Egyptian Poultry Science Journal

http://www.epsaegypt.com

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

SOME HATCHING TRAITS IN SINAI CHICKEN EGGS AS AFFECTED BY FLOCK AGE, DIETARY ASCORBIC ACID SUPPLEMENTATION AND EGG STORAGE PERIOD UNDER EGYPTIAN CONDITIONS

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Received: 21/10/2014 Accepted: 19/11/2014

ABSTRACT: The aim of this study was to investigate the effect of flock age, dietary ascorbic acid supplementation (AA) and egg storage period before incubation and their interactions on hatchability traits and newly hatched chick weight as well as eggs weight loss percentage during storage and incubation periods. A total number of 360 birds of Sinai chickens from both 40 and 60-wks-old (162 females and 18 males from each age) were used. Birds of each age were randomly divided into three treatment groups of three replicates (18 females and 2 males each), then the experimental birds were received diet supplemented with three levels of AA (0, 500 or 1000 mg /kg) for 12 weeks. Eggs produced from each treatment group for both flock ages were collected after dietary AA supplementation by 4 weeks, then divided into four storage periods (1-3, 4-6, 7-9 and 10-12 days) before incubation at normal room conditions during March to May month under Egyptian conditions.

Results indicated that eggs produced from the youngest flock age (40-wks-old) had better ($P \leq 0.001$) fertility and hatchability percentages of total set eggs than those from the oldest ones (60-wks-old), while embryonic mortality percent and chick weight at hatch were not significantly affected. Eggs produced from hens received 500 mg AA/kg diet had the highest ($P \leq 0.001$) values of fertility and hatchability percentages of total set and fertile eggs as compared with those fed the control diet. Adding 500 or 1000 mg AA/ kg to hens diet resulted in a significant ($P \leq 0.001$) reduction in embryonic mortality than those of the control treatment, whereas, chick weight (g) at hatch was significantly ($P \leq 0.001$) heavier by supplementing 1000 mg AA / kg diet only. Fertility and hatchability percentages of total

Key Words: Flock age, ascorbic acid, storage period, hatchability traits, egg weight loss.

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set eggs were significantly (P≤ 0.001) decreased for eggs stored for 7-9 and 10-12 days than those stored for 1-3 and 4-6 days before incubation.

Prolonged storage period to 10-12 days before incubation had significantly (P≤ 0.001) increased embryonic mortality and decreased chick weight at hatch as compared with those stored for 1-3 and 4-6 days before incubation. Egg weight loss (%) was significantly (P≤ 0.001) decreased for eggs produced from the younger flock age and by dietary AA supplementation as well as a short storage period before incubation. The different interactions between flock age, dietary AA supplementation and egg storage periods didn't significantly affected on any the studied traits except for chick weight which significantly improved by the interaction between flock age (40wks) and dietary AA supplementation (1000 mg/kg).

Generally, these results indicated that supplementing 500 mg AA/kg to laying diet may be an alternative method to maximize the hatchability traits and minimize embryonic mortality of Sinai chicken eggs which produced from 40-wks-old hens and stored up to 12 days before incubation at normal room conditions during March to May month under Egyptian conditions.

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, chickens contributes significantly to food security and serves as an immediate source of meat and income when money is needed for urgent family needs. Due to variable market demand for one day-old chicks in the poultry industry and the maximum hatchery capacity, the total length of egg storage varies between a few days and several weeks (Reijrink et al., 2010). There are many factors have affect on fertility and hatchability for chicken eggs such as parental genetics, nutrition, maternal age, and environmental conditions such as weather and lighting (French and Tullett, 1991) as well as egg storage period before incubation (Nahm, 2001).

Age of the hen appears to have influence upon fertility, hatchability and embryonic mortality (Alsobayel and Albadry, 2012). The decrease in fertility and hatchability was higher for older hens age (52-53 wks) than the younger (31-35 wks) ones (Elibol and Brake, 2006). Egg fertility and hatchability were significantly (P≤ 0.01) improved for eggs for younger hens (42 wks) than those of older hens (67 wks), while early and late embryonic mortality was significantly decreased (Zakaria et al., 2009). Generally, Abudabos (2010) and Almarshade (2011) reported that hens are likely to show decline in fertility and hatchability as they grow older for broiler breeds.

Avian species have the inherent ability to synthesize vitamin C (Keshavarz, 1996), therefore, this vitamin is not required in poultry diets under normal conditions but the increase demand take place during acute environmental stress such as excessive hot or cold weather (Bains, 1997). In laying hens, there are some reports indicated an improvement in egg production, egg weight and shell quality as a result of AA supplementation (Zapata and Gernat, 1995). Under normal rearing, an improvement in egg production, fertility, hatchability and egg weight and specific gravity were observed by AA supplementation in Leghorn layers (Orban et al., 1993). Mbajiorgu (2011) reported

that ascorbic acid supplementation (250-750 mg/kg) to laying diet is beneficial, mainly because of its positive effect on egg weight and hatchability as well as livability. Moreover, Souza et al. (2001) reported that supplementing 200 mg AA/kg during laying period resulted in improving egg quality (Haugh unit values and yolk indices) as compared with those produced from the control group after egg storage by 7 and 14 days.

There are strong positive correlations among pre-incubation egg weight, storage periods, chick weight and subsequent performance of different kinds of poultry (Nahm, 2001).Storage of hatching eggs is an indispensable part of hatchery operation, even though storage length and conditions may influence embryonic viability. In general, egg storage before incubation has no effect on hatchability when storage time is shorter than 7 days, but it is more harmful when storage time is prolonged (Fasenko et al., 2001). Moreover, Brake et al. (1997) reported that the effect of egg storage period on embryonic viability depend on storage time duration, environmental conditions, hen age and strain of breeder. Several investigators suggested that the decrease in embryonic viability may be due to changes in embryo or in albumen physical aspects of the egg (Tona et al., 2004). Also, Yassin et al. (2008) showed that prolonged egg storage from 8 to 14 days before incubation resulted in a decrease in hatchability and increase embryonic mortality. The objective of the present study was to determine the effect of flock age, dietary ascorbic acid supplementation and egg storage period at normal room conditions on hatchability traits and chick weight at hatch as well as egg weight loss in Sinai chicken eggs under Egyptian conditions.

