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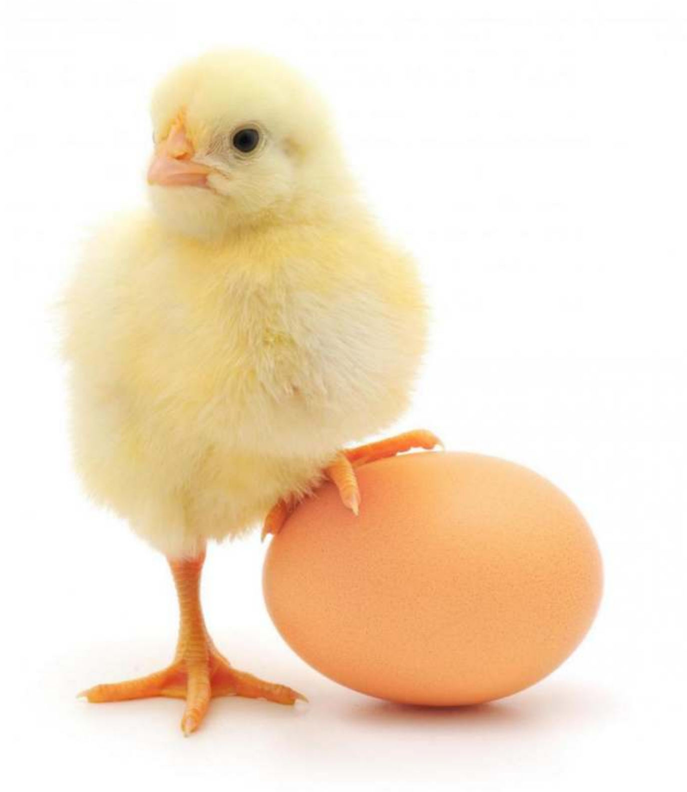

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Effect of Pre-incubation Storage of Hatching Eggs on Subsequent Post-hatch Growth Performance and Carcass Quality of Broilers

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Abstract: The study was conducted to assess the effect of eggs pre-incubation storage duration on post-hatch growth performance and carcass quality of broilers hatched from eggs purchased from local commercial hatchery in Riyadh area. A total of three groups of 80 one day-old, Ross meat-type chicks were used in the study. The chicks were hatched from eggs that were stored for either 1, 7 or 14 days and were randomly divided into four replicates of twenty birds, group weighed and assigned to 4 pens (1.5 m x 1 m) bedded with red sand as litter in an environmentally controlled house and grown under standard management practices. Birds in each replicate were weekly group weighed and weekly feed intake and daily mortality were recorded. Measurements were made of body weight gain, growth rate, feed intake and feed conversion at different age periods. At 5 weeks of age, 3 males and 3 females were randomly selected from each replicate, individually weighed and slaughtered after they have been fasted for 12 h and were inspected for breast blisters and foot pad lesions. Measurements were made of bird live weight, carcass weight and carcass percentage of live weight, abdominal fat weight, heart, liver and gizzard weights and their percentages of carcass weight. Results of the studies revealed that broilers produced from one day stored eggs had significantly ($p<0.05$) better growth performance which was reflected in higher body and carcass weights, less feed intake and better feed conversion compared with those of chicks produced from eggs stored for 7 or more days. Pre-incubation storage of hatching eggs for 7 days or more had an adverse effect on broilers' performance, however, the adverse effect was more pronounced at early age periods and with prolonged pre-incubation storage of hatching eggs.

Key words: Storage, hatching eggs, broiler, growth performance, carcass quality

INTRODUCTION

Storage of hatching eggs is an indispensable part of hatchery operation, even though storage length and conditions may influence embryonic viability. Brake *et al.* (1997) reported that the effect of egg storage on embryonic viability depend on storage time duration, environmental conditions, hen age and strain of breeder. Several investigators suggested that decrease in embryonic viability may be due to changes in embryo or in albumen physical aspects of the egg (Meijerhof, 1994; Lapao *et al.*,1999; Tona *et al.*, 2004). However, Arora and Kosin (1966a); Mather and Laughlin (1979) reported that pre-incubation egg storage leads to morphological changes in blastoderm and malformations in the embryo with increased cell necrosis as indicated by Arora and Kosin (1966b). Egg weight has been reported to have a major effect on chick weight (Bray and Iton, 1974; Wilson, 1991; Tona *et al.*, 2004). However, very sparse informations have been published concerning the effect pre-incubation storage duration on post-hatch broiler performance and carcass quality. Abdou *et al.* (1999) stored hatching eggs from 0-15 days and found that prolonged storage of hatching eggs for more than 7 days under ordinary room conditions in the tropics negatively affected the post-hatching growth performance of the chicks. The same authors, however, reported that the adverse effect disappeared with increasing age of the chicks. Tona *et al.* (2004) found that chicks hatched from eggs stored for 7 days at 15°C and 70% RH had significantly ($p<0.05$) higher body weight at 1-5 weeks of age compared to chicks hatched from non-stored eggs but their weights did not differ at hatch and at 6 weeks of age. The study was conducted to assess the effect of eggs pre-incubation storage duration on post-hatch performance and carcass quality of broilers hatched from eggs purchased from local commercial hatchery in Riyadh area.

