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EFFECT OF EGG WEIGHT ON SOME HATCHABILITY TRAITS IN BANDARAH AND GIMMIZAH BREEDS

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Abstract

A total of 900 eggs from Bandarah and Gimmizah hens were used in this study to determine the effect of egg weight on some hatchability traits, chick weight, shell thickness, hatchability %, embryonic mortality, mal position and non-hatched pipped eggs (dead in shell). The results can be summarized as follows:

1. Weight of hatched chick was increased as egg weight increased in both Gimmizah and Bandarah eggs. On the other hand, there were no significant differences in respect of chick weight% between different classes.
2. Bandarah eggs had significantly higher hatchability % than Gimmizah eggs. Although there were no significant differences among Bandarah egg weight classes in hatchability %, but medium egg weight of Gimmizah had higher hatchability % than both large and small eggs.
3. There were no significant differences in shell thickness due to hen strain or egg weight classes. However, non-hatched eggs had thicker shell eggs than hatched eggs.
4. Percentages of non-hatched pipped eggs showed the major efect on the non-hatched eggs 93.99, 93.29% from the total non-hatched eggs for Gimmizah and Bandarah, respectively.
5. Early embryonic mortality played a second role in decreasing hatchability, it recorded 6.57, 5.74% from the total non-hatched Bandarah and Gimmizah eggs, respectively.
6. Mal position embryos had very low effect in lowering hatchability % in the two strains.

It can be concluded from this study that medium Gimmizah eggs had significantly higher hatchability % than both large and small eggs, but in Bandarah, egg weight had no significant effect on the percentages of hatchability. Further studies are necessary to determine the factors that resulted to lowering percentages of non-hatched pipped eggs and early embryonic mortality.

INTRODUCTION

Hatchability is one of the fundamental characters in the breeding flocks of poultry. High hatchability of fertile eggs is a major goal to be achieved by the poultry breeders. A lot of money is lost from any decrease in hatchability, therefore, any success in improving hatchability is considered to be a good approach in poultry industry.

Many genetic and environmental factors affect hatchability. Some workers indicated significant correlation between egg weight and each of hatchability and chick weight at hatchnig (Hanafi, 1981). Goher *et al.* (1994) showed decreased infertility and hatchability percentages of Gimmizah and Mamoura eggs in high and low egg weight than medium one. Also, Kader *et al.* (1986) showed that hatchability of Fayoumi eggs classified as medium was significantly higher than those of either small or large eggs. On the other hand, Proudfoot and Hulan (1981) showed no significant effect of egg size on hatchability of eggs.

Also, there are many factors that influence on embryo development and survival rate before and after incubation. Wagdy *et al.* (1994) classified the total embryonic mortality to dead germs and pipped chicks with abnormalities, and found that they were lowest in Fayoumi breed than other developed strains. This tend was noticed also during the moderate weather. Robinson *et al.* (1991) observed that the early embryonic mortality of the first egg of a sequence was higher than those of within a sequence. More attention must be focused in identification of the causes of embryonic mortality.

Therefore, this experiment was conducted to study the relationshipp between egg weight and each of the following traits: shell thickness, mal position, embryonic mortality and hatchability percentages for Gimmizah and Bandarah eggs.

MATERIALS AND METHODS

This experiment was carried out during 1995 at Seds Poultry Research Station, Animal Production Research Institute, Agricultural Research Center, Ministry of Agriculture.

A total of 900 eggs were obtained from two strains of chickens, Gimmizah and Bandarah, at 32 weeks old. Birds were fed *ad libitum* a commercial laying diets 16.0% crude protein and 2700 k.cal M.E./kg. The eggs were collected daily during one week period and were held during collecting period in a holding room at about $18^{o}C$ temperature and 60% relative humidity (RH).

After the collection period, eggs were weighed to the nearest 0.01 gramme and classified according to their weights to three classes: small, medium and large. The corresponding figures were, 50.66, 54.61, 56.77, and 48.76, 51.90, 54.64 for Gimmizah and Bandarah, respectively. Each group was divided into three equal replicates. All eggs were incubated in automatic draft incubator. On 18th day of incubation period, the eggs were candled and the fertile eggs were removed out from the incubator. On twenty first day of incubation, hatched chicks were removed from the hatcher and weighed to the nearest one. All non-hatched eggs were examined for evidence of stage of embryonic mortality.

