Egyptian Poultry Science Journal

http://www.epsaegypt.com

ISSN: 1110-5623 (Print) – 2090-0570 (On line)

EFFECT OF DIPPING HATCHING EGGS IN ASCORBIC ACID SOLUTIONS ON SOME HATCHING TRAITS AND CHICK QUALITY FOR LOCAL SINAI CHICKENS

A. L. Awad and H.A. H. Abd El-Halim

Anim. Prod. Res. Inst., Agric. Res. Center, Ministry of Agric. Dokki, Giza

Received: 11/02/2015 Accepted: 01/03/2015

ABSTRACT: The aim of this study was to investigate the effect of the dipping hatching eggs in ascorbic acid (AA) concentration on hatchability traits and chick weight and quality at hatch. A total number of 3600 fertile Sinai hen's eggs were used in factorial experimental design (2x 4 x 6). The factors were, dipping day (the 12th and 18th day), dipping time (1, 2, 3 and 4 min.) and ascorbic acid (AA) concentrations (0.0, 5.0, 10.0, 15.0, 20.0 and 25.0 g /liter distilled water).

Results indicated that hatchability (%) was significantly (P≤0.01) improved as a result of dipping eggs at the 12th day of incubation period as compared to those dipped at the 18th day. Also, it was significantly improved by dipping eggs for 2, 3 or 4 minutes than those dipped for 1 minute. Dipping time for 3 minutes recorded the best hatchability percentage than those dipped for the other times. Moreover, hatchability (%) was significantly (P≤0.001) improved by about 2.64, 3.87, 8.77, 2.65 and 2.55 % for eggs dipped into 5.0 , 10.0 , 15.0 , 20.0 and 25.0 g AA/ L solution as compared with those dipped into distilled water (0.0 g AA/L), respectively. Embryonic mortality (%) was significantly (P≤0.01) decreased by 23.36 % for eggs dipped at the 12th day than those dipped at the 18th day of incubation period. Eggs dipped for 2, 3 or 4 minutes had significantly (P≤0.01) lower embryonic mortality than those dipped for 1 minute. Also, it was significantly (P≤0.001) decreased by dipping eggs into 5.0 up to 25.0 g AA/L solutions than those dipped into distilled water (0.0 g AA/L). The lowest embryonic mortality was occurred by dipping eggs into 15.0 g AA/L solution comparing to those dipped into other AA concentrations.

Key Words: Ascorbic Acid, Dipping Day And Time, Incubation Period And Hatchability.

Corresponding author: awad1512@yahoo.com

First-grade chicks was significantly ($P \leq 0.01$) improved by increasing dipping time and different AA concentrations. The best first-grade chicks was occurred by dipping eggs for 3 or 4 minutes, while it was occurred by dipping eggs into 15.0 g AA/L solution. All interactions between the dipping day, dipping time and AA concentration in dipping solution had a significant effects on hatchability, embryonic mortality percentages and chick quality. The highest hatchability and the lowest embryonic mortality values were occurred by dipping eggs at the 12^{th} day of incubation for both 2 and 3 minutes with 15.0 g AA/L solution. Generally, dipping Sinai hen's eggs at the 12^{th} day of incubation period for 2 or 3 minutes into 15.0 g ascorbic acid per liter may be alternative method to maximize the hatchability and chick quality percentage as well as minimize embryonic mortality percentage.

INTRODUCTION

Poultry production in Egypt has assumed greater importance on the background of rural unemployment, population explosion and vagaries of nature. Importantly, to the poor majority in rural areas, local chickens contributes significantly to food security and serves as an immediate source of meat and income when money is need for urgent family needs (Awad and Abd El-Halim, 2014) .

Due to variable market demand for 1-d-old chicks in the poultry industry, hatchability is an important economic trait of domestic poultry and represents a major component of reproductive fitness (Weis et al., 2011). Many factors can affect hatchability, especially egg size and age of breeders, season of the year and nutrition, egg handling and storage as well as temperature and humidity throughout the incubation and hatching period (Wilson et al., 1997). To obtain optimum incubation results, the conditions during incubation must be adjusted to meet the requirements of the embryo (Meijerhof, 2009). Also, the embryonic environment have influences the growth of the embryo in many species during hatching process (Hammond et al., 2007). Thus, a high temperature above 37.8 ^{o}C during incubation initially accelerates embryonic growth, utilization of nutrients and energy from the yolk and albumen reserves, but later decreases embryonic development as a result of limited metabolic process by insufficient exchange of oxygen (Lourens et al., 2005). Increasing internal egg temperature during incubation may result adversely effects on embryo development and hatchability (Pulikanti et al., 2011).

Dipping eggs during the incubation period is one of the tools used to improve hatchability percentage and chicks quality at hatch. In addition, it is considered the easiest compared to the injecting eggs process (Ghonim et al., 2009). If ascorbic acid is an anti-stress agent, then the addition of AA may be beneficial for conditions of embryonic stress during incubation period (Nowaczewski et al., 2012). Eggs treatment with AA by dipping, injection or spraying may reflect the positive effects on hatchability for any kind of poultry species. Dipping hatching eggs into AA solution (10 g/L) for 2 minutes had significantly improved hatchability and decreased embryonic mortality of eggs (Shafey, 2002). Ghonim et al. (2008) reported that a significant increase in hatchability and decrease in embryonic mortality (%) due to dipping Muscovy duck eggs in different AA concentrations (10 up to 40.0 g/L) at the first day of incubation period. Mohammed et al. (2011) reported that dipping eggs into 5.0 or 10.0 g AA/L for 2 minutes improved the hatchability and decreased embryonic mortality percentages during hatching process in eggs of Dokki4 and Dandarawi strain chickens. Therefore, the objective of the present study was to evaluate the effect of dipping hatching eggs with ascorbic acid during incubation period on hatchability

traits and chick weight and quality for local Sinai chicken eggs.

