



# **Impact of In Ovo Injection of Vitamin C on the Hatchability, Chick Weight, and Immunity of Broiler Chicks.**

Research project

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## **1- INTRODUCTION:**

In any commercial poultry production system, the first few weeks are the most critical period in a chick's life, which has a significant bearing on the survivability and growth of the bird. The most promising method that eliminates the unwanted effects of many factors that may affect the other delivery ways is in ovo injection method (Bakayaraj *et al.*, 2012).

The main use of in ovo injection continues to be for delivering vaccines to protect against MD (Marek's Disease) and other diseases (Wit and Montiel, 2022). Several studies demonstrated positive and encouraging results of in ovo feeding of amino acids, minerals, carbohydrates, probiotics, prebiotics and vitamins (Ghane *et al.*, 2021). Consequently, the advantages this technology provide continue to develop and offer additional benefits to poultry industry. The in ovo feeding also produces an exogenous nutrient absorption peak and was reported to improve economic traits, such as body weight gain, conversion factor, carcass characteristics and meat quality, as well as resistance to disease (Ghane *et al.*, 2021). The in ovo injection method provides the ability to stimulate embryonic development and the immune system (El-Moneim *et al.*, 2020).

The high metabolic demand during embryogenesis increases oxidation of lipids from the yolk as well as free reactive oxygen species (ROS), causing lipid peroxidation of cell membranes and cell degradation. To help and prevent this damage, several investigators have evaluated the in ovo administration of antioxidants such as vitamin C with encouraging results (Zhu *et al.*, 2019). Previous studies have shown positive effects of the use of supplementary L-ascorbic acid (L-AA) to mitigate various stressors such as heat and ammonia exposure in the broiler industry. This becomes particularly important due to the fact that the tissues of chicken embryos contain a high proportion of polyunsaturated fatty acids in the lipid fraction and, thus, need

antioxidant defense. Therefore, an increase in the serum or tissue concentrations of L-AA may improve the hatchability as well as the post-hatch performance of chickens (Mousstaaid *et al.*, 2022).

The aim of this review is to declare the effect of injecting the egg by different vitamin C on the hatchability, chick weight, and immunity of broiler chicks.

## 2- LITERATURE REVIEW:

### 2.1- Effect of in ovo injection of vitamin C on the hatchability of broiler chicks:

Zhu *et al.*, (2020) studied the effects of in ovo feeding of vitamin C on the hatchability trait in broiler chickens. A total of 240 Arbor Acres breeder eggs were randomly divided into two groups: normal saline (NS) and vitamin C (VC) groups. Results showed that the vitamin C via in ovo injection can be absorbed by broiler's embryo and IFO (In Ovo Feeding) of vitamin C at 11 days increased hatchability percentage as shown in Table 1.

**Table 1. Effect of in ovo feeding of vitamin C at embryonic age 11 days on the hatchability of fertilized eggs.**

Treatments	Number of eggs	Number of fertilized eggs	Number of newly hatched chicks	Hatchability of fertilized eggs (%)
NS	120	116	86	74.1 <sup>b</sup>
VC	120	115	107	93.0 <sup>a</sup>

NS, normal saline group; VC, vitamin C group.

Zhu *et al.*, (2020)

<sup>a,b</sup> Hatchability of fertilized eggs within a column with unlike superscript letters are significantly different (P < 0.05)

## 2.2- Effect of in ovo injection of vitamin C on the body weight of broiler chicks:

Ghane *et al.*, (2021) studied the effect of in ovo feeding of different levels of vitamins C on body weight at hatch and body weight from day old to 42 days of age. Results showed that there is no significant differences of body weight at hatch and body weight (1-42 days) among treatments as shown in table 2.

**Table 2. Effects of in ovo administration of vitamin C on body weight of broiler chickens.**

Item	Body weight at hatch, g	Body weight (1-42 days), g
NC	37.61	2232.7
PC	37.88	2217.1
Vitamin C 1.0 mg	38.08	2224.7
Vitamin C 3.0 mg	37.92	2390.6
Vitamin C 6.0 mg	36.99	2239.4

(Ghane *et al.*, 2021)

NC= negative control: eggs not injected; PC= positive control: eggs injected with 0.2 mL deionized water; Vitamin C, 1.0 mg; Vitamin C, 3.0 mg; Vitamin C, 6.0 mg.

<sup>a,b</sup> Mean values bearing different superscripts in the column differ significantly ( $p < .05$ ).

### 2.3- Effect of in ovo injection of vitamin C on the immunity of broiler chicks:

Zhu *et al.*, (2019) conducted a study to investigate the possible effects of in ovo feeding of vitamin C at embryonic age 15<sup>th</sup> day on immune function. The results indicated that in ovo feeding of vitamin C increased immunoglobulin M (IgM) (at the broiler's age 1st day, D1), IgG and IgM concentrations (D21), as well as lysozyme activity (D21, P <0.05) as shown in table 3.

**Table 3. Effect of in ovo feeding of vitamin C at E15 on immune function in plasma of broilers**

items	Days of age	Treatments		SEM	P-value
		NC	VS		
IgA (g/l)	1	0.208	0.208	0.028	0.965
	21	0.540	0.496	0.020	0.323
	42	0.676	0.752	0.032	0.241
IgG (g/l)	1	5.856	5.846	0.064	0.919
	21	3.234 <sup>b</sup>	5.410 <sup>a</sup>	0.510	0.024
	42	4.768	4.758	0.088	0.959
IgM (g/l)	1	2.274 <sup>b</sup>	4.082 <sup>a</sup>	0.451	0.029
	21	2.974 <sup>b</sup>	4.939 <sup>a</sup>	0.490	0.036
	42	0.867	1.259	0.191	0.357
Lysozyme activity (U/ml)	1	3.5	3.4	0.158	0.867
	21	200.7 <sup>b</sup>	231.8 <sup>a</sup>	8.047	0.044
	42	167.1	165.8	2.078	0.767

(Zhu *et al.*, 2019)

E15= embryonic age 15<sup>th</sup> day; NS=the normal saline group; VC=the vitamin C group; P-value=P value of independent sample t test; SI=stimulation index; IgA=immunoglobulin A; IgG=immunoglobulin G; IgM=immunoglobulin M.

<sup>a,b</sup> Means within a row with different superscript letters are different at P<0.05.

### 3- Conclusions:

- Noted from the results that in ovo feeding of vitamin C supported positively embryos hatchability and this is may be refer to it is key-role as antioxidant.
- Based on the finding, we can assume that dietary L-AA increases body weight at hatch and body weight from day old to 42 days of age.
- In regards of broiler physiology, we discovered that in ovo injection of vitamin C increases or improves immunity specifically at 21 days of age, this is by positive effect of vitamin C through increasing immune cells especially IgG and IgM also lysozyme enzyme.

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