MATERIALS AND METHODS

The present study was conducted at El- Serw Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agricultural, Egypt. The experiment was started in March and terminated in May 2012.

Bird's management and experimental design:

A total number of 360 Sinai birds from both 40 and 60-wks-old (162 females + 18 males from each age) were used. Birds of each age were individually weighed and randomly distributed into three equal experimental groups of three replicates (18 females and 2 males each). All birds were reared under similar hygienic and managerial conditions. Birds of each replicate were housed on litter floor and received additional artificial light to provide 16 h light daily. For each flock age, the control group was fed a basal diet without ascorbic acid (AA) supplementation, while the second and third groups were fed the basal diet which supplemented with 500 and 1000 mg AA/kg, respectively. The composition and calculated analysis of the basal diet are shown in Table 1. Feed and water were offered ad-libtum during the experimental period. After feeding the experimental diets by four weeks, eggs were separately collected for each treatment group of both two flock ages, then were divided and stored through four egg storage periods (1-3, 4-6, 7-9 and 10-12 days) before incubation at normal room conditions. The values of temperature and relative humidity were recorded day after day at the time of sunrise (minimum) and at noon time (maximum) inside the egg storage room during the experimental period. The monthly averaged of temperature and relative humidity are shown in Table 2.

Data collection and parameters estimated:

1. Eggs of each treatment for both flock ages were weighted at lay, 1st and the 18th days of incubation to determine egg weight loss during the experimental periods.
2. Fertility and hatchability: The incubated eggs were candled at the 7th day of incubation to determine fertility percentage. Fertility was estimated as number of fertile eggs / number of total eggs set. Hatchability was estimated as percentage of the number of hatched chicks to the number of total set or fertile eggs. Embryonic mortality was recorded.
3. Chick weight recorded to nearest gram at hatch for each treatment.

Statistical analysis:

Data obtained were statistically analyzed using the General linear model of SAS (2004). A factorial design 2x3x4 was used, considering the flock age, AA supplementation levels and egg storage period 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 flock age; i= (1 and 2) ; R = Effect of AA supplementation levels; j = (1, 2 and 3);C = Effect of egg storage period; l= (1,2,.. and 4); TR= Effect of interaction between flock age and AA supplementation level; TC=Effect of interaction between flock age and egg storage period; RC=Effect of interaction between AA supplementation level and egg storage period; TRC=Effect of interaction between flock age, AA supplementation level and egg storage period; and eijlk = Random error.

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

RESULTS AND DISCUSSION

Hatchability traits :

Eggs produced from 40-wks-old hens had significantly higher ($P \leq 0.001$) fertility and hatchability of set eggs by about 3.08 and 3.76 %, respectively than those produced from 60-wks-old hens (Table 3). These results may be due to the age of hens, which affect on hatching eggs quality such as the internal egg composition, egg weight, and egg shell quality (Tona et al., 2004; Joseph and Moran, 2005). This result was somewhat similar to the findings of Elibol and Brake (2006) who observed that fertility and hatchability of hatching eggs was significantly decreased by 3.79 and 24.41% by increasing flock age from 30 wks to 53 wks of age, respectively. Also, Tona et al. (2004) showed that the decrease in hatchability percentage was higher for eggs of the older birds (59 wks) than the younger ones (37 wks). Similarly, Yassin et al. (2008) showed that hatchability percent of total set eggs was increased between the ages of 31 and 36 wks and decreased thereafter. Zakaria et al. (2009) reported that fertility and hatchability of fertile eggs were significantly decreased by increasing flock age. Hatchability percentage of fertile eggs was insignificantly improved for 40-wks-old hens as compared to hen's 60-wks-old ones. The results in the present study are in agreement with those obtained by Ulmer-Franco et al. (2010) who reported that flock age did not significantly affected on hatchability of fertile eggs.

Eggs produced from younger hens had lower embryonic mortality by about 6.96 % than those of the older ones, however the difference was not significant. This result was consistent with those reported by Elibol and Brake (2008) who found that embryonic mortality was much lower from a 29-wks-old broiler than from 68-wks-old flock at all stages of embryo

development. Also, Zakaria et al. (2009) reported that the late dead embryos increased during incubation period due to increase flock age. Chick weight (g) was not significantly affected due to flock age (Table 3). It was improved by 1.03 % for chicks produced from 60-wks-old hen eggs as compared to those produced from 40-wk-old hens. These results are in agreement with those obtained by Tona et al. (2004) who reported that chicks hatched from eggs produced from older flock age had higher initial body weights than those produced from younger ages.

Dietary AA supplementation resulted in a significant effect on egg fertility percentage (Table 3). Hens received 500 mg AA /kg diet had significantly (P≤0.001) higher fertility by 2.32 % than those fed the control diet, whereas , fertility percentage of eggs produced from hens fed 1000 mg AA/kg diet look intermediate place between the control and 500 mg AA/kg diet groups. These results may be due to dietary AA supplementation resulted in improving sperm viability and concentration (Nowaczewski and Kontecka, 2005). Also, Elansary et al. (1999) ; Whitehead and Keller (2003) reported that supplementing AA (100 up to 500 mg/kg) to roosters diet improved ejaculate volume, sperm concentration and sperm motility compared to the control group. Similar findings were obtained by Torgowski and Kontecka (1998) who reported that feeding 500 mg AA /kg diet resulted in optimum egg fertility in Pheasants.