MATERIALS AND METHODS

This study was carried out at El-Serw Poultry Breeding Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture, Egypt. All eggs were obtained from Sinai birds (local strain), at the 8th month of age (first season) which fed on a standard layer ration (16.0 %CP, 2800 kcal ME/ kg, 3.01% calcium and 0.45% available phosphorus). The experimental design was 2x 4 x 6 factorial arrangement, the main factors were the dipping day (the 12th and 18th days), dipping time (1, 2, 3 and 4 minutes) and AA concentrations (0, 5, 10, 15, 20 and 25 g AA /liter distilled water). A total number of 3600 fertile Sinai eggs (45 – 48 g) at the 10th day of incubation period were randomly assigned to two main groups (dipping day , DD), each main group (1800 eggs) was further subdivided into equal four subgroups (dipping time, DT), each subgroup was divided into sex treatments group (AA treatments), each treatment consists of equal three replicates (25 eggs each). Ascorbic acid (AA) solutions (35-37ºC) were freshly prepared by dissolving in distilled water before treatment.

Incubation of eggs and data collection:

Eggs were incubated at 37.5 - 37.7 ºC and 55:60 % relative humidity. Eggs had been turned every 1 h until they transferred to the hatching compartment at the 18th day of incubation. The hatching compartment was kept at 37.0 - 37.2 ºC and 65:70 % relative humidity until the end of hatching period .Then, hatched chicks and accumulative embryonic mortality (un-hatched eggs with live or dead embryos and dead hatched chicks) were counted. Hatched chicks were weighed, then, hatchability and embryonic mortality percentages were calculated. Also, all chicks were graded as a first and second-grade chicks. A chick was classified as a first-grade chick when the chick was clean and dry, free of deformities, and eyes were bright (Tona et al., 2004). The rest of chicks were classified as second-grade chicks. The percentage of first and second-grade chicks were calculated as a percentage of total hatched chicks

Statistical analysis:

Data obtained were statistically analyzed using the General linear models procedure of SAS (2004). A factorial design 2x4x6 was used, considering the dipping day of incubation period, eggs dipping time and AA level as the main effects, as follows:

$Yijlk = \mu + T_i + R_j + C_l + (TR)_{ij} + (TC)_{il} + (RC)_{jl} + (TRC)_{ijl} + eijlk$ where :

Yijlk = An observation;

μ = Overall mean;

T = Effect of dipping day; i= (1 and 2) ;

R = Effect of dipping time; j = (1, 2, and 4);

C = Effect of AA level; l= (1,2,.. and 6);

TR= Effect of interaction between the dipping day and time;

TC=Effect of interaction between the dipping day and AA level;

RC=Effect of interaction between eggs dipping time and AA level;

TRC=Effect of interaction between the dipping day and time and AA level; and

eijlk = Random error. Differences between treatments means were compared using Duncan's multiple range test (Duncan, 1955).

RESULTS AND DISCUSSION

Hatchability percentage:-

Results in Table 1 shows the main effects of dipping day (DD), dipping time (DT) and ascorbic acid (AA) concentration in dipping solution during incubation period on hatchability traits. Hatchability (%) was significantly ($P \leq 0.01$) improved by 2.58% as a result of the dipping at the 12th day of incubation period comparing to those dipped at the 18th day. Also, it was

significantly (P≤0.01) improved by dipping eggs for 3 minutes comparing to the other dipping time, it was improved by 5.18, 1.30 and 2.34% than those dipped 1, 2 and 4 minutes, respectively. These findings could demonstrate that the improvement of hatchability may be due to the increase of embryonic viability during the late part of incubation period by dipping treatment which may act as an positive agent led to the decrease of the excessive egg temperature as a result of intense fetal growth and increase metabolism (Shafey, 2002). Also, it may be due to the dipping solutions which contained AA acts an positive role to increase egg shell conductance, which supply enough O_2 requirements and allow the embryos to brake egg shell at hatch (Shafey, 2002 and Lohakare et al., 2005).

Hatchability (%) was significantly (P≤0.001) improved by about 2.64, 3.87, 8.77, 2.65 and 2.55 % for eggs dipped into 5.0 , 10.0 , 15.0 , 20.0 and 25.0 g AA/ L solution as compared with those dipped into distilled water (0.0 g AA/L), respectively . However, eggs dipped into 15.0 g AA/L solution had significantly higher hatchability percentage than the other AA concentration. These results may be due to the decrease of embryonic mortality where AA may be regarded as an anti-stress agent which led to reduction of corticosterone which in turn has a negative impact in collagen synthesis and metabolism of minerals and vitamin D (Tullet, 1990). Also, AA had a primary antioxidants in biological systems which break the chain of lipid peroxidation in cell membranes and reduction characteristics in the endogenous of cells such as mixed function oxidation involving incorporation of oxygen in the substrate (Linder, 1991 and Nowaczewski and Kontecka, 2005). Furthermore, AA may improve immune responsiveness or decrease the number of dead chicks before hatching process. Similar results were obtained by Shafey (2002) who reported that a significant improvement in hatchability by dipping hatching broiler breeder eggs into 10.0 g AA/ litter solution for two minutes. Also, Mohammed et al.(2011) reported that hatchability of fertile and set eggs was significantly improved by dipping eggs into 5.0 g AA/L solution followed by those dipped in 10.0g AA/L solution compared with those dipped into 0.0 g AA/L group. Ghonim et al. (2008) found that a significant improvement in hatchability percentage (29.69 and 2.3.61%) as a result of dipping Muscovy ducks eggs into 20.0 g AA/L solution comparing with those dipped into 0.0 and 40.0 g AA/L.

All interactions between DD, DT and AA concentration during incubation period resulted in a significant effects on hatchability (Tables 2, 3, 4 and 5). It could be observed that the highest hatchability percentage were recorded for eggs which dipped for 2 or 3 minutes at the 12^{th} day of incubation period. The percentage of improvement was 7.36 and 7.66% for eggs dipped for both 2 and 3 minutes than those dipped for one minutes at the 12^{th} day of incubation period, also, it was significantly (P≤0.05) improved for these dipping times at the 12^{th} day than those dipped for any period times minutes at 18^{th} day of incubation. On the other hand, eggs dipped at the 18^{th} day of incubation period had recorded lower hatchability percentages than those dipped at the 12^{th} day at 2,3 and 4 minutes of dipping times (Table 2).

Regarding, the interaction between DD and AA concentration, it was observed that dipping eggs into 10, 15, 20 and 25 g AA/L at the 12^{th} day as well as 15 g AA/L at the 18^{th} day of incubation period significantly (P≤0.001) increased hatchability percentage over than the rest of the other interaction treatments either at the 12^{th} or 18^{th} days of incubation. However, the highest percentage was recorded for the eggs dipped into 15 g AA/L at the 12^{th} day, whereas, the lowest value was occurred by 25.0 AA/L at the 18^{th} day of incubation (Table 3).

