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EFFECT OF DIPPING AND SPRAYING HATCHING EGGS OF MUSCOVY DUCK BY ASCORBIC ACID SOLUTIONS DURING INCUBATION PERIOD ON HATCHABILITY TRAITS

By

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Abstract: *Two experiments involving 3240 settable hatching eggs of Muscovy duck were conducted to determine the effect of ascorbic acid (AA) by dipping or spraying treatments during incubation period on hatchability and embryonic mortality percentages, hatched duckling weights and economical efficiency. The treatments in dipping or spraying trial were as follows : control (non dipped or sprayed) , water dipped or sprayed (WD or WS) and dipped or sprayed groups into AA solutions by 10 , 20 , 30 and 40 g per liter(AA_1 ,AA_2 ,AA_3 and AA_4) at 0 , 14 and 30 days through incubation period(dipping trial) or at the last three weeks of incubation period (spraying trial).*

The results of the two experiments indicated that hatchability percentages were significantly ($P \leq 0.01$) *improved by dipped into AA_1 ,AA_2 and AA_3 compared to the control and WD groups at 0 and 14 days through incubation period , while it was significantly* ($P \leq 0.05$) *improved at 30.0 day only by AA_2 . The mean of hatchability between treatments was significantly* ($P \leq 0.05$) *improved for AA_1, AA2, AA3 and AA_4 groups as compared to the control and WD groups. Hatchability was significantly* ($P \leq 0.01$) *improved at 14, 0 and 30 day, respectively through incubation period by dipping into AA_2 as compared to the control. Also, hatchability percentage was significantly* ($P \leq 0.05$) *improved by sprayed with AA_3 as compared to the control during the last three weeks of incubation period. Embryonic mortality was significantly* ($P \leq 0.01$) *decreased at 14, 0 and 30 day, respectively through incubation period by dipping into AA_2 as compared to the control . The mean of embryonic mortality between treatments was significantly* ($P \leq 0.05$) *decreased by dipping into AA_1 ,AA_2 and AA_3 as compared to the control and WD groups. Also, embryonic mortality percentage was significantly* ($P \leq 0.05$) *decreased by spraying with*

AA3 as compared to the control. The mean of hatched Muscovy duckling weight was not significantly affected by AA. Economical efficiency and net return were improved by AA treatment during incubation period. Results indicated that all studied traits were improved by dipping hatching eggs of Muscovy duck into AA_2 solution at 14 days of incubation period or by spraying with AA_3 twice times daily during the last 3 weeks of incubation and may be alternative methods to maximize the hatchability percentage , net return , economic efficiency and decrease embryonic mortality during hatching process.

INTRODUCTION

There are several reports regarding the effect of vitamin C (ascorbic acid: AA) on production performance parameters in birds, such as growth, reproduction, hormonal relationship, immunosuppression, mortality, and fear behavior. A review on some of these parameters was given by ***Pardue and Thaxton (1986).*** Ascorbic acid is necessary for various biosyntheses (collagen, carnitine, 1,25-dihydroxyvitamin D, adrenaline etc.) as well as for the regulation of diverse reactions (secretion of corticosterone, regulation of body temperature, activation of the immune system) ***McDowell, (1989)***. Adult poultry under normal conditions are able to synthesize vitamin C, however it has been reported that ascorbic acid synthesis is inadequate under stress conditions such as low or high environmental temperatures, humidity, high productive rate, and parasite infestation ***(McDowell, 1989; Kutlu, 2001)***. Chick embryos may be subjected to stress caused by excessive production of heat during the latter part of egg incubation ***(Tullett , 1990)***.If ascorbic acid is an anti-stress agent , then the addition of AA may be beneficial for conditions of embryonic stress . One of the basic biological functions of the eggshell for the domestic fowl chick to allaw for adequate movement of water vapor and respiratory gases , it consists of overlaying cuticle which penetrated by thousands of microscopic pores which are essential for the exchange of respiratory gases during incubation ***(Tullett,1978)***. It also may enhance or reduce movement of water vapor across the shell ***(Meir et al.. 1984)***. Ascorbic acid is a weak acid and the ability of diluted acid to interact with the eggshell cuticle was reported by ***Burley and Vadehra (1989)***.

