsen and H.R. Bird, (1949). Role of vitamin B_{12} in reproduction of poultry.Exp. Biol. Med., 72(3): 598-602.

Momeneh, T. andM. Torki (2018) Effects of in ovo injection of vitamins B_6 and B_{12} in fertile eggs subjected to ethanol stress on hatching traits, performance and visceral organs of broiler chicks reared under cold stress condition. Iran. J. Appl.Anim. Sci., 8(3):491-498.

Narbaitz, R.; C.P. Tsang and A.A. Grunder (1987). Effects of vitamin D deficiency in the chicken embryo.Calcif. Tissue Int., 40(2): 109-113.

Parsaeimehr, K.; M. Afrouziyeh and S. Hoseinzadeh (2014). The effects of L-carnitine and different levels of animal fat on performance, carcass characteristics, some blood parameters and immune response in broiler chicks. Iran. J. Appl. Anim. Sci., 4(3): 561-566.

Saeed, M.; D. Babazadeh; M.Naveed; M.Alagawany; M.E.Abd El-Hack; M.A.Arain; R.Tiwari; S. Sachan; K. Karthik; K.Dhama; S.S.Elnesrand S. Chao (2019). In ovo delivery of various biological supplements, vaccines and drugs in poultry: current knowledge. J. Sci. Food Agric., 99(8): 3727- 3739.

SAS (2006). Statistical Analysis System. SAS User's Guide: Statistics SAS institute Inc., Cary, NC, USA.

Shafey, T.M.; H.A. Al-Batshan; A.N. Al-Owaimer and K.A. Al-Samawei (2010). Effects of in ovo administration of L-carnitine on hatchability performance, glycogen status and insulin-like growth factor-1 of broiler chickens.Br. Poult.Sci., 51(1): 122-131.

Sklan, D.; Y. Noy; A. Hoyzmanand T. Rozenboim (2000). Decreasing weight loss in the hatchery by feeding chicks and poults in hatching trays. J. Appl. Poult. Res., 9(2): 142-148.

Sogunle, O.M.;A.V. Elangovan; C.G. David; J.Ghosh and V.B. Awachat(2018).Response of broiler chicken to in ovo administration of inorganic salts of zinc, selenium and copper or their combination. Slovak J. Anim. Sci., 51(1): 8–19.

Spectrum Diagnostic Kits S.A.E. (2022). Egyptian Company of Biotechnology.

Stevens, V.I.; R. Blair and R.E. Salmon (1984). Effects of vitamin D_3, calcium, and phosphorus on growth and bone development of market turkeys.Poult. Sci., 63(8): 1571-1585.

Sunde,M.L.; C.M. Turkand H.F. Deluca(1978).The essentiality of vitamin D metabolites for embryonic chick development.Science,200(4345):1067-1069.

Teymouri, B.; J.G. Ghalehkandi; S. Hassanpour and H. Aghdam-Shahryar (2020).Effect of in ovo feeding of the vitamin B_{12} on hatchability, performance and blood constitutes in broiler chicken. Int. J. Peptide Res. Therap., 26(4):381–387.

Uni, Z. and P.R. Ferket (2004). Methods for early nutrition and their potential.World's Poult.Sci. J., 60(1):101–111.

Wang, J.; J. Han; G. Chen; H. Qu; Z. Wang; Y. Yan and Y. Cheng (2016). Comparison of bioavailability of 1α-hydroxycholecalciferol and cholecalciferol in broiler chicken diets.Poult. Sci., 53(1): 22-28.

Wang, Y.W.; D. Ning; Y.Z. Peng and Y.M. Guo (2013). Effects of dietary L-carnitine supplementation on growth performance, organ weight, biochemical parameters and ascites susceptibility in broilers reared under low-temperature environment. Asian-Austral.J. Anim. Sci., 26(2): 233-240.

Zhai, W.; S. Neuman; M.A. Latour and P.Y. Hester (2008). The effect of in ovo injection of L-carnitine on hatchability of White Leghorns. Poultry Sci., 87(3):569-572.

هل حقن بيض أمهات كتاكيت اللحم المسنة مفيدا ؟

زياد محمد قلبة ، هيام محمد أبو المعاطي، إسلام أحمد فتحي ترك محمد درة

قسم إنتاج الدواجن كلية الزراعة جامعة المنصورة مصر

الملخص

تهدف هذه الدراسة لتقييم تأثير حقن البيض بالمحلول الملحي ، فيتامين (د3) ، وفيتامين (ب12) وكذلك كل من الزنك والكارنتين علي معدل الفقس وبعض مكونات الدم فى الكتاكيت حديثة الفقس. تم استخدام عدد 1170 بيضة من قطيع أمهات كبيرة فى العمر، وتم تقسيم البيض الى 6 مجاميع تجريبية هى: مجموعة التحكم (لم يتم حقنها) وتم اعتبارها كمجموعة سلبية وخمس مجموعات تم حقنها بمحلول ملحي وفيتامين د3 والزنك وفيتامين ب12 والكارنتين علي التوالي . تم وضع البيض في درجة حرارة 24-26 درجة مئوي لمدة 6 ساعات قبل عملية التفريخ. تم اجراء عملية الحقن فى اليوم الثامن عشر و12ساعة من التطور الجنيني عن طريق وضع مواد الاختبار في كيس الهواء في الطرف العريض للبيض ثم تم اغلاق الحفرة بالشمع،سجلت أعلي قيمة فقس للبيض المخصب عند المعاملة بفتامين د3 والزنك علي التوالي يليهما فيتامين ب12 والكارنتين ،كان لمواد الاختبار المحقونة (فيتامين د3 ،الزنك ،فيتامين ب12 والكارنتين) تأثير ايجابي علي نسبة النفوق الجنيني المتأخر مقارنة بمجموعة السيطرة السلبية ،أدت جميع المواد المحقونة باستثناء الزنك الي زيادة مستويات الكولستيرول في البلازما والبروتين الدهني منخفض الكثافة ولكن لم تتأثر مستويات الجلوكوز والدهون الثلاثية والبروتين الدهني عالي الكثافة والبروتين الكلي والألبومين والجلوبيولين ،في الختام يمكن اقتراح حقن البيض بفيتاميني د3 وب12 والزنك والكارنتين كطريقة فعالة لزيادة قابلية الفقس والربحية لمربي الدجاج اللاحم المتقدم في العمر.