These findings could demonstrate that the improvement of hatchability may be due to the AA effect on egg shell conductance (EC), therefore, increased demand for gas exchange (O_2 uptake and CO_2 removal) of embryo (Tazawa and Whittow, 2000). On the other hand, increasing AA concentration in dipping solution to 25.0 g/L may be increase EC to a greater extent which may cause a reduction in albumin quality and increase in albumin pH and egg weight loss, which were associated with a decrease in hatchability (Shafey, 2002). Also, these results may be due to exogenous antioxidants (vitamin E or C) administration around day 14 of incubation (the time of intense fatty acid oxidation) had beneficial effect in increasing lipid utilization for energy production in order to improve hatchability (Schaal, 2008). These results are in agreement with those obtained by Ghonim et al. (2008) who reported that dipping Muscovy duck eggs at the 14th day of incubation into different AA solutions resulted in a significant improvement in hatchability than those dipped at the first day and the 30th day of incubation period. Nowaczewski et al. (2012) reported that Pekin ducks eggs which injected with 6 mg AA/egg at the 20th day of incubation had the best hatchability percentage than other those injected at different days of incubation period.

Concerning, the interaction between eggs dipping time and AA concentration. It could be observed that the best hatchability (%) was recorded by dipping eggs for 2 or 3 minutes into 15.0 g AA/L solution (Table 4), while, the lowest hatchability was occurred by dipping eggs into distilled water (0.0 g AA/L) for one minute. Respecting, the interaction between dipping day, dipping time and AA concentration showed that the best hatchability percentage was exhibited by dipping eggs into 15.0 g AA/L solutions for 2 or 3 minutes at the 12th and 18th days of incubation (Table 5). These results may be due to ascorbic acid does not exist in a freshly laid egg and it appears only on the 3rd /4th day of incubation as a result of endogenous biosynthesis by the developing embryo. However, the manufactured quantities may not be sufficient in conditions of artificial incubation, in particular towards the end of the incubation period when the embryo is most exposed to overheating (Nowaczewski et al., 2012). These results are partially in agreement with those obtained by Mohammed et al.(2011) who reported that the best hatchability was occurred by dipping eggs into 5.0 or 10.0 g AA/L solution at the 16th of incubation period for 2 minutes of Dokki4 and Dandarawi strain chickens. Also, Ghonim et al. (2008) found that the highest hatchability percentage was achieving by dipping Muscovy ducks eggs into 20.0 g AA/L solution for 2 minutes at the 14th day of incubation period.

Embryonic mortality percentage:-

Data presented in Table 1 shows that embryonic mortality (%) was significantly ($P \leq 0.01$) decreased by 21.98 % for dipping eggs at the 12th day than those dipped at the 18th day of incubation period. On the other hand, it was found that the lowest embryonic mortality (%) was recorded by dipping eggs for 3 minutes followed by those dipped for 2 or 4 minutes, respectively while the highest percentage was recorded for eggs dipped for 1 minute only. Embryonic mortality percentage was significantly ($P \leq 0.001$) decreased by dipping eggs into different AA concentrations than those dipped into distilled water (0.0 g AA/L) solution. Embryonic mortality (%) was significantly decreased by 19.00, 27.85, 63.06, 19.08 and 18.35% for eggs dipping into 5.0, 10.0, 15.0, 20.0 and 25.0 g AA/L solution than those dipped into distilled water (0.0 g AA/L), respectively. However, eggs dipped into 15.0 g AA/L solution had significantly lower embryonic mortality percentage than the other AA concentration.

Generally , during early embryonic development, there is rapid oxidative metabolism that leads to production of large quantities of free radicals in many tissues, making them more susceptible to oxidative damage (Selim et al., 2012), or this may complicate external pipping and negatively affects gas exchange by pulmonary respiration (Everaert et al., 2008). The beneficial obtained results may be due to AA may be regarded as an anti-stress agent which led to reduction the excessive production of metabolic heat during the latter period of egg incubation and improve the immune responsiveness by decreasing serum cholesterol, low density lipoprotein (LDL) and glutamic-oxaloacetic transaminase, whereas, it caused a liner increase in serum iron concentration and increase resistance to infections and stresses (Konca et al., 2009). These results are in agreement with those reported by Zakaria and Al-Anezi (1996), Shafey (2002), Samak and Mahmoud (2007) who reported that AA treatment during eggs incubation resulted in a low embryonic mortality. Ghonim et al. (2008) showed that dipping Muscovy duck eggs into different AA concentrations (10.0, 20.0, 30.0 and 40.0 g /L) significantly decreased embryonic mortality percentage as compared with those dipped into distilled water (0.0 g AA/L) solution . Also, Mohammed et al. (2011) reported that embryonic mortality was significantly decreased by dipping eggs into 5.0 or 10.0 g AA/L solution as compared with those dipped into 0.0 g AA/L solution.

All the interactions between DD, DT and AA concentrations during incubation period resulted in a significant effects on embryonic mortality (Tables 2, 3, 4 and 5). Embryonic mortality (%) was significantly ($P \leq 0.05$) decreased by dipping eggs at the 12^{th} day of incubation for 2, 3 or 4 minutes than the other interactions (Table 2). As regard to the interaction between DD and AA concentrations, Table 3 shows that the lowest embryonic mortality (%) were exhibited by dipping eggs in 15.0 g AA/L at both 12^{th} and 18^{th} days of incubation period being 4.68 and 4.33%, respectively. At the same time, there were no significant differences in embryonic mortality between the rest of AA dipping treatments each other and distilled water (AA-untreated) groups at both dipping days (12 or 18 days), except for 25.0 g AA/L treatment at the 18^{th} day , which recorded the highest mortality percentage. With regard to the interaction between DT and AA concentration, it can be observed that the lowest embryonic mortality percentages were obtained by dipping eggs for 2 or 3 minutes into 15.0 g AA/L solution comparing to the other interactions. Meanwhile, dipping eggs for 1 minute into distilled water (0.0 g AA/L) solution recorded the highest embryonic mortality percentage being 17.89% (Table 4). The interactions between dipping day, dipping time and AA concentration were significantly ($P \leq 0.01$) in the lowered embryonic mortality rates where, the lowest percentage of embryonic mortality were recorded by dipping eggs into 5.0 g AA/L solution for 2 minutes and into 15.0 g AA/L for 2 or 3 minutes at the 12^{th} day. Also, the same result was obtained by dipping eggs into 15.0 g AA/L solution for 3 minutes at the 18^{th} day of incubation period (Table 5). These results may be due to exogenous antioxidants (vitamin C) administration around day 14 of incubation (the time of intense fatty acid oxidation) had beneficial effect in reducing the production of free radicals that cause a serious damage in the cellular membranes (Selim et al., 2012)) as well as it may break the chain of lipid peroxidation in cell membranes and reduction characteristics in the endogenous of cells such as mixed function oxidation involving incorporation of oxygen in the substrate (Linder, 1991). These results are similar to that obtained by Mohammed et al. (2011) who reported that the lowest embryonic mortality was