MATERIALS AND METHODS

A total of three groups of 80 one day-old, Ross meat-type chicks were used in the study. The chicks were hatched from eggs that were stored for either 1, 7 or 14 days and purchased from local commercial hatchery in Riyadh area. The chicks in each group were randomly divided

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into four replicates of twenty birds, group weighed and randomly assigned to 4 pens (1.5 m x 1 m) bedded with red sand litter in an environmentally controlled house and grown under standard management practices. Birds were fed a starter diet to 2 weeks, followed by finisher diet to 5 weeks of age which were purchased from Arabian Agricultural Services Company (ARASCO) and contain 21.5 and 18.5% crude protein and 2950 and 3100 Kcal/kg metabolizable energy (Table 1), respectively. Birds were exposed to light 24 h a day with light intensity of 2,1, 0,71 and 0,39 foot candle for the first week, second week and the last three weeks, respectively. Birds in each replicate were group weighed again at 1, 2, 3, 4 and 5 weeks of age and weekly feed intake and daily mortality were recorded. Measurements were made of body weight gain, growth rate, feed intake and feed conversion ratio from day one to 2, 3, 4 and 5 weeks and from 2-3, 4 and 5 weeks of age. At 5 weeks of age, 3 males and 3 females were randomly selected from each replicate, individually weighed and slaughtered after they have been fasted for 12 h and inspected for breast blisters and foot pad lesions. Measurements were made of bird live weight, carcass weight and its percentage of live weight, abdominal fat weight, heart, liver and gizzard weights and their percentages of carcass weight. Data obtained were subjected to statistical analysis using the General Linear Models procedures of SAS Institute (1998) using the following statistical model:

$$Y_{ijk} = \mu + B_i + S_j + BS_{ij} + e_{ijk}$$

Where Yijk is the k^{th} observation of the i^{th} storage period (B), j^{th} sex (S). BS_{ij} is the interaction between storage period and sex. μ is the general mean and e_{ijk} is the random error associated with Y_{ijk} observation. Percentages of carcass, abdominal, liver, heart and gizzard weights were transformed to arc sin √ proportion prior to statistical analysis.

RESULTS AND DISCUSSION

Pre-incubation egg storage had a significant ($p<0.05$) effect on body weight at all ages studied except at 3 and 5 weeks of age and only at 0-2, 0-4 and 2-4 weeks of age for body weight gain (Table 2). However feed intake and conversion were significantly ($p<0.05$) affected by pre-incubation egg storage at all age periods studied except at 0-2, 0-3 and 2-3 for feed intake and at 2-3 for feed conversion (Table 3). With respect to carcass quality, pre-incubation egg storage had a significant ($p<0.05$) effect on live weight of slaughtered birds and weights of all studied traits except heart and gizzard weights (Table 4) and only on carcass percentage of live weight (Table 5). Sex had a significant ($p<0.05$) effect only on carcass and abdominal fat percentages (Table 5) and weights of all studied traits except heart and abdominal fat weights

Table 1: Composition and calculated analysis of diets used in the experiment

Ingredients	Starter*	Finisher	Unit
Metabolizable energy	2900	3000	Kcal/kg
Crude protein	21.0	18.5	% Min.
Crude fat	2.5	3.0	---
Fiber	3.0	3.5	% Max.
Calcium	1.0	0.9	% Max.
Available phosphorus	0.42	0.4	% Max.
Sodium	0.15	0.15	% Max.
Lysine	1.20	1.00	% Max.
Methionine	0.50	0.45	% Max.
Meth + Cystine	0.85	0.85	% Max.
Vit A	12000	12000	IU/Kg
Vit D	5000	5000	--
Vit E	60	60	mg/Kg
Vit C	100	100	---
Vit K	4	4	---
Vit B1	3	3	---
Vit B2	8	8	---
Vit B6	5	5	---
Vit B12	0.03	0.03	---
Niacin	40	40	mg/Kg
Pantothenic acid	15	15	---
Folic acid	2	2	---
Biotin (vit H)	0.2	0.2	---
Choline (added)	900	900	---
Cobalt	0.5	0.5	---
Cooper	8	8	---
Iodine	2	2	---
Iron	35	35	---
Manganese	90	90	---
Selenium	0.2	0.2	---
Zinc	70	70	---
Antioxidant	125	125	---

Ingredient: Cereals, Soya bean meal, Vegetable oil, Amino Acids, Vitamins and Minerals. *30% of copper, manganese, zinc and selenium as Bioplex minerals coccidiostat (Avatec/Cygro)

(Table 4). The interaction effect between sex and pre-incubation storage was not significant on all studied traits (Table 4 and 5). On the other hand there was no mortality recorded for the different experimental groups and no breast blisters and foot pad lesions were noticed in the slaughtered birds.