Hatchability percentage of fertile and total set eggs were significantly (P≤0.001) improved by both AA treatments, however, the highest percentages were exhibited by eggs of 500 mg AA treated hens (Table 3). Hatchability of fertile eggs was significantly improved by 5.85 and 2.19% for eggs produced from hens fed 500 mg AA/kg diet as compared with those fed 0.00 and 1000 mg AA /kg diet, respectively, whereas, the improvement was 8.30 and 3.21 % of the total set eggs. Embryonic mortality of fertile eggs was significantly (P≤0.001) lowered by 43.76 and 26.80 % for eggs produced from hens fed diet supplemented with 500 and 1000 mg AA/ kg diet as compared with those produced from control hens, respectively. Chick weight (g) at hatch was significantly (P≤0.001) heavier by 3.41 and 3.5% for eggs produced from hens received diet supplemented with 1000 mg AA/ kg diet than those received 0.0 or 500 mg AA/kg diet, respectively. These results may be due to AA supplementation to layer diet had beneficial effects on egg quality (interior and exterior) which may effect on hatchability traits by reduce the negative effects or changes in egg characteristics during production period (Mbajiorgu, 2011). Also, it may be due to decreasing yolk cholesterol as a result of dietary AA supplementation which may effect on embryonic mortality during incubation period (EL-Gendi et al., 1999). The results in the present study are similar to the findings of Bains (1997) who reported that ascorbic acid supplementation increased eggs hatchability and decreased embryonic mortality in broiler chicken breeds. Similar results were also observed by Kontecka et al. (2005) in ducks. Also, Mbajiorgu (2011) observed that supplementation of Venda chicken hens diet with 250 -750 mg AA /kg diet resulted in the best hatchability and low embryonic mortality percent than those fed the control diet.

Egg storage period had highly significant (P≤0.001) effects on fertility and hatchability traits (Table 3). Fertility of incubated eggs was significantly (P≤0.001) decreased by increasing egg storage period, it was decreased by about 2.04 and 5.30 % for eggs stored for 7-9 and 10-12 days before incubation as compared with those

stored for 4-6 days, respectively. Meanwhile, hatchability of fertile eggs was significantly (P≤0.001) decreased by about 4.71 and 6.48 % for eggs stored for 7-9 and 10-12 days as compared with those stored for 1-3 days before incubation, while, it was significantly (P≤0.001) decreased by 6.31 and 11.09% for total set eggs for the same storage groups, respectively. Embryonic mortality (EM) percentage was significantly (P≤0.001) increased by increasing egg storage period (Table 3). It could be notice that EM percent was approximately double in egg stored for 10-12 days comparing to those stored for 1-3 or 4-6 days before incubation. Prolonged storage period to 10-12 days before incubation resulted in a decrease in chick weight at hatch by about 5.18 and 3.49 % as compared with those stored for 1-3 and 4-6 days, respectively, however, there was no significant differences in all studied hatchability traits and chick weight between the eggs stored for 1-3 days and those stored for 4-6 days before incubation.

Decreasing hatchability and increasing embryonic mortality as a result of prolonged egg storage before incubation may be due to the decrease in embryonic cell number and embryonic growth rate (Hamidu et al., 2011), or may be due to the reduction in embryonic metabolism which may suggest that the embryos do not have enough cells to make effective use of the available O_2 to break down necessary nutrients in the yolk to release the needed energy for embryonic growth (Uddin and Hamidu, 2014). Prolonged egg storage leads to reduced embryonic growth in some muscles such as breast muscle (pectoralis major) and hatching (complexus) muscle, which are important for metabolically because of their ability to mobilize stored glycogen to aid in the hatching process and help the embryo to piercing the eggshell membranes and the shell during hatching (De Oliveira et al., 2008). The results in the present study are in agreement with those obtained by Elibol and Brake (2006; 2008) who reported that hatchability of fertile eggs was decreased and embryonic mortality was increased by increasing egg storage period. The authors added that fertility of hatching eggs was significantly decreased by 1.59 % of egg stored for 14 days as compared with those stored for 3-7 days before incubation, whereas, the hatchability of both set and fertile eggs was significantly decreased by about 7.06 and 7.13 %, respectively as well as embryonic mortality was significantly higher by 71.59%. Fasenko (2007) reported that egg storage longer than 7 days significantly reduces hatchability and increases embryonic mortality. Also, Yassin et al. (2008) reported that each day of egg storage up to 7 days reduce hatchability by 0.5% daily. Prolonged egg storage period had a negative effect on chick quality (Tona et al., 2004), and reduce body mass (Reijrink et al., 2010).

Concerning, no significant differences on all studied hatchability traits due to all the interactions between flock age, dietary AA supplementation and egg storage period except for chick weight at hatch (Tables 4 and 5). The highest weight of new hatched chick was recorded for eggs produced from 40-wks-old hens which received diet supplemented with 1000 mg AA/kg, followed by those produced from 60-wks-old hens which fed the same diet. On the other hand, hens of 40-wks-old which received 500 mg AA /kg diet had recorded the highest values of fertility, hatchability and the lowest embryonic mortality value than other interactions between flock age and dietary AA supplementation. Moreover, eggs produced from hens fed diet supplemented with 500 or 1000 mg AA/kg and stored for 1-3 or 4-6 days before incubation recorded the lowest embryonic mortality value and the best values of fertility and hatchability than

those fed the control diet and stored form 1 up to 12 days before incubation (Table 4). These results may be due to the decrease in embryonic mortality during incubation period as a result of AA supplementation to laying diet because AA which may improve immune responsiveness (Nameghi et al., 2007), or decrease the number of dead chicks before hatching process (Nowaczewski and Kontecka, 2005). These results are in the line with those obtained by Kontecka et al. (2005) who found that reproduction ducks fed diets supplemented with 500 mg AA/ kg diet were characterized by better hatching of ducklings from set and fertilized eggs than the control group.