occurred by dipping eggs into 10.0 g AA/L solution at the 16th day of incubation period for 2 minutes. Also, Ghonim et al. (2008) found that a high embryonic mortality value (41.09%) resulted from dipping Muscovy ducks eggs into 0.0 g AA/L solution for 2 minutes at the 14th day of incubation period, whereas, the lowest percentage was occurred by dipping eggs into 20.0 g AA/L at the 14th day of incubation.

Chick weight and quality:-

Results in Table 1 shows the effect of dipping day (DD), dipping time (DT) and ascorbic acid (AA) concentration in dipping solution during incubation period on newly hatched chick weight. It could be noted that newly hatched chick weight did not significantly affect by DD, DT and AA concentration during incubation period. On the other hand, all interactions between DD, DT and AA concentration during incubation period had no significant effects on newly hatched chick weight (Tables 2, 3, 4 and 5). These results are in agreement with those obtained by Ghonim et al. (2008) who found that duckling weight at hatch not significantly affected due to dipping Muscovy duck eggs into different concentrations of AA solution (10.0 to 40.0 g AA/L) for two minutes as compared with those dipped into distilled water (0.0 g AA/L). Also, they reported that the interaction between dipping day and AA concentration had no significant effect on duckling weight at hatch. Similarly, Ghonim et al. (2009) reported that duckling weight at hatch was not significantly affected by injection hatching eggs with 3.0 mg AA/egg or dipping eggs into 20.0 g AA/L solution (one time) at the 14th day of incubation period or spraying with 30.0 g AA/L (twice daily) during the last three weeks of incubation.

Data in Table 1 showed that chick quality was significantly ($P \leq 0.01$) effected by DT and AA concentration in dipping solution. The first-grade of chicks was insignificantly increased by about 0.58 % by dipping eggs at the 12th day than those produced from eggs dipped at the 18th day of incubation period, while, the second-grade was decreased by 7.49%. Also, the first- grade of chicks was significantly ($P \leq 0.01$) increased by increasing DT, it was improved by 0.87, 2.15 and 1.64% for chicks hatched from eggs dipped for 2, 3 and 4 minutes than those dipped for 1 minute, whereas, the second-grade was significantly ($P \leq 0.01$) decreased by 9.99, 24.72 and 18.85% for the same groups, respectively. All chickens hatched from eggs dipped into AA solutions had significantly ($P \leq 0.01$) higher first-grade and lower second-grade values of chicks than those hatched from eggs which dipped into distilled water (0.0 g AA/L). However, dipping eggs into 15.0 g AA/L solution exhibited the highest percentage of the first-grade and the lowest percentage of the second-grade of chicks comparing to those dipped into other AA concentrations or distilled water (0.0 g AA/L).

All interactions between DD, DT and AA concentration during incubation period resulted in a significant effects on chick quality (Tables 2, 3, 4 and 5). The best value of the first- grade and the lowest value of the second-grade of chicks were occurred by dipping eggs for 3 minutes at the 18th day of incubation period, while the highest second- grade value of chicks was produced by dipping eggs for 1 minute at the same dipping day (Table 2). Table 3 illustrate that the first-class chicks was significantly ($P \leq 0.01$) improved by the interaction between dipping day (12th or 18th day) and AA concentration. The best percentage of the first-grade and the lowest percentage of the second-grade chicks were achieved by the eggs which dipped into 15.0 g AA/L at the 12th day of incubation, while the worst percentages were recorded

for those dipped into distilled water at the 18th day of incubation period (Table 3).

The interaction between eggs dipping time and AA concentration resulted in increasing the first- grade and lowering the second-grade chicks percentage which exhibited by dipping eggs for 1, 2, 3 or 4 minutes into 15.0 g AA/L solution and 20.0 g AA/L for 3 minutes than other interactions (Table 4). Generally, the first-grade chicks was improved by dipping eggs into AA solutions for all dipping times as compared with those dipped into distilled water (0.0 g AA/ L) at the 12th or 18th day of incubation period, and the best results were recorded for eggs dipped into 15.0 g AA/L for all dipping times at both dipping days. While, the first- grade chicks was recorded the lowest value by dipping eggs into distilled water (0.0 g AA/L) solution for one minute at the 18th day of incubation than other interactions (Table 5). Increase the second-grade chicks at hatch may be due to the differential in tissues growth and asymmetries in skeletal development during the early and late stages of embryo development due to the increase of eggs temperature (Decuypere and Michels, 1992; Yalcin and Siegel, 2003). The improvement of chick quality in the present study may be due to AA play a role of increasing yolk-free body weight by increasing lipid utilization for energy production at the late stage of development (Schaal, 2008).

CONCLUSION

Generally, dipping local Sinai chickens eggs at the 12th day of incubation period for 2 or 3 minutes in 15.0 g ascorbic acid per liter solution may be alternative method to maximize the hatchability and chick quality percentage as well as minimize embryonic mortality percentage.

Table 1: Effect of dipping fertile eggs with ascorbic acid during incubation period on hatchability traits and chick weight and quality of Sinai chicken's eggs.