The objective of this study was to investigate the effect of ascorbic acid treatment (dipping or spraying) of hatching Muscovy duck eggs through incubation period on hatchability , embryonic mortality , hatched duckling weights and economical efficiency.

MATERIALS AND METHODS

This study was carried out at El-Serw Water Fowl Research Station , Animal Production Research Institute , Agricultural Research Center, Ministry of Agriculture , Egypt during June and July ,2007 . Eggs obtained from a commercial strain of duck breeders (Muscovy) were used in two experiments. Birds were reared under standard husbandry conditions at 8th month of age (first season) and fed on a standard breeder ration (160 g /kg CP, 2825 kcal of ME per kg , 34.1 g / kg calcium and 4.5 g/kg available phosphorus). Eggs were collected during 10 days pre-incubation. Ascorbic acid (AA) solutions were freshly prepared by dissolving in distilled water and protected from light.

Experiment 1:

This trial was carried out to investigate the effects of dipping eggs into AA solutions (35-37 ºC) for up to 2 minutes. on hatchability traits. The experimental design was 3 x 6 factorial arrangement. The factors were dipping time through incubation period (0 , 14 and 30 days) and experimental treatments , which were control (non dipped) , water dipped (WD) and treatments dipped into AA solutions with 10 g AA /liter (AA1) , 20 g AA / liter (AA2) , 30 g AA / liter (AA3) and 40 g AA / liter (AA4) . A total number of 1890 fertile eggs (77.5 – 78.3 g) were obtained and divided into three equal groups (each group was assigned to one time of dipping). Each group was further subdivided into equal six subgroup (each subgroup was randomly assigned to one of the experimental treatments, then divided into equal five replicates of 21 eggs).

Experiment 2:

This trial was carried out to investigate the effects of spraying AA solutions (35-37ºC) during incubation on hatchability traits . Experimental design was completely randomized and the treatments were , control (non sprayed) , water sprayed (WS) and groups sprayed by AA solutions with 10 g AA /liter (AA1) , 20 g AA / liter (AA2) , 30 g AA / liter (AA3) and 40 g AA / liter (AA4). A total number of 1350 fertile eggs (77.5 – 78.3 g) were obtained and randomly assigned to six treatments .Each treatment containing 225 eggs were subdivided into 5 replicates of 45 eggs . the spraying was uses twice times daily (one time at morning and the other at night) by 45 ml solution per treatment during the last 3 weeks of incubation period .

Incubation of eggs and data collection:

Eggs were set in a Econom incubator and incubated at 37.6 °C and 65 % relative humidity . Eggs had been turned every 1 h until they transferred to the hatching compartment on day 31 of incubation .Eggs were examined by candling at day 14 of incubation and infertile eggs were removed .The hatching compartment was kept at 37.0 °C and 75 % relative humidity until the end of hatching through incubation period , at which time hatched chicks and accumulative embryonic mortality (unhatched eggs with live or dead embryos and dead hatched chicks) were counted. Hatched chicks were weighed , then , hatchability and embryonic mortality were calculated on the basis of the number of fertile eggs per treatment .Economical efficiency and net return were calculated according to the prices of AA (14 LE/ 100 g) , fertile one egg of Muscovy duck(1.75 LE) and one hatched duckling (6.0 LE) prevailing during year 2007:

Total cost LE = Total price of fertile eggs + Total price of AA LE ,

Total price of ducklings =Total hatched ducklings per each treatment ×

price one hatched duckling ,

Net return LE per treatment = Total price of ducklings - Total cost LE, Net return per treatment of control % = Net return LE per treatment ÷

Net return LE of control x100 ,and

Economical efficiency (EEF)% = Net return LE ÷ Total cost LE x 100

Statistical analysis : Data obtained were statistically analyzed for the analysis of variance using the General linear model of ***SAS (1990).***

In this study , two models were used: Model 1: 3x6 factorial design in experiment 1,considering the dipping time through incubation period and AA levels as the main effects, the used model was :

$$Y_{ijk} = \mu + T_i + R_j + (TR)_{ij} + e_{ijk}$$ where :