Generally, eggs produced from 60-wks-old hens and stored for 10-12 days before incubation had the lowest values for fertility, hatchability and chick weight, whereas, it was recorded the highest embryonic mortality percentage as compared with those produced from 40-wks-old hens and stored for 1 up to 12 days before incubation (Table 4). These results may be due to increasing egg weight loss (%) and the decrease of egg quality as a result of increasing hens age and prolonged egg storage period before incubation (Tona et al., 2004 and Reijrink et al., 2010). Also, these results may be due to poor shell quality as a result of increasing hens age and prolonged egg storage period which may decrease albumen and yolk quality by increasing water loss from eggs (Peeples et al., 2001; Fasenko, 2007). These results are in agreement with those obtained by Hulet et al. (1987) who found that the best hatchability is obtained when egg lose 12 % of their fresh weight from the time of egg lay to the time of the embryo opens the shell and it decreased for egg losing less than 10% or greater than 15% of their fresh egg weight.

Results in Table 5 showed that there were insignificant improvements in hatchability traits for eggs produced from 40-wks-old hens which received 500 mg AA/kg diet at different egg storage periods as compared with other interaction treatments. Generally, the best values of fertility and hatchability were gat form eggs produced by 40-wks-old hens which fed either 500 or 1000 mg AA/kg diet supplementation and stored for one up to 6 days before incubation. These results may be due to the effect of the young flock age which lay eggs that have good albumens (viscosity) and that are fairly resistant to degradation (Nowaczewski and Kontecka, 2005), or it may be due to dietary AA supplementation which may improve egg quality especially Haugh unit values and yolk indices (Souza et al., 2001) .

Eggs weight loss %:

Data in Table 6 showed that there were no significant differences in the fresh egg weight among flock age, AA supplementation and studied storage periods before incubation while egg weight loss percentage was significantly affected. Egg weight loss percentage was significantly ($P \leq 0.001$) lowered by 29.73 and 3.26 % for eggs produced from 40-wks-old hens than those produced from 60-wks-old hens during storage period before incubation and during incubation period, respectively. Total egg weight loss percentage was significantly ($P \leq 0.001$) lowered by 7.35 % for eggs of 40-wks-old hens than from 60-wks-old ones during the whole experimental period (from lay time to the 18^{th} day of incubation). These results may be due to flock age which effect on egg weight and shell quality as well as larger eggs has less shell area per unit of interior egg weight than do smaller eggs, or may be due to the younger hens produce eggs with thicker shells and longer pore than older hens (Sukanya, 2007). These results are in agreement with those obtained by Tona et al. (2004) who

reported that percentage of egg weight loss was lower for 27- wks-old than 60-wks-old for Cobb broiler eggs.

Table 6 showed that there was a significant (P≤0.001) and non-significant reduction in egg weight loss percentage during storage period for eggs produced by 500 mg AA-treated hens than those produced from hens fed 1000 mg AA/kg and the control diet, the reduction was 28.49 and 22.64 %, respectively. The reduction in egg weight loss percentage was recorded 0.21 and 8.97 % for eggs produced from hens fed 500 mg AA/kg diet comparing with those produced from hens fed 1000 mg AA/kg and the control diet, respectively during incubation period. Generally, total egg weight loss percentage recorded 4.48 and 10.76% for eggs produced from hens fed 500 mg AA/kg diet comparing with those produced from hens fed 1000 mg AA /kg and the control diet, respectively during the overall period (storage and incubation periods), however, the differences were not significant. The increase in egg weight loss may be due to the change of the cuticle properties by increasing egg storage period before incubation (Orban et al., 1993). Also, the decrease in egg weight loss percentage as a result of AA supplementation may be due to its role which prevent a part of the decline in eggs shell quality because it is improve egg shell strength, shell thickness, and interior egg quality (Bains, 1997).

Table 6 showed that there were significant (P≤0.001) differences in egg weight loss percentage before incubation among different storage periods. The highest egg loss percentage was recorded for eggs stored for 10-12 days followed by those stored for 7-9 days before incubation, meanwhile, the lowest percentage was recorded for eggs stored for 1-3 days. Regarding, egg weight loss percentage during incubation and the total periods, it's clear from Table 6, that eggs stored for 7-9 or 10-12 days loss weight much more than those stored for 1-3 or 4-6 days and the differences between them were highly significant. This result may be due to the change in the relative humidity during storage period which influenced on daily egg weight loss, or may be due to prolonged egg storage period which may effect on the deterioration of egg quality such as the permeability of the vitilline membrane and the changes in osmotic pressure between egg yolk and albumen contents (Fasenko , 2007). These results are in agreement with those obtained by Davis and Ackerman (1997) who reported that egg weight loss of domestic poultry and waterfowl eggs generally lose 11 to 15% of their initial weight during incubation. Zakaria et al. (2009) reported that percentage of egg weight loss approached 10% during incubation period. Also, Reijrink et al. (2010) reported that egg weight loss during storage was higher for eggs stored for 14 days than for eggs stored for 4 days.

Fresh eggs weight and eggs weight loss percentage was insignificantly affected due to the interaction between flock age and dietary AA supplementation (Tables 7). In general, eggs produced from 60-wks old hens lose larger percentage of their fresh weights at all dietary AA supplementation during storage, incubation and the total periods over than those produced from 40-wks-old hens at the same levels of dietary AA supplementation. On the other hand, egg weight loss percentage was insignificantly affected due to the interaction between flock age and egg storage period before incubation. The highest value of egg weight loss % was occurred for eggs of 60-wks-old hens which stored for 7-9 days followed by 10-12 days before incubation during storage and incubation periods. This may be due the decrease in albumen water content which increased by increasing egg storage

period. Also, there were no significant effects on the studied parameters due to the interaction between dietary AA supplementation and egg storage periods (Table 7). But generally, it could be observed that supplementing AA to laying diet either 500 or 1000 mg/kg resulted in a decrease of total egg weight loss percent for eggs stored up to 12 days as compared to the control (unsupplemented) diet during the incubation and the whole experimental period (Table 7). These results may be due to dietary AA supplementation which may prevent the deterioration of egg quality (Orban et al., 1993 and Bains, 1997).