As shown in Table 1 chicks hatched from one day stored eggs had significantly ($p<0.05$) higher average weight at hatch, 1,2.4 weeks of age and tended to have the highest weight at 3 and 5 weeks of age compared to chicks hatched from eggs stored for 7 and 14 days. However chicks hatched from eggs stored for 14 days tended to have lower average weight at early ages but tended to have higher weight at 3, 4 and 5 weeks of age than those hatched from eggs stored for 7 days. The same table shows that chicks hatched from one day stored eggs had significantly ($p<0.05$) higher body weight gain at 0-2, 0-4 and 2-4 weeks of age and tended to have higher body weight gain at all other age periods compared with chicks hatched from eggs stored for 7 and 14 days. On the other hand, chicks hatched from eggs stored for 14 days had significantly ($p<0.05$) lower

Table 2: Effect of pre-incubation egg storage duration on post-hatch broilers' body weight and body weight gain

	Body weight					
Age (weeks)	0	1	2	3	4	5
Storage period (days)	**	*	**	NS	*	NS
01	51.00^{A}	142.00^{a}	334.25^{A}	722.25	1264.04^{a}	1742.59
07	48.06^{B}	130.16^{b}	323.92^{A}	623.02	1049.39^{b}	1532.52
14	47.97^{B}	124.53^{b}	291.66^{B}	682.19	1110.32^{b}	1644.53
SEM	±0.078	±2.331	±4.815	±28.645	±29.174	±41.126

	Body weight gain							
Age period (weeks)	0-1	0-2	0-3	0-4	0-5	2-3	2-4	2-5
Storage period (days)	NS	**	NS	*	NS	NS	*	NS
01	91.00	283.25^{A}	671.25	1213.04^{a}	1691.59	388.00	929.79^{a}	1408.34
07	82.19	275.86^{A}	574.97	1001.34^{b}	1484.46	299.10	725.47^{b}	1208.60
14	76.48	243.69^{B}	634.22	1062.23^{b}	1596.56	390.53	818.66^{b}	1352.88
SEM	±2.375	±4.806	±28.710	±29.192	±41.156	±28.489	±26.394	±38.271

*Significant ($p<0.05$). **Highly significant ($p<0.01$). NS = Non Significant.

Means in the same column with different superscripts differ significantly ($p<0.05$)

Table 3: Effect of pre-incubation egg storage duration on post-hatch broilers' feed intake and feed conversion

	Feed intake							
Age period (weeks)	0-1	0-2	0-3	0-4	0-5	2-3	2-4	2-5
Storage period (days)	*	NS	NS	*	**	NS	**	**
01	153.00^{ab}	503.00	1196.38	2117.74^{ab}	2961.37^{B}	693.38	1614.74^{A}	2458.37^{B}
07	142.52^{b}	538.56	1138.42	1926.77^{b}	2807.22^{B}	599.86	1388.21^{B}	2268.66^{B}
14	162.50^{a}	537.50	1399.66	2230.78^{a}	3396.25^{A}	862.16	1693.28^{A}	2858.75^{A}
SEM	±2.336	±13.833	±46.915	±43.176	±66.363	±41.307	±33.226	±59.129

	Feed conversion							
Age period (weeks)	0-1	0-2	0-3	0-4	0-5	2-3	2-4	2-5
Storage period (days)	**	*	**	**	*	NS	**	*
01	1.69^{B}	1.78^{b}	1.79^{B}	1.75^{C}	1.77^{b}	1.79	1.74^{C}	1.76^{b}
07	1.87^{A}	1.95^{ab}	1.98^{B}	1.93^{B}	1.88^{b}	2.01	1.92^{B}	1.88^{ab}
14	1.98^{A}	2.21^{a}	2.24^{A}	2.10^{A}	2.12^{a}	2.31	2.07^{A}	2.11^{a}
SEM	±0.338	±0.052	±0.051	±0.023	±0.046	±0.093	±0.027	±0.051