Y_{ijk} = An observation

μ = Overall main ,

T = Effect of dipping time , i= (1,2 and 3)

R = Effect of AA level, j = (1 to 6) ,

TR=Effect of interaction between dipping and AA levels

, and e_{ijk} = Random error

Model 2: one–way in experiment 2, considering the spraying by different levels of AA as the main effects, the used model was : $Y_{ij} = \mu + T_i + e_{ij}$ where, Y_{ij} = An observation ,

μ = Overall mean ,

T_i = Effect of treatment (1, 2 , … , 6) , and

e_{ij} = Random error ,

and significant differences among treatments were determined by Duncan's multiple range test ***(Duncan,1955)***.

RESULTS

Experiment 1:

Hatchability percentage:

Results in Table (1) showed significant ($P \leq 0.01$) differences among the experimental groups in hatchability percentages of fertile Muscovy duck eggs dipped into AA solutions at different times through incubation period. Hatchability percentage was significantly ($P \leq 0.01$) affected by dipping into AA solutions at 0 day of incubation period. It was significantly ($P \leq 0.01$) improved by about 21.05,38.30 and 14.93 % of groups AA1, AA2 and AA3 ,respectively as compared to the control group .Also, it was significantly improved by about 10.0 ,25.68 and 4.44% of groups AA1,AA2 and AA3 ,respectively as compared to WD group .Whereas , the groups dipped with water and AA4 were insignificantly ($P \leq 0.01$) affected as compared to the control although that of WD improved by 10.04 %. Hatchability percentage was significantly ($P \leq 0.01$) improved with AA at 14 days from incubation period by about 24.61 , 43.61 , 31.63 and 22.40 % for groups of AA1, AA2, AA3 and AA4 ,respectively as compared to the control . It was also observed significant ($P \leq 0.05$) improvement in hatchability percentage at 30 days through incubation period by about 33.14 % for AA2 group only as compared to the control, while the insignificant improvement of other groups ranged from 10.29 to 14.55 % as compared to the control .

Hatchability percentage was significantly ($P \leq 0.05$) affected by AA treatments and improved by about 20.05 ,38.31 ,19.83 and 11.89 % for AA1, AA2, AA3 and AA4 groups, respectively as compared to the control and by 12.57 ,29.69 and 12.37 % for AA1,AA2 and AA3 groups, respectively as compared to WD group. The best values of hatchability percentage were occurred by AA2 followed by AA1 , AA3 and AA4 ,respectively as compared to the control and WD groups. The time of dipping through incubation period did not significantly affect hatchability

percentage of fertile eggs , although hatchability percentage was improved by 4.07 and 4.55 % at 14 day than those dipped at 0 and 30 day through incubation period , respectively. The interaction between dipping time and dipping AA levels was significant (P≤0.01) effect on hatchability during incubation period .The best interaction values of hatchability were occurred by dipping into AA2 at 14 , 0 and 30 days, respectively as compared to other interaction values through incubation period .

Embryonic mortality:

Results in Table (2) showed significant (P≤0.01) differences among the experimental groups in embryonic mortality percentages of fertile Muscovy duck eggs dipped into AA solutions at different times through incubation period. Embryonic mortality percentage was significantly (P≤0.01) affected at 0 day of incubation period, it was significantly decreased by about 31.51and 57.33 % for groups of AA1 and AA2 ,respectively as compared to the control and by 49.66% for group of AA2 as compared to the WD group. Each of WD , AA3 and AA4 groups were not significantly affected by AA treatment compared to the control, although the embryonic mortality was decreased by 15.03 and 22.35 % for WD and AA3 groups, respectively as compared to the control.