No significant effects were observed on the fresh egg weight and egg weight loss percentage due to the interaction between flock age, dietary AA supplementation and egg storage period (Table 8). The lowest value of total egg weight loss percentage was recorded for eggs produced from 40-wks-old hens fed diet supplemented with 500 mg AA/kg and stored for 1-3 days before incubation followed by eggs produced from the same hens age which fed diet supplemented with 1000 mg AA/kg diet and stored for the same period as compared to the other interactions. Increasing egg weight loss due to the interaction between hens age (60-wks –old) , 0.0 mg AA /kg diet and prolong storage period (10-12 days) before incubation may be due to a thinner cuticle, resulting in increased egg shell conductance which may increase water loss (Zakaria et al., 2009).

CONCLUSION

It could be advised that supplementing 500 mg AA/kg to laying hens diet may be an alternative method to maximize the hatchability traits and minimize embryonic mortality of Sinai chicken eggs which produced from 40-wks-old hens and stored up to 12 days before incubation at normal room conditions during March to May month under Egyptian conditions.

Table (1): Composition and calculated analysis of the basal diet.

Ingredients	%
Yellow corn	67.65
Soy bean meal (44 %)	23.20
Di-calcium phosphate	1.70
Limestone	6.70
Vit & Min. premix [1]	0.30
NaCl	0.35
DL- Methionine (99%)	0.10
Total	100
Calculated Analysis [2]	
Crude protein %	16.05
ME (Kcal / kg)	2786
Crude fiber %	3.11
Ca. %	3.00
Av. Phosph.%	0.43
Lysine (%)	0.79
Methionine (%)	0.36
Meth. + Cyst. (%)	0.55
Na %	0.16

1- Each 3kg of Vit .and Min. premix contains 100 million IUVit A;2 million IU Vit.D3;10 g Vit.E; 1 g Vit.K_3 ; 1 g Vit B1; 5 g Vit B2 ;10 mg Vit.B12 ; 1.5 g Vit B6; 30 g Niacin ;10 g Pantothenic acid ;1g Folic acid;50 mg Biotin ; 300 g Choline chloride; 50 g Zinc; 4 g Copper; 0.3 g Iodine ; 30 g Iron; 0.1 g Selenium; 60g Manganese ;0.1 g Cobalt; and carrier $CaCO_3$ to 3000 g .

2- According to NRC (1994)

Table (2): Average of temperature and relative humidity during experimental period inside egg storage room.

Month	Temperature °C		Relative humidity %	
	Minimum	Maximum	Minimum	Maximum
March	14.04±1.69	21.47±4.91	55.13±12.11	79.91±11.0
April	14.86±2.32	22.64±3.30	54.43±2.34	81.28±11.7
May	19.17±3.51	26.67±2.09	55.62±10.51	80.85±16.23

Table (3): Effect of flock age (wks), dietary ascorbic acid supplementation (mg/kg) and egg storage period (day) before incubation on hatchability traits and chick weight of local Sinai hen eggs.

Traits / Main effects	Fertility, %	Hatchability, %		Embryonic mortality, %	Chick Wt. (g)
		of fertile eggs	of total set eggs		
Flock age (wks)					
40	93.02±0.46^{a}	91.31±0.52	84.97±0.71^{a}	8.69±0.52	35.95±0.35
60	90.24±0.50^{b}	90.66±0.63	81.89±0.87^{b}	9.34±0.63	36.32±0.26
P- value	< 0.001	0.259	< 0.001	0.259	0.321
Ascorbic acid supplementation (mg/kg/diet)					
0.0	90.55±0.67^{b}	88.21±0.69^{c}	79.91±0.94^{c}	11.79±0.53^{a}	35.74±0.39^{b}
500	92.65±0.59^{a}	93.37±0.52^{a}	86.54±0.83^{a}	6.63±0.52^{c}	35.71±0.31^{b}
1000	91.69±0.58^{ab}	91.37±0.65^{b}	83.85±0.95^{b}	8.63±0.65^{b}	36.96±0.40^{a}
P- value	0.021	< 0.001	< 0.001	< 0.001	<0.001
Egg storage period before incubation (day)					
1-3	93.09±0.51^{a}	94.01±0.66^{a}	87.53±0.85^{a}	5.99±0.66^{c}	37.06±0.45^{a}
4-6	93.43±0.64^{a}	92.44±0.67^{a}	86.38±0.90^{a}	7.57±0.67^{c}	36.41±0.49^{ab}
7-9	91.52±0.77^{b}	89.58±0.73^{b}	82.01±1.02^{b}	10.42±0.73^{b}	35.92±0.42^{bc}
10-12	88.48±0.62^{c}	87.92±0.72^{c}	77.82±0.92^{c}	12.08±0.72^{a}	35.14±0.30^{c}
P- value	< 0.001	< 0.001	< 0.001	< 0.001	<0.001

a,b,c :means in the same column within each item with different superscript are significantly different ($P \leq 0.05$).

Table (4): Effect of the interaction between flock age (wks) and dietary AA supplementation (mg/kg) and egg storage period (day) before incubation on hatchability traits and chick weight of local Sinai hen eggs.

