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EFFECT OF TURKEY EGG WEIGHT AND STORAGE PERIOD ON FERTILITY, HATCHABILITYPERCENTAGES AND HATCHING POULTS WEIGHT

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SUMMARY

This study was carried out to investigate the effects of turkey hatching egg weight and length of egg storage period on fertility, hatchability % and hatching poults weight. Eggs were collected from a Bronze Turkey (Baladi) flock aged 32 weeks and classified into 2 groups on the basis of storage period 4 and 10 days. Prior to egg storage, the eggs in each group were further divided according to egg weight into small: (≤ 55 gm); medium: (55.01-65gm) and large: (≥ 65.01gm) egg. The apparent fertility and the hatching poults weight were not affected significantly by the length of egg storage period. Hatchability of total and fertile eggs was affected significantly by length of storage period ($p < 0.001$). Apparent fertility and hatchability of total eggs was not significantly affected by hatching egg weight, while the hatching poults weight was significantly affected by the hatching egg weight ($p < 0.001$). There was no significant interaction between hatching egg weight and length of egg storage period for apparent fertility, hatchability of total and fertile egg % and hatching poults weight. It was concluded that hatchability percentages of total and fertile Turkey eggs decreased significantly due to long period of egg storage (10 days) by 11 and 14% respectively than short period of egg storage (4 days). Heavier poults weight at hatching could be obtained from large eggs weighing 65gm or more at setting.

INTRODUCTION

In Turkey breeding, one of the main aims of production is to provide an increase in poult production. The production costs of poults can be lowered by increasing egg yield, fertilization capacity, and hatchability.

Egg yield in Turkeys is lower compared to that in other poultry species ***Ozcelik,*** et al **(2006):**. For this reason, the primary way to increase the number of poults is to increase the number of eggs for hatching produced by each

mother bird, and these eggs should benefit from the most effective hatching procedure available.

In addition to low egg yield, decreases in the egg fertility and hatchability constitute great obstacles for breeding enterprises. Therefore, many authors are searching for ways to determine the factors affecting hatching, and for defining and improving the environmental factors affecting the factors related to hatching. There are strong positive correlations among pre-incubation egg weight, storage periods, chick weight and subsequent performance of different kinds of poultry ***Nahm,* (2001)** and **Loughln & Gousi(1999).**

The size of newly hatched chicks is directly related to the size of the hatching egg ***Farooq* et al (2001) and Shanawany (1984)** and the survival rate of birds hatched from small eggs was lower than those of larger eggs **Among et al (1984).** Early chick performance is influenced by egg source, since egg weight and chick weight at hatching are highly correlated (Halbersleben & Mussehl (1922). Embryo size before hatching and at hatching may be altered by egg weight and incubation environment regardless of the avian species . **Wilson (1992)** Hatching eggs, whether produced by chickens or turkeys, are not usually incubated immediately after lay. Hatching eggs are stored at both hatcheries and breeder farms, as the latter are usually located a considerable distance from one another and from the hatchery, thus daily egg pickup from all farms would be inefficient when hatching eggs are plentiful, eggs are stored at the hatchery until sufficient incubator space is available and when the number of eggs is limited, they may be stored at the hatchery until there are enough to fill large incubator racks. In preparation for a drop in egg production during hot weather, the hatchery may stockpile eggs in storage to maintain chick and poult production levels during the summer months ***Fasenko (1997).*** It is well documented that storage of fertilized poultry eggs depresses embryonic survival in a direct proportion to the length of the storage period ***Fasenko, (1996).***

Longer egg storage results in a decreased hatchability **Deeming (2000).** Also **Kosin (1964)** reported some adverse effects of extended storage on hatchability and the subsequent performance of the domestic fowl. These adverse effects include reduced hatchability and increased mortality and decreased body weight **Reis et al(1997)** of the chicks hatched from eggs which had been subjected to extended pre-incubation storage.

The aim of the present study was to examine the effect of hatching egg weight and length of egg storage period on fertility, hatchability percentages and hatching poults weight.

MATERIALS AND METHODS

This study was carried out in both Animal Production Department, Faculty of Agriculture, Moshtohor, Benha University (for bird rearing) and in a Private Hatchery (Zin El-Dean Hatchery), Kalyobia Governorate (for Egg storage and incubation).

Bird management

A total of 160 bronze turkey (Baladi) (150 female and 10 males) aged 32 weeks old and with an average body weights of 7.53kg and 4.52kg for males and females respectively were selected from a Bronze turkey (baladi) flock 4 weeks after the onset of egg laying. They were housed together in a separate poultry house measuring (10 ×15m) at the department of Animal Production, Faculty of Agriculture, Moshtohor, Benha University. So the allowed floor pace area per bird was 0.94m^2 according to **Mercia (1985)**. They were reared on a litter of fine sawdust 10cm depth.