Experimental parameters

1. Shell thickness at three areas within each of three eggshell regions (large, equator and small end) were measured and averaged without membrane by using micrometer capable of 0.01 mm, for hatched and non-hatched eggs.

2. Fertility %.

3. Hatchability %, recorded as a percent of the total number of fertile eggs.

4. Chick weight to the nearet one at hatching time.

5. Chick weight %, by dividing average chick weigh / average egg weight x 100.

6. Total non-hatched eggs% classified as the following:

a. pipped eggs %: chicks having normal position, pipped and failed to hatch.

b. mal-position embryos %.

c. total embryonic mortality, classified as early embryonic mortality (embryos dead before 7 days of incubation period) and late embryonic mortality (embryos dead between 7 days to hatching time.

Data were statistically analyzed using the analysis of variance (Harvey, 1987). As for comparison between means, Duncans test was applied (Snedecor and Cochran 1974).

The following statistical model was used:

Yijk = M + Si + Tj + Stij + Eijk.

where : Y is the value of observation

M is the general means.

Si is the breed effect.

Tj is the effect of egg weight.

ST ij is the interaction between egg weight and breed.

E ijk is the experimental error.

RESULTS AND DISCUSSION

Chick weight

It was observed from Table 1 that the large eggs produced significantly heavier chick than both medium and small eggs, 35.58, 34.45 and 32.26g for large, medium and small Gimmizah ones, respectively. In Bandarah eggs, small eggs produced significantly lighter chicks than medium and large ones, 30.80, 34.27 and 34.96 g, respectively. There are positive correlation between egg weight and chick weight for both Gimmizah and Bandarah chicks (Table 4). On the other hand, there were no significant differences between Gimmizah and Bandarah chick weight, 34.10, 33.34g, respectively. These results are in agreement with the findings of Kader *et al.* (1986) and Manduor *et al.* (1990), who found that high egg weight produced heavier chick weight.

Chick weight %

There are no significant differences among classes in this trait; the values ranged from 62.68% for Gimmizah large eggs to 64.44% for Bandarah medium eggs as shown in Table 1.

Hatchability %

Table 1 shows the averages of hatchability percentages for different classes of egg weight. It was observed that Bandarah eggs had significantly higher hatchability (92.23%) than Gimmizah eggs (88.81%). In view of the effect of egg weight, it was noticed that there were no significant differences between different classes, small, 92.69, medium 91.41 and large, 92.61 for Bandarah eggs. These results were in agreement with the findings of Produdfoot and Hullan (1981) who did not find significant effect of egg weight on hatchability. On the other hand, Gimmizah medium aggs had significantly higher hatchability 91.03% than both of small, 87.5% and large 87.60% ones. Moreover, there was positive correlation between egg weight and hatchability in Gimmizah eggs as shown in Table 4. These findings were in agreement with Kader *et al.* (1986) who found significantly higher hatchability for Fayomi eggs classified as medium than those of either small or large ones.

Shell thickness

In hatched eggs, there were no significant differences between any of the different classes of egg weight in respect of shell thickness of Gimmizah eggs, as

Table 1. Effect of egg weight on some hatching traits.

Item	Egg weight classes							
	Gimmizah				Bandarah			
	small	medium	large	mean	small	medium	large	mean
Chick	bc	bc	a	AB	c	ab	ab	B
weight (g)	32.26	34.45	35.58	34.10	30.80	34.27	34.96	33.34
Chick	a	a	a	A	a	a	a	A
weight (%)	63.71	63.07	62.68	63.15	63.16	64.44	63.97	63.86
hatchability	b	a	b	B	a	a	a	A
(%)	87.50	91.03	87.60	88.81	92.69	91.41	92.61	92.23
fertility	ab	b	ab	A	ab	a	a	AB
(%)	94.89	93.05	95.54	94.50	94.69	96.67	96.22	92.23
Shell (h)	a	a	a	A	b	b	a	A
thickness (mm)	0.35	0.36	0.36	0.35	0.32	0.32	0.39	0.35
Shell (n)	a	b	a	A	a	b	b	AB
Thickness (mm)	0.36	0.41	0.37	0.38	0.36	0.40	0.41	0.39

Means having different small or capital letters within each row are significantly different at ($P<0.05$).

(h) Shell thickness of hatched eggs.