Traits / Main effects	Hatchability %	Embryonic mortality %	Chick weight (g)	Chick quality, %	
				First-grade	Second-grade
The dipping day of incubation period (DD)					
12th	91. 80[a]	8.20 [b]	35.41	93.33	6.67
18th	89.49 [b]	10.51 [a]	35.39	92.79	7.21
Pooled MSE	0.21	0.21	0.18	0.26	0.26
Significance	**	**	NS	NS	NS
Eggs dipping time (DT / min.)					
1	88.05 [d]	11.95 [a]	35.87	91.99[c]	8.01[a]
2	91.42 [b]	8.58 [c]	35.26	92.79[b]	7.21[b]
3	92.61 [a]	7.39 [d]	35.17	93.97[a]	6.03[c]
4	90.49 [c]	9.51 [b]	35.30	93.50[a]	6.50[c]
Pooled MSE	0.30	0.21	0.26	0.36	0.36
Significance	**	**	NS	**	**
Ascorbic acid concentration (g AA/L)					
0.0	87.79 [d]	12.21 [a]	35.18	88.52[d]	11.48[a]
5.0	90.11 [c]	9.89 [b]	35.57	92.90[c]	7.10[b]
10.0	91.19 [b]	8.81 [c]	35.37	93.40[bc]	6.60[bc]
15.0	95.49 [a]	4.51 [d]	35.23	96.47[a]	3.53[d]
20.0	90.12 [c]	9.88 [b]	35.41	93.42[bc]	6.58[bc]
25.0	90.03 [c]	9.97[b]	35.64	93.65[b]	6.35[c]
Pooled MSE	0.37	0.37	0.31	0.44	0.44
Significance.	***	***	NS	**	**

a,b,c,d : means in the same column within each main effect different superscript are significantly different ($P \leq 0.05$).
NS = non -significant
** = $P \leq 0.01$
*** = $P \leq 0.001$

Table 2 : Effect of the interaction between dipping day (DD) and dipping time (DT) into ascorbic acid solutions during incubation period on hatchability traits and chick weight and quality of Sinai chicken's eggs.

Traits / Interaction		Hatchability %	Embryonic mortality %	Chick weight(g)	Chick quality,%	
					First-grade	Second-grade
DD	**DT (min.)**					
12th	**1**	87.42 c	12.58 a	35.57	92.32ab	7.68abc
	2	93.85 a	6.15 c	35.39	93.76ab	6.24bc
	3	94.12 a	5.88 c	35.27	93.89ab	6.11c
	4	91.81 ab	8.19 bc	35.42	93.37ab	6.63abc
18th	**1**	88.68 c	11.32 a	36.16	91.66b	8.34 a
	2	89.00 bc	11.00 ab	35.16	91.83b	8.19ab
	3	90.11 bc	9.89 ab	35.00	94.04 a	5.96c
	4	89.17 bc	10.83 ab	35.57	93.63ab	6.37abc
Pooled MSE		0.42	0.42	0.36	0.51	0.51
Significance		*	*	NS	**	**

a,b,c,d : means in the same column within each item with different superscript are significantly different (P≤ 0.05).
NS : non- significant
* = P≤ 0.05
** = P≤ 0.01

Table 3 : Effect of the interaction between dipping day (DD) and ascorbic acid (AA) concentration on hatchability traits and chick weight and quality of Sinai chicken's eggs.

Traits / Interaction		Hatchability %	Embryonic mortality %	Chick weight (g)	Chick quality,%	
					First-grade	Second-grade
DD	**AA (g/L)**					
12th	**0.0**	86.33 ^{d}	13.67 ^{ab}	35.15	89.53^{e}	10.47^{b}
	5.0	91.59 ^{bcd}	8.41 ^{bcd}	35.56	93.38^{cd}	6.62^{cd}
	10.0	92.25 ^{abc}	7.75 ^{bcd}	35.67	92.94^{cd}	7.06^{cd}
	15.0	95.32 ^{a}	4.68 ^{d}	35.31	97.15^{a}	2.56^{f}
	20.0	92.50 ^{abc}	7.50 ^{bcd}	34.94	93.65^{cd}	6.35^{cd}
	25.0	92.80 ^{abc}	7.20 ^{bcd}	35.84	93.36^{cd}	6.64^{cd}
18th	**0.0**	89.25 ^{bcd}	10.75 ^{bcd}	35.21	87.52 ^{f}	12.48^{a}
	5.0	88.63 ^{bcd}	11.37 ^{abc}	35.58	92.42^{d}	7.58^{c}
	10.0	90.13^{bcd}	9.87 ^{bcd}	35.08	93.87^{c}	6.13^{d}
	15.0	95.67 ^{a}	4.33 ^{d}	35.15	95.80^{b}	4.20^{e}
	20.0	87.73 ^{cd}	12.27 ^{ab}	35.89	93.20^{cd}	6.80^{cd}
	25.0	86.33 ^{d}	14.67 ^{a}	36.45	93.93^{cd}	6.07^{d}
Pooled MSE		0.52	0.52	0.44	0.63	0.63
Significance		***	***	NS	**	**

a,b,c,d : means in the same column within each item with different superscript are significantly different ($P \leq 0.05$).
NS : non-significant
** = $P \leq 0.01$ *** = $P \leq 0.001$

Table 4: Effect of the interaction between dipping time (DT) and ascorbic acid (AA) concentration on hatchability traits and chick weight and quality of Sinai chicken's eggs.