Embryonic mortality percentage was significantly (P≤0.01) decreased by about 35.64, 63.16 , 45.80 and 32.44 % for AA1,AA2,AA3 and AA4 groups, respectively as compared to the control at 14 days through incubation period and by about 49.0 % for AA2 only as compared to the control at 30 day through incubation period. Embryonic mortality percentage differences between treatments were significantly (P≤0.05) affected by AA except AA4 group. Embryonic mortality percentages were significantly decreased by about 31.27 ,57.57 and 30.96 % for AA1, AA2 and AA3 groups, respectively as compared to the control. It was also significantly decreased by 21.92 ,51.74 and 21.56 % for AA1,AA2 and AA3 groups, respectively as compared to the WD group . Embryonic mortality percentage was decreased by 19.54 and 8.59 % for AA4 group as compared to the control and WD groups , respectively. The best values of decreasing embryonic mortality were occurred by dipping into solutions of AA2 followed by AA1 , AA3 and AA4 compared to the control and WD groups.

The time of dipping through incubation period did not significantly affect embryonic mortality percentage of fertile eggs , while embryonic mortality percentage decreased by 8.82 and 9.71 % at 14 day as compared to those at 0 and 30.0 day through incubation period, respectively. The

interaction between dipping time and dipping AA levels was significant ($P \leq 0.01$) effect on embryonic mortality during incubation period .The best interaction values of embryonic mortality were occurred by dipping into AA2 at 14 , 0 and 30 days, respectively as compared to other interaction values through incubation period.

Hatched Muscovy duckling weights:

Results in Table (3) showed that duckling weights differences due to AA were only significant ($P \leq 0.05$) at 30 days . Hatched Muscovy duckling weights were decreased by 0.21 to 3.11 % by treatment at 0 day through incubation period except AA2 group which increased by 1.66 % as compared to the control. It was also significantly ($P \leq 0.05$) decreased for all experimental groups at 14 day and significantly decreased by 2.28 , 5.19 , 6.64 , 3.32 and 9.96 % for WD, AA1,AA2, AA3 and AA4 groups, respectively as compared to the control at 30 days through incubation period. Hatched Muscovy duckling weights differences between treatments were not significantly affected with AA .It was decreased by about 3.0 ,3.32 , 3.35 , 2.49 and 4.98 % for WD , AA1, AA2, AA3 and AA4 groups, respectively as compared to the control. The highest value of decreasing hatched Muscovy duckling weight was occurred by AA4 as compared to the control and WD groups. The time of dipping through incubation period had significant ($P \leq 0.05$) effect on hatched Muscovy duckling weight where the mean was decreased by 3.56 % at 30 day and 1.68 % at 14 day as compared to that at 0 day through incubation period. The interaction between dipping time and dipping AA levels was significant ($P \leq 0.05$) effect on duckling weight only at 30 days through incubation period .The lowest interaction value of duckling weight was occurred by dipping into AA4 at 30 days.

Economic efficiency

Calculations were carried out according to the prices of AA and Muscovy duck eggs and ducklings prevailing during year 2007 as listed in Table (4). Economic efficiency values were 114.8 ,117.69 , 140.96 , 174.04 , 133.46 and 115.07 % for control , WD, AA1, AA2, AA3 and AA4 groups, respectively . Dipping treatment of hatching Muscovy duck eggs into AA solutions of AA1, AA2,AA3 and AA4 resulted in clear improvement of net return by 36.93 , 71.78 , 33.81 and 16.64 % , respectively as compared to the control group .

Experiment 2:

Hatchability, embryonic mortality percentages and hatched duckling weights of fertile Muscovy duck eggs sprayed by solutions of different concentrations of ascorbic acid during incubation period are presented in Table (5). The statistical analysis of data showed no significant duckling weight differences among treatments, while hatchability of fertile eggs and embryonic mortality percentages were significantly ($P \leq 0.05$) different. Hatchability percentage was significantly ($P \leq 0.05$) improved by AA3 as compared to other treatments which also improved by about 7.21 , 9.34 , 8.20 , 15.56 and 6.79 % for WS , AA1 ,AA2 ,AA3 and AA4 groups, respectively as compared to the control. The best values of hatchability percentage of fertile eggs were occurred by spraying ascorbic acid solution AA3 followed by AA1 and AA2 .