Traits / Interactions		Fertility, %	Hatchability, %		Embryonic mortality %	Chick Wt. (g)
			fertile eggs	total set eggs		
Age	AA					
40	0.0	92.03±0.90	87.97±0.85	80.96±1.11	12.03±0.85	34.40±0.43 [c]
	500	94.01±0.69	93.81±0.53	88.20±0.87	6.19±0.53	35.84±0.58 [b]
	1000	93.02±0.76	92.16±0.76	85.76±1.16	7.84±0.76	37.60±0.61 [a]
60	0.0	89.07±0.91	88.45±1.10	78.86±1.52	11.55±1.10	36.88±0.50 [b]
	500	91.29±0.88	92.93±0.91	84.89±1.34	7.07±0.91	36.31±0.27 [b]
	1000	90.36±0.79	90.59±1.04	81.93±1.40	9.41±1.04	36.57±0.48 [b]
P- value		0.978	0.346	0.617	0.345	0.001
Age	Egg storage period					
40	1-3	94.08±0.69	93.38±0.85	87.90±1.22	6.62±0.85	37.12±0.76
	4-6	95.31±0.63	92.78±0.78	88.41±0.87	7.22±0.78	35.88±0.83
	7-9	92.62±1.01	90.24±0.99	83.54±1.07	9.76±0.99	36.37±0.56
	10-12	90.06±0.76	88.85±1.14	80.04±1.37	11.15±1.14	34.42±0.50
60	1-3	92.09±0.67	94.63±1.01	87.17±1.22	5.37±1.01	36.99±0.51
	4-6	91.55±0.88	92.09±1.10	84.34±1.42	7.91±1.10	36.95±0.52
	7-9	90.42±1.11	88.92±1.08	80.48±1.68	11.08±1.08	35.87±0.61
	10-12	86.90±0.80	86.99±0.87	75.59±0.98	13.01±0.87	35.48±0.24
P- value		0.707	0.253	0.282	0.253	0.107
AA	Egg storage period					
0.0	1-3	91.53±1.01	90.15±0.72	82.48±0.75	9.85±0.72	36.58±0.86
	4-6	92.79±1.20	90.53±1.45	84.05±1.94	9.47±1.45	36.21±0.69
	7-9	90.67±1.52	86.87±1.44	78.75±1.80	13.13±1.44	35.95±0.83
	10-12	87.21±1.07	85.29±1.15	74.36±1.26	14.71±1.26	34.23±0.60
500	1-3	94.61±0.68	96.26±0.73	91.07±0.91	3.74±0.73	36.34±0.37
	4-6	94.13±1.07	94.13±0.71	88.57±0.85	5.87±0.71	34.92±0.94
	7-9	92.10±1.18	92.48±0.73	85.18±1.07	7.52±0.73	36.10±0.53
	10-12	89.75±1.22	90.62±1.12	81.36±1.70	9.38±1.12	35.46±0.54
1000	1-3	93.12±0.69	95.62±0.79	89.05±1.05	3.38±0.79	36.25±0.92
	4-6	93.36±1.10	92.64±0.98	86.51±1.48	7.36±0.98	35.75±0.64
	7-9	91.79±1.36	89.39±0.89	82.10±1.70	10.61±0.89	35.72±0.85
	10-12	88.49±0.83	87.86±0.96	77.73±1.03	12.14±0.96	36.11±0.31
P- value		0.982	0.561	0.662	0.561	0.101

a,b,c: means in the same column within each item with different superscript are significantly different ($P \leq 0.05$).

Table (5): Effect of the interaction between flock age (wks), dietary AA supplementation (mg/kg) and egg storage period (day) before incubation on hatchability traits and chick weight of local Sinai hen eggs.

Interaction / Traits			Fertility %	Hatchability %		Embryonic mortality %	Chick Wt. (g)
Age	AA	Egg storage (day)		of fertile eggs	of total set eggs		
40	0.0	1-3	93.10±1.45	89.52±0.41	83.34±1.20	10.49±0.41	35.01±0.66
		4-6	94.38±0.73	90.20±1.27	85.11±1.18	9.80±1.27	34.93±0.78
		7-9	91.48±2.75	87.07±2.00	79.50±1.69	12.93±2.00	35.02±1.06
		10-12	89.15±1.12	85.10±1.97	75.88±2.20	14.90±1.97	32.65±0.55
	500	1-3	95.29±1.05	95.95±0.40	91.44±1.30	4.05±0.40	37.03±0.34
		4-6	95.95±1.17	93.74±1.07	89.91±1.07	6.26±1.07	34.06±1.79
		7-9	93.13±1.02	92.57±1.19	86.22±1.42	7.43±1.19	37.13±0.53
		10-12	91.66±1.64	92.97±0.91	85.22±1.77	7.03±0.91	35.15±1.02
	1000	1-3	93.66±1.08	94.68±1.20	88.91±2.00	5.32±1.20	37.33±1.77
		4-6	95.60±1.40	94.40±1.01	90.21±1.16	5.60±1.01	36.64±0.67
		7-9	93.25±1.25	91.07±0.91	84.90±0.92	8.92±0.91	36.95±1.12
		10-12	89.38±1.10	88.47±1.08	79.03±0.65	11.53±1.08	35.46±0.28
60	0.0	1-3	89.96±1.13	90.78±1.39	81.62±0.85	9.22±1.39	36.15±1.27
		4-6	91.21±2.17	90.87±2.79	82.98±3.87	9.13±2.79	37.48±0.85
		7-9	89.86±1.59	86.66±2.31	78.00±3.39	13.34±2.31	36.88±1.25
		10-12	85.27±1.42	85.47±1.43	72.83±1.05	14.53±1.43	35.80±0.25
	500	1-3	93.94±0.87	96.56±1.48	90.69±1.41	3.44±1.48	35.64±0.51
		4-6	92.32±1.46	94.52±1.01	87.23±1.11	5.48±1.01	35.79±0.60
		7-9	91.07±2.15	92.39±0.99	84.13±2.14	7.61±0.99	35.07±0.64
		10-12	87.83±1.48	88.26±1.44	77.50±3.82	11.74±1.44	35.78±0.48
	1000	1-3	92.38±0.83	96.55±0.98	89.18±0.98	3.45±0.98	37.17±0.31
		4-6	91.13±1.00	90.89±1.32	82.81±1.30	9.11±1.32	37.58±1.13
		7-9	90.33±2.38	87.70±1.01	79.29±2.87	12.30±1.01	34.48±1.10
		10-12	87.60±1.21	87.24±1.67	76.42±1.86	12.76±1.67	36.03±0.57
P- value			0.961	0.427	0.443	0.428	0.767

Table (6): Effect of flock age (wks), dietary ascorbic acid (AA) supplementation (mg/kg) and egg storage period (day) before incubation on fresh egg weight and egg weight loss (%) of local Sinai hen eggs.