Traits / Interaction		Hatchability %	Embryonic mortality %	Chick weight (g)	Chick quality,%	
					First-grade	Second-grade
DT (min.)	**AA (g/L)**					
1	**0.0**	82.11 ^{c}	17.88 ^{a}	35.19	87.00^{g}	13.00^{a}
	5.0	86.42^{bc}	13.58 ^{ab}	36.04	92.35^{cd}	7.65^{c}
	10.0	89.84 ^{abc}	10.16 ^{abc}	36.22	92.05^{de}	7.95^{c}
	15.0	93.34 ^{ab}	6.66 ^{cd}	35.61	95.36 ^{ab}	4.64^{de}
	20.0	89.74 ^{abc}	10.26 ^{abc}	35.68	92.02^{cd}	7.98^{c}
	25.0	86.88 ^{bc}	13.12 ^{ab}	36.48	93.17^{cd}	6.83^{cd}
2	**0.0**	88.39 ^{bc}	11.61 ^{ab}	34.83	88.58^{fg}	11.42^{a}
	5.0	94.33 ^{ab}	5.67 ^{cd}	35.48	92.38^{cd}	7.62^{c}
	10.0	88.84 ^{abc}	11.16^{abc}	34.96	93.38^{cd}	6.62^{cd}
	15.0	97.70 ^{a}	2.30 ^{c}	35.17	95.58 ^{ab}	4.42^{de}
	20.0	88.27 ^{bc}	11.73 ^{ab}	35.78	93.38^{cd}	6.62^{c}
	25.0	91.02 ^{abc}	8.98 ^{bc}	35.39	94.18^{bc}	5.82 ^{cde}
3	**0.0**	90.67 ^{abc}	9.33 ^{bc}	35.11	89.20^{f}	10.80^{b}
	5.0	93.17 ^{ab}	6.83 ^{cd}	36.09	93.21^{cd}	6.79^{cd}
	10.0	92.87 ^{ab}	7.13 ^{cd}	34.95	94.08^{bc}	5.93 ^{de}
	15.0	97.05 ^{a}	2.95 ^{d}	35.00	97.92 ^{a}	2.08^{e}
	20.0	90.15 ^{abc}	9.85 ^{bc}	34.97	95.17 ^{ab}	4.83^{de}
	25.0	91.79 ^{ab}	8.21 ^{bc}	34.89	94.22^{bc}	5.78 ^{cde}
4	**0.0**	90.00 ^{abc}	10.00 ^{bc}	35.59	89.31^{f}	10.69 ^{b}
	5.0	86.50 ^{bc}	13.50 ^{ab}	34.67	93.65^{bc}	6.35 ^{cd}
	10.0	93.22 ^{ab}	6.78 ^{cd}	35.34	94.10^{bc}	5.90^{cde}
	15.0	93.88 ^{ab}	6.12 ^{cd}	35.15	97.03 ^{a}	2.97^{e}
	20.0	92.32 ^{ab}	7.68 ^{cd}	35.24	93.90^{bc}	6.10^{cd}
	25.0	87.00 ^{bc}	13.00 ^{ab}	35.82	93.02^{cd}	6.98 ^{cd}
Pooled MSE		0.73	0.73	0.63	0.88	0.88
Significance		***	***	NS	**	**

a,b,c,d : means in the same column within each item with different superscript are significantly different (P≤ 0.05).
NS : non -significant
** = P≤ 0.01
*** = P≤ 0.001

Table 5: Effect of the interaction between dipping day (DD), dipping time (DT) and ascorbic acid (AA) concentration on hatchability traits and chick weight and quality of Sinai chicken's eggs.

Interaction / Traits			Hatchability %	Embryonic mortality %	Chick weight (g)	Chick quality,%	
						First-grade	Second-grade
DD	**DT (min.)**	**AA (g/L)**					
12th	**1**	**0.0**	79.22 e	20.78 a	34.98	88.12 cd	11.88 a
		5.0	86.17 cd	13.87 b	36.00	93.01 ab	6.99 bc
		10.0	86.67 cd	13.33 b	35.83	92.44 ab	7.56 bc
		15.0	92.67 ab	7.33 bc	34.67	95.71 a	4.29 e
		20.0	88.37 bc	11.63 b	35.27	92.49 ab	7.51 bc
		25.0	91.43 ab	8.57 bc	36.68	92.13 ab	7.87 bc
	2	**0.0**	88.11 cd	11.89 b	35.10	90.01 bc	9.99 bc
		5.0	96.33 a	3.67 e	35.62	93.85 ab	6.15 cd
		10.0	94.00 ab	6.00 cd	35.92	93.56 ab	6.44 cd
		15.0	97.40 a	2.60 e	35.67	97.34 a	2.66 e
		20.0	94.20 ab	5.80 cde	35.23	93.55 ab	6.45 cd
		25.0	93.03 ab	6.97 cd	34.72	94.24 ab	5.76 cd
	3	**0.0**	89.00 cd	11.00 b	35.10	90.02 bc	9.98 bc
		5.0	93.67 ab	6.33 cd	35.70	93.57 ab	6.43 cd
		10.0	94.40 ab	5.60 cde	34.57	92.88 ab	7.12 bc
		15.0	97.43 a	2.57 e	35.67	97.86 a	2.14 e
		20.0	94.30 ab	5.70 cde	34.85	95.00 a	5.00 cde
		25.0	95.90 a	4.10 de	35.73	94.00 ab	6.00 cd
	4	**0.0**	89.00 cd	11.00 b	35.42	89.97 cd	10.03 ab
		5.0	90.17 bc	9.83 bc	34.90	93.07 ab	6.93 cd
		10.0	93.93 ab	6.07 cd	36.35	92.86 ab	7.14 bc
		15.0	93.77 ab	6.23 cd	35.24	97.69 a	2.31 e
		20.0	93.13 ab	6.87 cd	34.42	93.55 ab	6.45 cd
		25.0	90.83 bc	9.17 bc	36.22	93.07 ab	6.93 cd
18th	**1**	**0.0**	85.00 cde	15.00 ab	35.40	85.88 d	14.12 a
		5.0	86.67 cd	13.33 b	36.08	91.70 bc	8.30 bc
		10.0	93.00 ab	7.00 bc	36.60	91.67 bc	8.33 bc
		15.0	94.00 ab	6.00 cd	36.55	95.00 a	5.00 cde
		20.0	91.10 bc	8.90 bc	36.08	91.54 bc	8.46 bc
		25.0	82.33	17.67 ab	36.27	94.20 ab	5.80 cde
	2	**0.0**	88.67 cd	11.33 bc	34.56	87.15 d	12.85 a
		5.0	92.33 ab	7.67 bc	35.33	90.91 bc	9.09 bc
		10.0	83.67 de	16.33 ab	34.00	93.20 ab	6.80 cd
		15.0	98.00 a	2.00 e	34.67	93.84 ab	6.16 cd
		20.0	82.33 e	17.67 ab	36.33	91.67 bc	8.33 bc
		25.0	89.00 cd	11.00 b	36.06	94.12 ab	5.88 cd

Continued Table 5 :