In general, most of sprayed egg groups had the lower embryonic mortality percentage than the control group . Embryonic mortality percentage was significantly ($P \leq 0.05$) decreased by about 37.54 % for AA3 group as compared to the control non sprayed , while it was insignificantly ($P \leq 0.05$)decreased than the control by 17.4 , 22.5 ,19.8 and 16.4 % for WS ,AA1 ,AA2 and AA4 groups, respectively. The lowest values of embryonic mortality percentage of fertile eggs were occurred by AA3 and AA1 , respectively.

Although the differences between groups of duckling weight were not significant the spraying by ascorbic acid solutions during incubation period produced lower duckling weight at hatch . Duckling weights at hatch were 48.9 , 48.2 ,48.5 , 47.7, 47.4 and 48.3 g for the control , WS , AA1 , AA2 , AA3 and AA4 groups , respectively.

Economic efficiency:

Calculations were carried out according to the prices of AA and Muscovy duck eggs and ducklings prevailing during year 2007 as listed in Table (6). Economic efficiency values were 142.29 , 159.05 , 159.22 , 150.64 , 162.39 and 137.35 % for the control ,WS, AA1, AA2, AA3 and AA4 ,respectively. Spraying treatment of hatching Muscovy duck eggs by AA solutions during the last 21 days during incubation period by twice times daily resulted in clear improvement of net return by 14.46 , 10.71 , 21.95 and 5.35 % for WS, AA1, AA2, AA3 and AA4 groups, respectively., respectively as compared to the control .

DISCUSSION

Egg injection or dipping with vitamins , such as pyridoxine , pantothenic acid and ascorbic acid , has been applied during incubation to study their effects on hatchability of poultry eggs ***(Robel and Christensen , 1991 ; Robel , 1993 ; Zakaria and El-Anezi , 1996 ; Shafey , 2002 and Tag El-Din et al. 2004)***. Hatchability percentages of fertile eggs were significantly ($P \leq 0.01$ and $P \leq 0.05$) improved by dipping or spraying of AA solutions (contains 10 , 20 , 30 and 40 gram per liter) during incubation period (Tables 1 and 5). The findings suggest that the improvement of hatchability percentage may be due to the decreasing of embryonic mortality where ascorbic acid may be regarded as an anti-stress agent led to the reduction of corticosterone which has a negative impact in collagen synthesis and the metabolism of minerals and vitamin D (***Pardue and Thaxton,1986 ; Weiser et al., 1988 ; McDowell , 1989 ; Tullett, 1990; Roberson and Edwards ,1994 ; Kutlu ,2001 ,and Lohakare et al.,2005)***. These results were agreement with those obtained by ***Zakaria and Al-Anezi (1996)*** who found that the injection of incubated eggs with ascorbic acid at a level of 3.0 mg/egg at different times of incubation had significantly($P \leq 0.05$) improved hatchability . ***Shafey (2002)*** reported that hatchability was significantly ($P \leq 0.05$) improved by dipping eggs into ascorbic acid solution 10 g / liter for up to 2 minutes before incubation while , ***Tag El-Din et al.(2004)*** reported that the injection of Domiaty duck eggs with 3 mg ascorbic acid per egg at 0 day of incubation period resulted in improving hatchability . Embryonic mortality percentages of fertile eggs were significantly ($P \leq 0.01$ and $P \leq 0.05$) decreased by dipping or spraying of AA solutions at 14 days of incubation period (Tables 2 and 5) and by spraying fertile hatching duck eggs with ascorbic acid solution contains 30 gram AA per liter during last 3 weeks of incubation period . The findings suggest that the improvement of hatchability percentage may be due to the increasing in eggshell conductance where the ascorbic acid treatment changed in the properties of cuticle . This change may have been obtained from an interaction between the eggshell cuticle and AA in the dipping or spraying solutions which may have cause a thinner cuticle or a differences in their morphology ***(Burley and Vadehra ,1989 , and Shafey , 2002)*** .In this respect ascorbic acid may act a weak acid solution which dissociate the organic and inorganic components of eggshell and facilitates gaseous exchange between the embryo and its surround environment . Also, chick embryos may be subjected to stress caused by excessive production of heat during the latter part of egg incubation ***(Tullett, 1990)*** but ascorbic acid may exert its effects by modulation of adrenal metabolism , it inhibits 21-