*Significant ($p<0.05$) **Highly significant ($p<0.01$) NS = Non Significant

Means in the same column with different superscripts differ significantly ($p<0.05$)

body weight gain from hatch to 2 and tended to have lower body weight gain from hatch to 1 week of age but tended to have higher body weight gain at all other age periods than chicks hatched from eggs stored for seven days. The results indicate that pre-incubation egg storage for 7 and 14 days had an adverse effect on body weight and body weight gain. The adverse effect, however, was more pronounced at early ages. Our results partially agrees with that of Abdou *et al.* (1999) and Tona *et al.* (2004). As it is shown in Table 3, chicks hatched from eggs stored for 14 days consumed significantly ($p<0.05$) more feed from 0-5 and 2-5 weeks of age and also tended to consume higher amount of feed during all other age periods than those hatched from one day stored eggs. Chicks hatched from eggs stored for 7 days significantly ($p<0.05$) consumed less feed at 2-4 weeks of age and tended to consume less feed most of the age periods compared with chicks hatched from one day or 14 days stored eggs (Table 3). The same table showed that chicks hatched from one day stored eggs had significantly ($p<0.05$) better feed conversion than those hatched from eggs stored for seven days at 0-1, 0-4 and 2-4 weeks of age and for 14 days at all age periods except at 2-3 weeks of age. On the other hand, chicks hatched from eggs stored for 7 days had significantly ($p<0.05$) better feed conversion at 0-3, 0-4 and 2-4 weeks of age than those hatched from eggs stored for 14 days. Table 4 indicates that live weight of slaughtered birds hatched from one day stored eggs was significantly ($p<0.05$) higher and had higher carcass, liver and abdominal fat weights than those hatched from eggs stored for 7 and 14 days which have statistically similar weights (Table 4). Females had significantly ($p<0.05$) lower live, carcass, liver and gizzard weights than males but had statistically similar heart and abdominal fat weight (Table 4). However females and chicks hatched from eggs stored for 7 days had higher carcass percentage than males and chick hatched from one day stored eggs, respectively. From the results reported herein, we conclude that, broilers

Table 4: Effect of pre-incubation egg storage duration on broilers' Live (LBW), Carcass (CW), Liver (LW), Heart (HW), Gizzard (GW) and Abdominal Fat (AFW) weights at 5 weeks of age

	LBW	CW	LW	HW	GW	AFW
Storage period in days (B)	**	**	*	NS	NS	*
01	1850.21[A]	1262.13[A]	34.92[a]	11.79	31.33	21.83[a]
07	1651.67[B]	1177.71[B]	31.67[b]	11.17	30.71	18.04[b]
14	1649.79[B]	1147.33[B]	31.92[b]	11.13	29.42	17.96[b]
Sex (S)	**	**	**	NS	*	NS
Females	1592.92[B]	1123.08[B]	30.69[B]	10.83	29.31[b]	19.36
Males	1841.53[A]	1268.36[A]	34.97[A]	11.89	31.67[a]	19.19
Bx S	NS	NS	NS	NS	NS	NS
SEM	±16.247	±10.473	±0.561	±0.330	±0.572	±0.656

*Significant (p<0.05). **Highly significant (p<0.01). NS = Non significant,
Means in the same column with different superscripts differ significantly (p<0.05)

Table 5: Effect of pre-incubation egg storage duration on broilers' Carcass Percentage (CP) of Live Body Weight (LBW), Liver (LP), Heart (HP), Gizzard (GP) and Abdominal Fat (AFP) percentages of Carcass Weight (CW) at 5 weeks of age

	CP (%)	LP (%)	HP (%)	GP (%)	AFP (%)
Storage period in days (B)	**	NS	NS	NS	NS
00	68.46[B]	2.76	0.94	2.49	1.73
07	71.38[A]	2.70	0.95	2.63	1.55
14	69.67[AB]	2.79	0.97	2.57	1.57
Sex (S)	*	NS	NS	NS	*
Females	70.58[a]	2.74	0.97	2.62	1.72[a]
Males	69.10[b]	2.76	0.94	2.51	1.51[b]
Bx S	NS	NS	NS	NS	NS
SEM	±0.003	±0.0002	±0.0003	±0.0004	±0.001

*Significant (p<0.05) **Highly significant (p<0.01) NS = Non Significant
Means in the same column with different superscripts differ significantly (p<0.05)

produced from one day stored hatching eggs had in general better growth performance which was reflected in higher body and carcass weights, less feed intake and better feed conversion than chicks produced from eggs stored for 7 or 14 days. Pre-incubation of hatching eggs for 7 days or more had an adverse effect on broilers' performance. The adverse effect, however, was more pronounced at early age periods and with prolonged pre-incubation storage of hatching eggs.

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