Traits / Mean effects	Fresh egg weight (g)	Egg weight loss,%		
		Storage period	Incubation period	Total
Flock age (wks)				
40	54.04±0.33	1.30±0.08 ^{b}	9.79±0.28 ^{b}	11.09±0.32 ^{b}
60	54.18±0.42	1.85±0.09 ^{a}	10.12±0.22 ^{a}	11.97±0.27 ^{a}
P- value	0.750	0.001	0.035	0.005
AA level supplementation (mg/kg)				
0.0	53.91±0.58	1.59±0.13 ^{ab}	10.59±0.29 ^{a}	12.18±0.38 ^{a}
500	54.30±0.31	1.23±0.11 ^{b}	9.64±0.26 ^{b}	10.87±0.30 ^{b}
1000	54.03±0.45	1.72±0.10 ^{a}	9.66±0.35 ^{b}	11.38±0.40 ^{b}
P- value	0.607	0.014	0.009	0.007
Egg storage period before incubation (day)				
1-3	54.37±0.56	0.93±0.06 ^{d}	8.15±0.22 ^{c}	9.08±0.22 ^{c}
4-6	54.29±0.63	1.33±0.09 ^{c}	9.59±0.30 ^{b}	10.92±0.32 ^{b}
7-9	54.32±0.47	1.79±0.12 ^{b}	11.21±0.34 ^{a}	13.00±0.36 ^{a}
10-12	53.46±0.44	2.28±0.12 ^{a}	10.89±0.25 ^{a}	13.17±0.27 ^{a}
P- value	0.364	0.001	0.001	0.001

a,b,c :means in the same column within each item with different superscript are significantly different ($P \leq 0.05$).

Table (7): Effect of the interaction between flock age (wks), dietary ascorbic acid (AA) supplementation (mg/kg) and egg storage period (day) before incubation on fresh egg weight and egg weight loss (%) of local Sinai hen eggs.

Interaction / Traits		Fresh egg weight (g)	Egg weight loss,%		
			Storage period	Incubation period	Total
Age	AA				
40	0	53.46±0.42	1.49±0.17	10.30±0.39	11.79±0.51
	500	55.48±0.41	1.20±0.13	9.57±0.42	10.77±0.47
	1000	53.86±0.36	1.53±0.11	9.59±0.62	11.11±0.67
60	0	56.36±0.76	1.98±0.16	10.83±0.45	12.81±0.54
	500	53.32±0.30	1.93±0.16	9.70±0.30	11.63±0.37
	1000	55.20±0.74	1.65±0.17	9.74±0.33	11.39±0.44
P- value		0.091	0.127	0.799	0.452
Age	Egg storage period				
40	1-3	55.58±0.57	0.84±0.10	7.87±0.35	8.71±0.32
	4-6	54.41±0.59	1.03±0.11	9.19±0.44	10.22±0.45
	7-9	53.27±0.55	1.36±0.12	10.40±0.56	12.76±0.59
	10-12	53.91±0.73	1.99±0.16	10.82±0.39	12.81±0.42
60	1-3	53.15±0.86	1.02±0.07	8.45±0.27	9.47±0.27
	4-6	54.18±1.14	1.64±0.09	9.97±0.40	11.61±0.40
	7-9	54.01±0.68	2.59±0.14	10.96±0.41	13.55±0.43
	10-12	55.36±0.47	2.16±0.14	10.97±0.32	13.13±0.30
P- value		0.072	0.062	0.426	0.637
AA	Egg storage period				
0.0	1-3	53.93±0.99	1.87±0.13	8.60±0.36	10.46±0.38
	4-6	54.54±1.28	1.30±0.21	10.02±0.54	11.31±0.61
	7-9	54.55±1.32	1.78±0.20	11.89±0.40	13.67±0.50
	10-12	52.61±1.12	2.40±0.25	11.77±0.33	14.17±0.42
500	1-3	55.14±0.70	0.85±0.09	8.20±0.39	9.05±0.39
	4-6	54.55±0.70	1.22±0.12	9.54±0.61	10.76±0.62
	7-9	53.85±0.41	1.46±0.20	10.30±0.42	11.76±0.36
	10-12	54.05±0.60	2.18±0.18	10.57±0.26	12.75±0.27
1000	1-3	54.03±1.19	1.08±0.09	7.68±0.40	8.77±0.38
	4-6	53.79±1.28	1.49±0.11	9.18±0.43	10.67±0.47
	7-9	53.73±0.46	2.29±0.17	11.37±0.81	12.63±0.81
	10-12	54.55±0.40	2.04±0.20	10.34±0.52	13.41±0.52
P- value		0.461	0.646	0.622	0.336

Table (8): Effect o of the interaction between flock age (wks), dietary ascorbic acid (AA) supplementation (mg/kg) and egg storage period (day) before incubation on fresh egg weight and egg weight loss (%) of local Sinai hen eggs.