hydroxylase and 11-beta hydroxylase enzymes which may produce less corticosterone ,so that ascorbic acid is essential to for the maintenance of normal immune processes during physiological stress in the chicken ***(Pardue and Thaxton,1986 ; Brake , 1989 , and Kutlu and Forbes ,1993).*** Corticosterone was known as immune suppresent hormone . The present results are in agreement with those obtained by ***Zakaria and Al-Anezi (1996)*** who found that the injection of incubated eggs with 3.0 mg/egg ascorbic acid at different times of incubation had significantly ($P \leq 0.05$) decreased embryonic mortality .Also, ***Shafey (2002)*** reported that embryonic mortality was significantly ($P \leq 0.05$) decreased by dipping eggs into ascorbic acid solution of 10 g AA / liter for up to 2 minutes before incubation while ***Tag El-Din et al.(2004)*** found that embryonic mortality of Domiaty duck eggs was decreased by the injection of 3 mg ascorbic acid per egg at 0 day of incubation period.

CONCLUSION

The obtained results generally showed that the best results in studied traits were recorded for the dipping hatching Muscovy duck eggs into ascorbic acid solutions by 20 or 30 gram AA at 14 day of incubation period or spraying treatment by 30 gram AA per liter twice times daily during the last 3 weeks of incubation period . It could be advise that the treatment of ascorbic acid during incubation period may be alternative methods to maximize the hatchability percentage , net return and economic efficiency , and decrease embryonic mortality during hatching process of Muscovy duck eggs without adverse effects.

Table (1): Hatchability percentages of fertile Muscovy duck eggs dipped into AA solutions at different times through incubation period.

Treatments	Incubation period (days)			Mean of treatment
	0	14	30	
control	59.95±3.38^{c}	59.15±3.58^{c}	59.65±3.48^{b}	59.59±3.58^{d}
WD	65.97±2.66b^{c}	58.91±5.69^{c}	65.79±8.68^{b}	63.55±6.66^{cd}
AA_1	72.57±7.27^{b}	73.71±8.18^{b}	68.33±7.76^{b}	71.54±7.56^{b}
AA_2	82.91±8.0^{a}	84.95±8.38^{a}	79.42±8.51^{a}	82.42±8.04^{a}
AA_3	68.90±10.3^{b}	77.86±6.95^{ab}	67.47±5.17^{b}	71.41±8.63^{b}
AA_4	59.96±4.87^{c}	72.40±9.96^{b}	67.69±10.23^{b}	66.68±9.65^{bc}
Mean of time	68.38±10.09	71.16±11.62	68.06±9.12	69.20±7.86

a,b,c,d :means in the same column bearing different superscript are significantly different ($P \leq 0.05$).

Table (2): Embryonic mortality percentages of fertile Muscovy duck eggs dipped into AA solutions. at different times through incubation period .

Treatments	Incubation period (days)			Mean of treatment
	0	14	30	
control	40.05±4.71^{a}	40.85±4.51^{a}	40.35±4.61^{a}	41.41±4.71^{a}
WD	34.03±2.66^{ab}	41.09±5.67^{a}	34.21±8.68^{a}	36.45±6.66^{a}
AA_1	27.43±7.28^{b}	26.29±8.18^{b}	31.67±7.76^{a}	28.46±7.56^{b}
AA_2	17.09±7.93^{c}	15.05±8.38^{c}	20.58±8.51^{b}	17.57±8.02^{c}
AA_3	31.10±10.3^{ab}	22.14±6.95^{bc}	32.53±5.17^{a}	28.59±8.63^{b}
AA_4	40.04±4.87^{a}	27.60±9.96^{b}	32.31±10.23^{a}	33.32±9.70^{ab}
Mean of time	31.63±9.97	28.84±11.47	31.94±9.01	30.80±8.15

a,b,c,d :means in the same column bearing different superscript are significantly different ($P \leq 0.05$).

Table (3): Hatched Muscovy duckling weight (g) from fertile eggs dipped into AA solutions. at different times through incubation period .