(n) Shell thickness of non-hatched eggs.

shown in Table 1, but, in Bandarah eggs, shell thickness of large eggs had significantly more shell thickness than low and medium ones (0.39 vs 0.32, 0.32, 0.32 mm). These results were confirmed with the findings of El-Wardany *et al.* (1994) who found that high egg weight group had more shell thickness than low egg weight. In general, it can be noticed that, non-hatched eggs had thicker shell than the hatched ones 3.5.38 and 0.35,0.39 mm for hatched and non-hatched eggs in Gimmizah and Bandarah eggs, respectively. These differences in shell thickness between hatched and non-hatched eggs may be attributed to the more consumption of calcium carbonate by the live embryo than the dead one in the non-hatched eggs (Salah, 1988). Our results indicated that shell thickness trait could not be considered as a good indicator for expecting hatchability percentages.

Non-hatched eggs %

It was observed from Table 2 that, Gimmizah eggs had significantly higher percentages of non-hatched eggs (11.32) than Bandarah eggs (7.67%). Most of non-hatched eggs were pipped eggs, but chicks failed in hatch, recorded (10.64%) in Gimmizah and 7.24% in Bandarah eggs. Moreover, medium Gimmizah eggs had significantly lower non-hatched pipped eggs (8.31%) than both large (11.9%) and small (11.73%) eggs. On the other hand, there were no significant differences among egg classes of Bandarah breed. When we calculated the non-hatched pipped eggs as a percentage from total non hatched eggs, it can be revealed that, non hatched pipped eggs recorded 93.99% from the total non-hatched Gimmizah eggs and 93.29% in Bandarah eggs (Table 3).

Bandarah eggs had significantly lower embryonic mortality 0.519% compared to Gimmizah eggs 0.668% (Table 2). Moreover, in Gimmizah eggs, total embryonic mortality percentages were significantly decreased as egg weight increased. They were 0.600, 0.753, 0.653, 0.600% for small, medium and large eggs, respectively. In Bandarah eggs, both small and large eggs had significantly lower embryonic mortality percentages than medium eggs, 0.463, 0.477 and 0.617% for small, large and medium eggs, respectively. It was also observed from Table 2 that, most embryonic mortality for the different egg classes occurred during the first 7 days of incubation period (early embryonic mortality), where 82% from the total embryonic mortality was recorded in this period for Gimmizah eggs and 63% for Bandarah eggs. When the early embryonic mortality was determined as percentages of the total non-hatched eggs, as shown in Table 3, it was noticed that, early embryonic mortality had an important role following the pipped eggs, 5.74 and 6.57% for Gim-

Table 2. Effect of egg weight and breed on embryonic mortality, ml position and non-hatched pipped eggs.

Item	Egg weight classes							
	Gimmizah				Bandarah			
	small	medium	large	mean	small	medium	large	mean
non hatched eggs %	a 12.50	b 8.97	a 12.50	A 11.32	b 7.31	b 8.95	b 7.39	B 7.76
pipped eggs %	a 11.73	b 8.31	a 11.90	A 10.64	b 6.84	b 7.97	b 6.91	B 7.24
Mal-position Embryo %	a 017	b 007	c 000	B 008	b 007	b 003	b 003	B 004
Early embryonic mortality %	a 697	b 653	d 600	C 650	f 463	d 617	f 451	E 510
Late embryonic mortality %	a 056	e 000	e 000	C 018	e 000	e 000	b 026	D 510
Total embryonic mortality %	a 753	B 653	c 600	B 668	e 463	c 617	e 477	D 519

Means having different small or capital litters within each row are significantly different (p<0.05).

mizah and Bandarah eggs, respectively. There was no correlation between egg weight and this trait (Table 4).

It was shown from Table 2 that, small eggs have higher mal-position percent than both medium and large eggs with significant differences in Gimmizah eggs, but, there were no significant differences in Bandarah eggs. Percentage values were 0.017, 0.007, 0.000, 0.007, 0.003 and 0.003 for small, medium and large of Gimmizah and Bandarah eggs, respectively. Also, it was observed that there were no significant differences between Gimmizah and Bandararah in this trait. When the mal-position eggs was determined as a percentage of the total non-hatched eggs (Table 3), it can be observed that mal-position had very low percentages in both Gimmizah and Bandarah eggs 0.07 and 0.03%, respectively.