Traits / Interaction			Hatchability %	Embryonic mortality %	Chick weight (g)	Chick quality,%	
						First-grade	Second-grade
DD	**DT (min.)**	**AA (g/L)**					
18th	**3**	**0.0**	92.33 ab	7.67 bc	35.11	88.38 cd	11.62 ab
		5.0	92.67 ab	7.33 bc	36.48	92.85 ab	7.15 bc
		10.0	91.33 bc	8.67 bc	35.33	95.27 a	4.73 de
		15.0	96.67 a	3.33 e	34.33	97.99 a	2.01 e
		20.0	86.00 cd	14.00 ab	35.08	95.33 ab	4.67 de
		25.0	87.67 cd	12.33 bc	34.04	94.44 ab	5.56 cde
	4	**0.0**	91.00 bc	9.00 bc	35.75	88.65 cd	11.35 ab
		5.0	82.83 e	17.17 ab	34.43	94.22 ab	5.78 cde
		10.0	92.50 ab	7.50 bc	34.33	95.33 a	4.67 de
		15.0	94.00 ab	6.00 cd	35.05	96.37 a	3.63 e
		20.0	91.50 bc	8.50 bc	36.05	94.25 ab	5.75 cde
		25.0	83.17 de	16.83 ab	35.42	92.97 ab	7.03 bc
Pooled MSE			1.03	1.03	0.88	1.25	1.25
Significance			**	**	**NS**	**	**

a,b,c,d : means in the same column within each item with different superscript are significantly different (P≤ 0.05).
NS : non- significant
** = P≤ 0.01

REFERENCES

Awad, A.L. and H.A. H. Abd El-Halim (2014). Some hatching traits in Sinai chicken eggs as affected by flock age, dietary ascorbic acid supplementation and egg storage period under Egyptian conditions. Egypt. Poult. Sci., 34: 959 – 978.

Decuypere, E. and H. Michels (1992). Incubation temperature as a management tool: a review," World's Poult. Sci. J., 48: 28–38.

Duncan, D.B.(1955). Multiple range and multiple F tests. Biometrics, 11:1-42.

Everaert, N.; H. Willemsen; L. De Smit; A. Witters; J. De Baerdemaeker; E. Decuypere and V. Bruggeman (2008). Comparison of a modern broiler and layer strain during embryonic development and the hatching process. Br. Poult. Sci., 49:574–582.

Ghonim, A.I.A.; A.L. Awad; M.H.A. Fattouh and A.M. El- Shhat (2009). Comparative study of ascorbic acid treatment methods on hatchability traits and growth performance of ducklings. Egyptian Poult. Sci., 29: 1085-1099.

Ghonim, A. I. A.; A. L. Awad; A. M. El-Shhat; M. H. A. Fatouh and Kh. A. A. Ali. (2008). Effect of dipping and spraying hatching eggs of Muscovy duck by ascorbic acid solutions during incubation period on hatchability traits. Egypt. Poult. Sci., 28: 283 – 298.

Hammond, C. L.; B. H. Simbi and N. C. Stickland (2007). In ovo temperature manipulation influences embry- onic motility and growth of limb tissues in the chick (Gallus gallus). J. Exp. Biol., 210:2667–2675.

Konca,Y. ; F. Kirkpinar and M. Cabuk (2009). Effect of dietary ascorbic acid on blood heamatological profile, serum biochemical components and tonic immobility reaction of male Turkeys under summer condition. J. Poult. Sci., 46:105-111.

Linder M.C. (1991). Nutrition and metabolism of vitamins. In: Linder M.C. (ed.): Nutritional Biochemistry and Metabolism with Clinical Applications. Elsevier, New York, 111–189.

Lohakare, J.D; M.H. Ryu; T.W. Hahn; J.K. Lee and B.J. Chae (2005). Effects of supplemental ascorbic acid on performance and immunity of commercial broilers.J.App.Poult.Res.,14:10-19.

Lourens, A.; H. van den Brand; R. Meijerhof and B. Kemp (2005). Effect of eggshell temperature during incubation on embryo development, hatchability, and post-hatch development. Poult. Sci., 84: 914–920.

Meijerhof, R. (2009). The influence of incubation on chick quality and broiler performance. Pages 167–176 in Proc. 20th Austral. Poult. Sci. Symp., 9–11 February 2009. New South Wales, Syd- ney, Australia.

Mohammed, K.A.; A. El-Boghdady; M.A.H.Soliman; M.A.Abd Al-Galil and N.M. Abd Al-Aleem (2011). The effect of both pre-incubation dipping eggs in vitamin c and cooling eggs during incubation period on embryonic and hatchability parameters in two local chicken strains. Egypt. Poult. Sci. Vol., 31:379-392.

Nowaczewski, S. and H. Kontecka (2005). Effect of dietary vitamin C supplement on reproductive performance of aviary pheasants. Czech J. Anim. Sci., 50: 208-212.

Nowaczewsk, S.; H. Kontecka and S. Krystianiak (2012). Effect of in ovo injection of vitamin C during incubation on hatchability of chickens and ducks. Folia biologic., 60:93-97.

Pulikanti, R.; E.D. Peebles and P.D. Gerard (2011). Use of implantable temperature transponders for the determination of air cell temperature, eggshell water vapor conductance, and their functional relationships in embryonated broiler hatching eggs. Poult. Sci., 90: 1191-1196.

Samak, H. R. and R. M. Mahmoud. (2007). Effect of ascorbic or citric acid solutions on egg shell conductance and incubation traits of Sinai eggs. J. Agric. Sci. Mansoura Univ., 32:8111 – 8118.

SAS Institute. (2004). SAS User's Guide: Statistics. Edition 9.1 . SAS Institute Inc., Cary, NC.

Schaal, T. P. (2008). The effect of in-ovo feeding of fatty acids and antioxidants on broiler chicken hatchability and chick tissue lipids. Honors Bachelor of Sci. (HBS), Oregon State Univ.

Selim, Sh. A.; K. M. Gaafar and S. S. El-ballal (2012). Influence of in-ovo administration with vitamin E and ascorbic acid on the performance of Muscovy ducks. Emir. J. Food Agric., 24: 264-271

Shafey, T. M. (2002). Egg shell conductance, embryonic growth, hatchability and embryonic mortality

of broiler breeder eggs dipped into ascorbic acid solution. Br. Poult. Sci., 43: 135 – 140.