Treatments	Incubation period (days)			Mean of treatment
	0	14	30	
control	48.2±0.6	48.2±0.6	48.2±0.6^{a}	48.2±0.6
WD	47.0±3.5	46.9±5.4	47.1±4.1^{a}	47.0±4.1
AA_1	48.1±4.2	46.1±0.7	45.7±2.2^{ab}	46.6±2.7
AA_2	49.0±1.7	45.5±3.9	45.0±9.1^{ab}	46.5±3.4
AA_3	46.7±4.6	47.7±2.8	46.6±0.3^{ab}	47.0±2.9
AA_4	47.1±3.2	46.9±1.1	43.4±0.4^{b}	45.8±2.5
Mean of time	47.7±3.1^{A}	46.9±2.9^{AB}	46.0±2.6^{B}	46.9±

a,b,c,d :means in the same column bearing different superscript are significantly different ($P \leq 0.05$).
A,B :means in the same row bearing different superscript are significantly different ($P \leq 0.05$).

Table (4): Economical efficiency of dipping hatching Muscovy duck eggs into AA solutions during incubation period.

Items	Treatment					
	control	WD	AA_1	AA_2	AA_3	AA_4
No. of fertile eggs	315	315	315	315	315	315
Total price of eggs LE	551.25	551.25	551.25	551.25	551.25	551.25
Total price of AA LE	-	-	9	18	27	36
Total cost LE	551.25	551.25	560.25	569.25	578.25	587.25
No. of hatched ducklings	188	200	225	260	225	210
Total price of hatched ducklings LE	1128	1200	1350	1560	1350	1260
Net return LE	576.75	648.75	789.75	990.75	771.75	672.75
Net return % of control	100	112.48	136.93	171.78	133.81	116.64
EEF	114.8	117.69	140.96	174.04	133.46	115.07

L.E = Egyptian pound ,

Table (5): Hatchability , embryonic mortality percentages and hatched ducklings weights of fertile Muscovy duck eggs sprayed by AA solutions during last 3 weeks of incubation period .

Treatments	Htchability %	Embryonic mortality %	Hatched duckling weight g
control	70.7 ± 5.4^{b}	29.3 ± 5.4^{a}	48.9±9.8
WS	75.8 ± 3.8^{ab}	24.2 ± 3.8^{ab}	48.2±1.1
AA_1	77.3 ± 4.7^{ab}	22.7 ± 4.7^{ab}	48.5±3.5
AA_2	76.5 ± 3.8^{ab}	23.5 ± 3.8^{ab}	47.7±2.1
AA_3	81.7 ± 5.4^{a}	18.3 ± 5.4^{b}	47.4±0.8
AA_4	75.5 ± 5.6^{ab}	24.5 ± 5.7^{ab}	48.3±1.1

a,b,c,d :means in the same column bearing different superscript are significantly different ($P \leq 0.05$).

Table (6): Economical efficiency of spraying hatching Muscovy duck eggs with AA solutions during the last 3 weeks of incubation period.

Items	Treatment					
	control	WS	AA_1	AA_2	AA_3	AA_4
No. of fertile eggs	225	225	225	225	225	225
Total price of eggs LE	393.75	393.75	393.75	393.75	393.75	393.75
Total price of AA LE	-	-	9	18	27	36
Total cost LE	393.75	393.75	402.75	411.75	420.75	429.75
No. of hatched ducklings	159	170	174	172	184	170
Total price of hatched ducklings LE	954	1020	1044	1032	1104	1020
Net return LE	560.25	626.25	641.25	620.25	683.25	590.25
Net return % of control	100	11.78	114.46	110.71	121.95	105.35
EEF	142.29	159.05	159.22	150.64	162.39	137.35

L.E = Egyptian pound ,

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الملخص العربي

تأثير غمر ورش بيض التفريخ للبط المسكوفى بمحاليل فيتامين ج خلال فترة التفريخ على صفات التفريخ