Free mating was used in the flock, and the sex ratio was one male per 15 female as recommended by **Mercia (1985)** for light-type turkey breeders.

The birds were received 16 h of light per day by using of 60 watt bulbs 2.5m above the bird's level with 3 meter distance between each two bulb giving light intensity of 22.6 lux at the bird's back level.

Feed and water were offered ad-libitum. The birds were fed a basic breeder diet which was formulated according to **Mercia (1985)** and calculated according to **National Research Council (1994)** as shown in table (1). A hopper type of feeders was used for birds and was hanged above the birds and the lip of the hopper held at about the level of the bird's back to avoid feed waste. Large waterers made from a plastic bucket and a shallow pan was used for watering the birds.

Table (1): The composition and nutritive value of the basal breeder diet:

Ingredients	Percentage
Yellow corn	66.08
Soybean meal (44%)	23.22
Wheat Bran	5.60
Bone meal	3.53
$Ca\ Co_3$	0.53
Vit. and mineral mix (1)	0.42
Salt	0.35
Lysine	0.22
DL. methionine	0.05
Total	100
Calculated analysis: (2)	**Percentage**
Crude protein	17
ME (kcal/kg)	2850
Fat	2.86
Calcium	1.34
Phosphorus total	0.84
Available phosphorus	0.56
Methionine	0.35
Meth. + cyst	0.63
Lysine	1.03
Ash	3.25

1- Vit. and Min. mixture: (Multi-mix) the Egyptian – Holland Co ®
2- Calculated according to **National Research Council (1994).**

Experimental design

Freshly laid Bronze Turkey (Baladi) eggs were collected daily from a flock aged 32 weeks old. A total of 900 eggs were obtained and classified into two storage treatment groups of 4 (S1) or 10 (S2) days (450 eggs for each group). The storage lengths were chosen based on industry practices in which hatching eggs are commonly stored prior to incubation for 3 to 7 days **Fasenko et al (2001).**

Prior to egg storage, the eggs in each group were further divided into three subgroups according to the weight : (small eggs ≤ 55gm,(E1) Medium eggs: 55.01-65gm,(E2) and large eggs: ≥ 65.01gm),(E3). Each egg weight treatment is represented by 150 eggs as three replicates per treatment (50 eggs each).

Each egg in all treatment were individually weighed and marked prior to storage. All egg treatment groups were stored in a special storage room and kept at 12.5C° and 75% relative humidity for the entire period of storage according to **Christensen et al (2003).**

Eggs were removed from the cold storage room and allowed to warm overnight to room temperature before setting. After that all egg treatment groups were set in a **Petersime®** incubator . Temperature and humidity in the incubator were 36.6-37.8C° and 84%-86%, respectively for the first 25 days while in the hatcher they were 35.6-36.6C° and 90%-92%, respectively for the last 3 days according to **Ozcelik et al (2006).**

Hatching usually started on day 27 and was completed by end of day 28. The poults were removed from the hatcher and counted and individually weighed and any unhatched eggs were broken to determine fertility.

Parameters measured

The variables investigated in the study were determined as follows according to **Ozcelik et al (2006):**

- **Egg fertility (%)** = (Number of fertile eggs / total number of eggs incubated) × 100.
- **Hatchability of total eggs (%)** = (Number of chicks hatched / total number of egg incubated) × 100.
- **Hatchability of fertile eggs (%) (Machine yield)** = (Number of chick hatched / number of fertile eggs) × 100.

Statistical analysis

- Analysis of variance was calculated by using **SAS procedure guide 1996**
- Means were compared by the "Duncan" multiple comparison **(SAS, 1996)**
- Egg weight and length of egg storage period were the main effect

RESULTS AND DISCUSSION

Data presented in table (2) show the least square means and standard errors of apparent fertility, hatchability of total eggs, hatchability of fertile eggs percentages and hatching poults weight as affected by storage period and egg weight and the interaction between storage period and egg weight. Regarding the effect of storage period on apparent fertility % of turkey egg, from the obtained results it is clear that there were no significant differences between apparent fertility % for eggs stored for 4 days or 10 days. The apparent fertility were 76.44 and 76.22% for 4 and 10 days storage period, respectively.

The obtained results regarding apparent fertility % may be due to that fertilization of eggs would or would not have occurred before the eggs were exposed to the different storage period treatments. The obtained results regarding the effect of storage period on apparent fertility % agreed with those obtained by ***Fasenko et al.*** **(2001)** who found that storage of turkey egg for 4 or 14 days did not significantly affect fertility.