Tazawa, H. and G.C. Whittow (2000). Incubation physiology. In: Sturkey´s Avian Physiology. Tazawa, H. and G.C. Whittow (Eds.), 5th Rev. Edn., Academic Press, p: 617-634.

Tona, K., O. M. Onagbesan, Y. Jego, B. Kamers, E. Decuypere, and V. Bruggeman (2004). Comparison of embryo physiological parameters during incubation, chick quality, and growth performance of three lines of broiler breeders differing in genetic composition and growth rate. Poult. Sci., 83:507–513.

Tullet, S.G. (1990). Science and art of incubation. Poult. Sci., 69:1-15.

Weis, J.; H. Cyril; P. Gabriel; B. Baraňska; J.Bujko and L. Malíková (2011). Effect of the egg size on egg loses and hatchability of the Muscovy duck. Anim. Sci. and Biotech., 44 :354-356.

Wilson, H.R.; A.R. Eldred and C.J. Wilcox (1997). Storage time and ostrich egg hatchability. J Appl. Poult. Res., 6: 216-220.

Yalcin, S. and P. B. Siegel (2003). Exposure to cold or heat during incubation on developmental stability of broiler embryos. Poult. Sci., 82: 1388–1392.

Zakaria, A.H. and M. A. Al-Anezi (1996). Effect of ascorbic acid and cooling during incubation on hatchability, culling, mortality and body weight of broiler chickens. Poult. Sci., 75: 1204 – 1209.

.

الملخص العربي

تأثير غمر البيض فى محاليل فيتامين ج على بعض صفات التفريخ وجودة الكتاكيت لدجاج السينا المحلي

عوض لطفي عوض ، حسن عبدالكريم حسن عبدالحليم

معهد بحوث الإنتاج الحيواني ـ مركز البحوث الزراعية ـ وزارة الزراعة ـ الدقي ـ جيزة

تهدف هذه الدراسة إلى معرفة تأثير غمرالبيض فى محاليل ذات تركيزات مختلفة من فيتامين ج على بعض صفات التفريخ ووزن وجودة الكتاكيت عند الفقس. أستخدم عدد **٣٦٠٠** بيضة مخصبة من دجاج السينا المحلى فى تصميم تجريبى عاملى ٢ x ٤ x ٦ حيث كانت العوامل هى: ١- يوم الغمرمن فترة التفريخ (الثانى عشر والثامن عشر) ،٢- مدة غمر البيض (دقيقة واحدة ، دقيقتين ، ثلاث دقائق ، أربع دقائق) ، ٣- تركيز فيتامين ج فى محلول الغمر (**صفر ، ٥,٠ ، ١٠,٠ ، ١٥,٠ ، ٢٠,٠ ، ٢٥,٠** جم لكل لترماء مقطر).

تشير النتائج المتحصل عليها الي الآتى:-

لوحظ تحسنا معنويا في نسبة الفقس بغمر البيض فى اليوم الثانى عشرمن التفريخ مقارنة بالغمر فى اليوم الثامن عشركما تحسنت معنويا بغمر البيض لمدة دقيقتين و ثلاث و أربع دقائق مقارنة بالغمر لمدة دقيقة واحدة وكانت أفضل القيم المتحصل عليها للبيض المغمور لمدة ثلاث دقائق. كما تحسنت نسبة الفقس معنويا بمقدار **٢,٦٤ ، ٣,٨٧ ، ٨,٧٧ ، ٢,٦٥ ، ٢,٥٥**% بالغمر فى محلول يحتوى **٥,٠ ، ١٠,٠ ، ١٥,٠ ، ٢٠,٠ ، ٢٥,٠** جم فيتامين ج لكل لتر ماء مقطربالمقارنة بالغمر فى الماء المقطر (بدون فيتامين ج) على التوالى ، وسجلت أفضل قيمة للفقس بالغمر فى محلول يحتوى **١٥,٠** جم فيتامين ج لكل لتر ماء مقارنة بالتركيزات الأخرى من فيتامين ج .

لوحظ انخفاضا معنويا في نسبة النفوق الجنينى بغمر البيض فى اليوم الثانى عشرمن التفريخ مقارنة باليوم الثامن عشر وكذلك انخفضت معنويا بغمر البيض لمدة دقيقتين أو ثلاث أو أربع دقائق مقارنة بالغمر لمدة دقيقة واحدة وكانت أقل القيم للبيض المغمور لمدة ثلاث دقائق. كما انخفضت نسبة النفوق الجنينى معنويا بالغمر فى محاليل تحتوى من **٥,٠ - ٢٥,٠** جم فيتامين ج لكل لتر ماء مقطر بالمقارنة بالغمر فى الماء المقطر (بدون فيتامين ج) ، كما سجلت أقل قيمة للنفوق الجنينى بالغمر فى محلول يحتوى **١٥,٠** جم فيتامين ج لكل لتر ماء مقارنة بالتركيزات الأخرى من فيتامين ج.

لوحظ تحسنا معنويا في نسبة كتاكيت الدرجة الأولى بزيادة مدة غمر البيض وتركيزات فيتامين ج المختلفة حيث سجل الغمر لمدة ثلاث أو أربع دقائق أفضل القيم لها كما وجدت أفضل القيم بالغمر فى محلول يحتوى **١٥,٠** جم فيتامين ج لكل لتر ماء مقطر. جميع التداخلات بين يوم الغمر ومدة غمر البيض وتركيز فيتامين ج فى محلول الغمر كانت ذات تأثير معنوى جيدعلى نسبتى الفقس والنفوق الجنينى وكذلك جودة الكتاكيت حيث سجلت أعلى قيمة للفقس و أقل قيمة للنفوق الجنينى بالغمر فى محلول يحتوى **١٥,٠** جم فيتامين ج لكل لتر لمدة دقيقتين أوثلاث دقائق فى اليوم الثانى عشروالثامن عشر من فترة التفريخ.

تشير النتائج إلى إمكانية تحسين نسبة الفقس وجودة الكتاكيت وخفض نسبة النفوق الجنينى بغمر بيض التفريخ لدجاج السينا فى محلول يحتوى ١٥,٠ جم فيتامين ج لكل لتر ماء مقطر لمدة دقيقتين أوثلاث دقائق فى اليوم الثانى عشر من فترة التفريخ.