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قسمت ٣٢٤٠ بيضة تفريخ مخصبة للبط المسكوفى على تجربتين لبحث تأثير المعاملة بفيتامين ج بالغمر أو الرش خلال فترة التفريخ على نسبة الفقس والنفوق الجنينى ووزن الكتاكيت الفاقسة والكفاءة الاقتصادية .وكانت المعاملات في تجربة الغمر أو الرش مجموعة مقارنة غير مغمور أو غير مرشوش ، مجموعة مغمورة أو مرشوشة بالماء ومجموعات مغمورة أو مرشوشة في محاليل تحتوى على (١٠ ، ٢٠ ، ٣٠ ، ٤٠ جرام فيتامين ج لكل لتر ماء) عند بداية التفريخ ، ١٤ ، ٣٠ يوما من فترة التفريخ لتجربة الغمر و خلال الأسابيع الثلاثة الأخيرة من فترة التفريخ لتجربة الرش بمعدل مرتين يوميا ، وتم عد الكتاكيت الفاقسة السليمة والنافقة وتم وزن الكتاكيت الفاقسة ، ثم تم حساب نسبة الفقس والنفوق الجنينى والكفاءة الاقتصادية .

من نتائج التحليل الاحصائى اتضح الآتي :

تحسنت نسبة الفقس معنويا (١%) للمجموعات التي غمرت في محاليل تحتوى على ١٠ ،٢٠ ،٣٠ جم فيتامين ج لكل لتر بالمقارنة بمجموعة المقارنة عند بداية و ١٤ يوما من فترة التفريخ بينما تحسنت معنويا (٥%) فقط المجموعة التي غمرت في محلول به ٢٠ جم فيتامين ج لكل لتر عند ٣٠ يوم من فترة التفريخ و من أفضل تداخلات المعاملة مع وقت الغمر زيادة لنسبة الفقس كانت بالغمر في محلول يحتوى ٢٠ جم فيتامين ج عند ١٤ و ٠ و ٣٠ يوما من التفريخ على التوالي . أيضا تحسنت نسبة الفقس معنويا (٥ %) فقط للمجموعة التي رشت بمحلول يحتوى على ٣٠ جم فيتامين ج لكل لتر خلال الثلاث أسابيع الأخيرة من فترة التفريخ بينما كان التحسن غير معنويا لباقي المعاملات بالمقارنة بمجموعة المقارنة غير المرشوشة.

انخفضت نسبة النفوق الجنينى معنويا للمجموعات التي غمرت في محاليل تحتوى على ١٠ و٢٠ جم فيتامين ج لكل لتر عند بداية التفريخ، بينما انخفضت معنويا لكل المجموعات التي غمرت في محاليل فيتامين ج عند ١٤ يوما من فترة التفريخ وانخفضت المجموعة التي غمرت في محلول به ٢٠ جم فيتامين ج لكل لتر فقط عند ٣٠ يوم من فترة التفريخ و من أفضل تداخلات المعاملة مع وقت الغمر خفضا لنسبة النفوق الجنينى كانت بالغمر في محلول يحتوى ٢٠ جم فيتامين ج عند ١٤ و ٠ و ٣٠ يوما من التفريخ على التوالي . أيضا انخفضت نسبة النفوق الجنينى معنويا للمجموعة التي رشت بمحلول يحتوى على ٣٠ جم فيتامين ج لكل لتر خلال الثلاث أسابيع الأخيرة

من فترة التفريخ بينما كان الانخفاض غير معنويا لباقي المعاملات بالمقارنة بمجموعة المقارنة غير المرشوشة .

لم يتأثر وزن الكتاكيت الفاقسة معنويا بالمعاملة بفيتامين ج بالغمر والرش . تحسنت الكفاءة الاقتصادية وصافى العائد بالمعاملة بفيتامين ج بالغمر والرش خلال فترة التفريخ .

من النتائج السابقة يمكن الاستنتاج بأنه يمكن غمر بيض التفريخ للبط المسكوفى في محلول فيتامين ج بتركيز ٢٠ جراما لكل لتر عند ١٤ يوما من فترة التفريخ أو الرش بمحلول فيتامين ج بتركيز ٣٠ جرام لكل لتر مرتين يوميا في الثلاث أسابيع الأخيرة من فترة التفريخ حيث يمكن تعظيم نسبة الفقس وتقليل النفوق الجنينى وصافى العائد والكفاءة الاقتصادية خلال عملية التفريخ .