Regarding the effect of storage period on hatchability of total and fertile egg %, it is cleared that there were highly significant differences between hatchability of total and fertile eggs % for eggs stored for 4 and 10 days. The results were (58.89 and 77.06%); (48 and 63.04%) for the hatchability of total and fertile eggs stored for 4 and 10 days respectively.

These results are in agreement with those obtained by ***Fasenko et al.*** **(2001)** who found that long period of egg storage (14 days) significantly reduce the hatchability of total eggs by (4.8%) and of fertile eggs by (6.49%) compared with eggs stored for 4 days.

The decreased hatchability % of eggs stored for longer period may be due to that longer storage of egg prior to incubation leads to morphological changes in the embryo (***Bakst and Gupta*** **(1997)**; ***Mather and Laughlin*** **(1979)** and depressing the embryonic survival rates as mentioned by ***Meijerhof*** **(1992)** and also increasing length of egg storage period lead to increasing water loss and albumen degradation and so increasing early and late embryonic mortalities as explained by ***Petek et al.*** **(2005).**

Regarding the poults weight at hatching, the obtained results in the present study revealed that there were no significant differences between poults weight hatched from eggs stored for 4 days (51.73gm) and those hatched from eggs stored for 10 days (51.23gm). The obtained results in the present study regarding the hatching poults weight are in agreement with those reported by

Reinhart and Hurnik **(1976)** who found that length of storage times did not have a significant effect on chick body weight. On the other hand, the obtained results disagreed with those reported by ***Kosin*** **(1964)** in domestic fowl and by ***Dere et al.*** **(2005)** in Quail who found that long term storage of egg had adverse effect on hatchability and body weight of hatched chick.

Regarding the effect of hatching egg weight on the studied variables, from the obtained results it is clear that there were no significant differences in the apparent fertility, and hatchability of total eggs % due to differences in egg weight. The apparent fertility were (74.67, 77 and 77.33%) for small, medium and large egg respectively. The obtained results are in agreement with the results obtained by ***Petek et al.*** **(2005)** who reported that hatching egg weight has no significant effect on apparent fertility % in Pharaoh quail's egg. Also ***Vieira et al.*** **(2005)** found that egg weight has no significant effect on hatchability % in Ross breeder's egg.

Regarding the effect of egg weight on hatchability of fertile egg it is clear that there were no significant differences between hatchability of fertile eggs % for medium and large eggs. They were 69.29 and 68.92% respectively, while there was a slight increase in the percentage of hatchability of fertile egg of small eggs it was (71.95%) and these results may be in accordance with those opinion reported by ***Lerner and Gunns*** **(1952)** who demonstrated that in flocks selected for large egg size, the eggs with optimum hatchability were usually below the mean egg size of the population.

Regarding the effect of different egg weight on the hatching poults weight from the obtained results it is clear that there were highly significant differences in hatching poults weight as affected by different egg weights. The poults weights at hatching were 41.53, 50.21 and 62.30gm for small, medium and large egg respectively. The obtained results in the present study for poults weight at hatching are in agreement with those obtained by ***Todd and Michael*** **(1996)** who found that turkey egg weight was positively correlated with poult weight and they added the increased egg size was associated with decreased moisture loss through 25 days of incubation and increased poult weight as a percentage of egg weight. Also the obtained results are in accordance with those obtained by ***Vieira et al.*** **(2005)** for Ross breeder and by ***Farooq et al.*** **(2001)** for Quail they reported that the size of newly hatched chicks is directly related to the size of the hatching egg which mean that heavier eggs produce heavier chicks. Regarding the hatching egg weight X length of egg storage period interactions, there was no significant effect on apparent fertility, hatchability of total and fertile eggs % or poult weight at hatching. The non significant interactive

effects are in agreement with the results recorded by ***Petek et al.*** **(2005)** who found no hatching egg weight X length of egg storage period interactions on apparent fertility, hatchability of total and fertile egg % and chick weight at hatching in Quail.

In conclusion, hatchability % of total and fertile turkey eggs decreased significantly due to long period of egg storage (10 days) by 11 and 14% than short period of egg storage (4 days). Heavier poults weight could be obtained from large turkey eggs weighing 65gm or more at setting.

Table (2): Least square means and standard error for the effect of storage period and egg weight on apparent fertility, hatchability of total and fertile eggs and poults weight at hatching.