Traits / Interaction			Fresh egg weight (g)	Egg weight loss,%		
Age	**AA**	**Egg storage period**		**Storage period**	**Incubation period**	**Total**
40	0.0	1-3	53.54±0.80	0.59±0.15	8.48±0.54	9.07±0.54
		4-6	52.16±0.46	0.81±0.15	9.91±0.83	10.72±0.98
		7-9	50.78±0.14	1.32±0.20	11.27±0.33	12.59±0.37
		10-12	49.34±0.33	2.06±0.40	11.56±0.53	13.62±0.73
	500	1-3	56.62±0.81	0.83±0.13	7.60±0.60	8.43±0.55
		4-6	55.74±1.13	1.01±0.21	8.95±0.86	9.96±0.77
		7-9	54.54±0.53	1.12±0.22	10.82±0.59	11.94±0.61
		10-12	55.02±0.63	1.83±0.25	10.91±0.20	13.74±0.25
	1000	1-3	56.58±0.78	1.11±0.16	7.53±0.71	8.64±0.68
		4-6	55.32±0.46	1.28±0.15	8.71±0.65	9.99±0.72
		7-9	54.50±0.77	1.64±0.15	12.11±1.61	13.75±1.66
		10-12	54.38±0.48	2.06±0.20	10.01±0.97	12.07±1.00
60	0.0	1-3	54.32±1.92	1.15±0.12	8.71±0.52	9.86±0.53
		4-6	56.92±2.10	1.79±0.24	10.13±0.77	11.92±0.73
		7-9	58.32±0.84	2.24±0.20	12.51±0.65	14.75±0.64
		10-12	55.88±0.38	2.73±0.23	11.99±0.44	14.72±0.30
	500	1-3	53.66±0.69	0.87±0.14	8.80±0.37	9.67±0.44
		4-6	53.36±0.44	1.43±0.05	10.14±0.89	11.57±0.89
		7-9	53.16±0.50	1.80±0.27	9.77±0.54	11.57±0.42
		10-12	53.08±0.87	2.52±0.12	10.24±0.47	12.76±0.52
	1000	1-3	51.48±1.57	1.06±0.11	7.84±0.44	8.90±0.41
		4-6	52.26±2.46	1.70±0.10	9.64±0.54	11.34±0.52
		7-9	54.60±0.59	2.44±0.16	10.64±0.31	13.08±0.32
		10-12	53.08±0.55	2.52±0.35	10.67±0.47	13.19±0.27
P- value			0.643	0.922	0.383	0.557

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الملخص العربي

بعض صفات التفريخ لبيض دجاج السينا وتأثرها بعمر القطيع وإضافة فيتامين ج وفترة تخزين البيض تحت الظروف المصرية

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

تهدف هذه الدراسة إلى معرفة تأثير عمر القطيع وإضافة فيتامين ج وفترة تخزين البيض قبل التفريخ والتداخل بينهم على صفات التفريخ ووزن الكتكوت عند الفقس ومعدل الفقد فى وزن البيض . أستخدم عدد ٣٦٠ طائر من دجاج السينا لكل من عمري ٤٠ و ٦٠ أسبوع (١٦٢ دجاجة + ١٨ ديك لكل عمر) قسمت طيور كل عمر إلى ثلاث مجموعات في ثلاث مكررات (١٨ دجاجة + ٢ ديك) ، تم تغذية الطيور على عليقة بياض مضاف لها فيتامين ج بمستويات مختلفة هي (صفر ، ٥٠٠ ، ١٠٠٠ مجم / كجم عليقة) . تم جمع البيض الناتج من كل معاملة وتقسيمه وتخزينه لفترات مختلفة هي ١ – ٣ ، ٤- ٦ ، ٧ – ٩ ، ١٠ – ١٢ يوم تحت ظروف الغرفة العادية قبل التفريخ خلال شهر مارس حتى مايو تحت الظروف المصرية. تمت عملية التفريخ للبيض وتم حساب نسبتى الخصوبة والفقس ووزن الكتاكيت الفاقسة والفقد في وزن البيضة خلال مرحلتى تخزين وتفريخ البيض.

تشير النتائج المتحصل عليها الي الآتى:-

لوحظ تحسنا معنويا في نسبتي الخصوبة والفقس للبيض الكلى الموضوع لقطيع الدجاج الأصغر عمرا (٤٠ أسبوع) بالمقارنة بالأكبر عمرا (٦٠ أسبوع) بينما لم تتأثر معنويا نسبة النفوق الجنينى ووزن الكتكوت عند الفقس بعمر الأمهات. كما لوحظ تحسنا معنويا فى نسبتى الخصوبة والفقس للبيض الناتج من الدجاج المغذى على عليقة مضاف لها ٥٠٠ مجم فيتامين ج /كجم بالمقارنة للدجاج المغذى على عليقة الكنترول بينما إنخفضت نسبة النفوق الجنيني معنويا باضافة ٥٠٠ أو ١٠٠٠ مجم فيتامين ج/ كجم بالمقارنة بالكنترول كما لوحظ ارتفاعا معنويا فى وزن الكتكوت عند الفقس لبيض الدجاج المغذى على عليقة مضاف لها ١٠٠٠ مجم فيتامين ج / كجم فقط.

لوحظ إنخفاضا معنويا لنسبتى الخصوبة والفقس وإرتفاعا معنويا فى نسبة النفوق الجنيني بتخزين البيض قبل التفريخ لمدة ٧-٩ و ١٠-١٢ يوم مقارنة بالبيض المخزن لمدة ١-٣ و ٤-٦ يوم. بينما إنخفض وزن الكتكوت عند الفقس معنويا بزيادة مدة التخزين الى ١٢ يوم قبل التفريخ . سجلت النسبة المئوية للفقد فى وزن البيضة إنخفاضا معنويا باضافة فيتامين ج للعليقة وقصر فترة تخزين البيض قبل التفريخ. كما لم يكن للتداخلات بين عمر القطيع وإضافة فيتامين ج وفترة تخزين البيض قبل التفريخ أى تأثير معنوى على جميع الصفات المدروسة فيما عدا وزن الكتكوت الذى تحسن معنويا باضافة ١٠٠٠ مجم فيتامين ج للأمهات عمر ٤٠ أسبوع مقارنة بباقى التداخلات.

تشير النتائج إلى أن إضافة ٥٠٠ مجم فيتامين ج /كجم لعليقه إنتاج البيض يمكن أن تكون طريقة مناسبة لتحسين صفات التفريخ وتقليل النفوق الجنيني للبيض الناتج من الدجاج السينا عمر ٤٠ أسبوع والمخزن لمدة تصل الى ١٢ يوم قبل التفريخ تحت ظروف الغرفة العادية خلال شهور مارس حتى مايو تحت الظروف المصرية.