Table 3. Embryonic mortality, mal-position embryos and pipped eggs as percentages of total non-hatched eggs.

Item	Egg weight classes							
	Gimmizah				Bandarah			
	small	medium	large	mean	small	medium	large	mean
Total non-hatched eggs %	100%	100%	100%	100%	100%	100%	100%	B 100%
pipped eggs %	93.84	92.64	95.20	93.99	93.57	92.78	93.50	93.29
mal position%	13	08	00	07	09	03	04	03
early embryonic mortality %	5.57	7.27	4.80	5.74	6.33	7.18	6.10	6.57
late embryonic mortality %	44	00	00	15	00	00	3,7	10
total embryonic mortality %	6.01	7.27	4.80	5.90	6.33	7.18	6.45	6.67

Table 4. Correlation coefficient of Gimmizah and Bandarah egg weight with chick weight, hatchability %, pipped eggs, mal-position and embryonic mortality.

breed	Traits				
	chick weight (g)	Hatchability %	Pipped eggs %	mal-position %	embryonic mortality %
Gimmizah	+ 0.9	+ 0.8	-0.5	- 0.2	0.0
Bandarah	+ 0.7	+ 0.5	-0.3	- 0.1	0.0

- Negative correlation. + Positive correlation. 0.0 No correlation.

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تأثير وزن البيضة علي بعض صفات الفقس في سلالتي البندرة والجميزة

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استخدم في هذا البحث عدد ٩٠٠ بيضة تفريخ من سلالتي البندرة والجميزة بمعدل ٤٥٠ بيضة لكل سلالة قسمت حسب وزنها الي ثلاث مجموعات (كبير - متوسط - صغير) وذلك لدراسة تأثير وزن البيضة علي كل من وزن الكتكوت - سمك القشرة - نسب النفوق الجنيني والاوضاع الشاذة الجنينية الاخرى. وقد وجد الاتي :

١- زادت اوزان الكتاكيت الناتجة بزيادة وزن البيضة المفرخة في كل من سلالتي البندرة والجميزة. كما كانت كتاكيت الجميزة اعلي في الوزن عن سلالة البندرة ولم يكن هناك فروق معنوية بين مجموعات البيض من حيث نسبة وزن الكتكوت الناتج الي وزن البيض المفرخ.

٢- تفوقت سلالة البندرة بفارق معنوي عن سلالة الجميزة في نسبة الفقس ولم تكن هناك فروق معنوية بين مجموعات البيض في سلالة البندرة بينما في سلالة الجميزة تفوق البيض المتوسط بصورة معنوية عن البيض الكبير والصغير في نسبة الفقس.

٣- لم تكن هناك فروق معنوية بين مجموعات البيض في سمك القشرة لأي من السلالتين ولكن زاد سمك القشرة في البيض الفاقس عن البيض الغير فاقس في كل المعاملات.

٤- احتلت نسبة البيض الناقر وغير الفاقس اعلي نسبة من النسبة الكلية للبيض الغير فاقس وكانت ٩٣,٩٩ و ٩٢,٢٩٪ في سلالة الجميزة والبندرة بالترتيب وكان لها الدور الرئيسي في التأثير علي نسبة الفقس لجميع مجموعات البيض.

٥- لعبت نسبة النفوق الجنيني المبكر في جميع مجموعات البيض دورا ثانويا في خفض نسبة الفقس حيث شكلت نسبة ٦,٥٧ و ٥,٧٤٪ لسلالة البندرة والجميزة علي التوالي من نسبة البيض الغير فاقس.

٦- نسبة الاوضاع الشاذة الجنينية لها دور محدود في التأثير علي نسبة الفقس لجميع المجموعات.

ويمكن القول من هذه الدراسة بأن البيض متوسط الحجم يعطي نسبة فقس اعلي من البيض الصغير والكبير في سلالة الجميزة اما في سلالة البندرة فلم يكن هناك تأثير معنوي لوزن البيضة علي صفة الفقس. كما انه لكي يتم تحسين نسب الفقس في بيض كل من سلالتي الجميزة والبندرة فانة يلزم المزيد من الدراسة لتحديد الطرق والعوامل التي تؤدي الي خفض وتقليل نسبة البيض الناقر وغير الفاقس وكذلك نسبة النفوق الجنيني المبكر حيث ان لهما الدور الرئيسي في تحديد نسبة الفقس.