Item	No.	Apparent Fertility (%)	Hatchability of total egg (%)	Hatchability of fertile egg (%)	No.	Poult weight at hatching
Storage period (s)						
4 days (s_1)	9	76.44 ± 1.11a	58.89 ± 0.65a	77.06 ± 0.59a	266	51.73 ± 0.21a
10 days (s_2)	9	76.22 ± 1.11a	48.00 ± 0.65b	63.04 ± 0.59b	222	51.23 ± 0.22a
Egg weight (E)						
Small (E_1)	6	74.67 ± 1.36a	53.67 ± 0.79a	71.95 ± 0.72a	161	41.53 ± 0.26c
Medium (E_2)	6	77.00 ± 1.36a	53.33 ± 0.79a	69.29 ± 0.72b	166	50.21 ± 0.26b
Large (E_3)	6	77.33 ± 1.36a	53.33 ± 0.79a	68.92 ± 0.72b	161	62.30 ± 0.26a
S × E						
$S_1 \times E_1$	3	74.67 ± 1.92a	58.00 ± 1.12a	77.69 ± 1.02a	87	41.40 ± 0.36d
$S_1 \times E_2$	3	76.67 ± 1.92a	59.33 ± 1.12a	77.40 ± 1.02a	89	50.20 ± 0.36c
$S_1 \times E_3$	3	78.00 ± 1.92a	59.33 ± 1.12a	76.10 ± 1.02a	90	63.38 ± 0.35a
$S_2 \times E_1$	3	74.67 ± 1.92a	49.33 ± 1.12b	66.21 ± 1.02b	74	41.67 ± 0.39d
$S_2 \times E_2$	3	77.33 ± 1.92a	47.33 ± 1.12b	61.18 ± 1.02c	77	50.42 ± 0.38c
$S_2 \times E_3$	3	76.67 ± 1.92a	47.33 ± 1.12b	61.74 ± 1.02c	71	62.08 ± 0.40b
ANOVA						
Storage period		n.s	***	***		n.s
Egg weight		n.s	n.s	*		***
Storage × egg weight		n.s	n.s	n.s		n.s

* $p < 0.05$ ** $0.05 < p < 0.01$

*** $p < 0.001$ n.s non significant

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تأثير وزن بيض الرومى وفترة تخزينه على نسبة الخصوبة والفقس ووزن الكتاكيت عند الفقس

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أجريت هذه الدراسة لبحث تأثير وزن البيض في الرومى البلدي وفترة تخزينه على نسبة الخصوبة والفقس ووزن الكتاكيت عند الفقس، تم تجميع عدد 900 بيضة من قطيع رومي برونزي بلدى عمر 32 أسبوع 0 تم تقسيم البيض إلى مجموعتين على أساس فترة تخزين البيض0 مجموعة تم تخزينها أربعة أيام والأخرى تم تخزين البيض بها لمدة عشرة أيام قبل دخوله الحضانة 0 قبيل عملية التخزين تم تقسيم البيض داخل كل مجموعة إلى ثلاثة مجموعات على أساس وزن البيض مجموعة (أ) (بيض صغير) وكان وزن البيض بها 55 جرام فيما أقل، مجموعة (ب) (بيض متوسط) وكان وزن البيض بها 55.01 – 65 جرام ثم مجموعة (ج) (بيض كبير) بوزن 65 جرام فيما أكثر0

ويمكن تلخيص نتائج هذه الدراسة كما يلى:-

- وجد أن نسبة الخصوبة لبيض الرومى البلدى ووزن الكتاكيت عند الفقس لم تتأثر معنوياً بطول فترة تخزين البيض 0
- نسبة الفقس للبيض الكلى والبيض المخصب تأثرت معنوياً بطول فترة التخزين حيث كانت نسبة الفقس للبيض الكلى (58.89، 48%) وكانت (77.06، 63.04%) للبيض المخصب لكلاً من فترتى التخزين 4و 10 يوم على التوالى 0

- وجد أن كلاً من نسبة الخصوبة والفقس للبيض الكلى لم تتأثر معنوياً بأوزان البيض المختلفة بينما تأثر وزن الكتاكيت عند الفأس تأثيراً معنوياً بأوزان البيض حيث كانت أوزان الكتاكيت عند الفقس 41.53، 50.21 و 62.30 جرام لمجموعات أوزان البيض الصغير والمتوسط والكبير الوزن على التوالى0

وخلصت الدراسة إلى :-

(1) نسبة الفقس لبيض الرومى الكلى والمخصب تقل معنوياً بسبب طول فترة التخزين (عشرة أيام) بحوالى 11 و 14% على التوالى عنها فى فترة التخزين (أربعة أيام)

(2) يمكن الحصول على أوزان أكبر للكتاكيت عند الفقس باستخدام بيض الرومى بوزن 65 جرام فيما أكبر عند دخول البيض للحضانات0