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The Relationships between Hatchability and Interior Egg Characteristics in Fayoumi

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THE HATCHABILITY percentage was estimated for190 Fayoumi hens, on a total number of 9703 eggs. Correlations of hatchability percentage (and arc $\sqrt{H\%}$) with some of the egg characeristics were calculated. These characteristics were egg weight, yolk weight, albumen weight, shell weight, shell thickness, yok percentage, arc $\sqrt{Y\%}$, albumen percentage, arc$\sqrt{A\%}$, shell percentage, are $\sqrt{S\%}$, egg number, yolk/albumen and albumen/yolk ratios. All the correlations were found to be of very small magnitudes. The highest correlations were observed between hatchability and the shell characteristics (shell weight, shell percentage and shell thickness). These were all negative. An index of a higher correlation (0.1355) was suggesed using yolk weight, albumen percentage and shell percentage.

Hatchability percentage is one of the most important economic characteristics for poultry raisers. This character, however, has only a very low heritability since it is connected with fitness and most of the factors affecting it are environmental. The temperature, humidity, the turning of eggs, the chemical environment during hatching, oxygen supply and ventilation are but some of these environmental factors (Landauer, 1951). The characteristics of the egg itself, for instance its weight, shape, colour and quality, have its role in determining hatchability percentage (Ghany and Kamar, 1966). Any appreciable degree of relation between the characteristics of the egg and hatchability should be of practical importance.

Material and Methods

This work carried out at the Poultry Breeding Farm, Faculty of Agriculture, Cairo University. Data about hatchability were collected on a total number of 190 hens, represented by at least 20 fertile eggs, summing up 9703 eggs, produced during the period from October to April. Two eggs out of each then were used for egg components studies.

The components of each egg were examined and the mean of the two eggs of every hen were used for analysis. Shell thickness for each individual egg was taken as the mean of four measurements : two on the equatorial regions and one on each of the two ends. The characteristics to be correlated with hatchability percentage (H%) and are $\sqrt{HA\%}$ included egg weight (E), yolk weight (Y), albumen weight (A), shell weight (S), shell thickness (ST), yolk percentage (Y%), are $\sqrt{Y\%}$ (YA), albumen percentage (A%), arc $\sqrt{A\%}$ (AA), shell percentage (S%), arc $\sqrt{S\%}$ (SA), egg number (EN), yolk/albumen (Y/A) and albumen/yolk (A/Y).

Results and Discussion

The Fayoumi eggs are known to be of a relatively small size, compared to the standard foreign breeds, and by its higher percentage of yolk and shell and its thicker shell (Hafez *et al.*, 1954 ; Mostageer, 1958 and Kamar, 1967). The means obtained in this study (Table 1) are in agreement with the foregoing statement. Scott and Warren (1941) found in White Leghorns that the mean ratio for yolk to albumen was 1 : 2, but the ratio obtained here for Fayoumi is a bit lower (1.81).

TABLE 1. **Means of the traits studied.**

Item	Means	Item	Means
E	45.75	AA	48.81
Y	13.75	S %	11.89
A	24.78	SA	20.78
S	5.20	EN	51.07
ST	0.34	Y/A	0.56
Y %	31.47	A/Y	1.81
YA	34.10	H %	76.18
A %	56.62	HA	61.46

Hens were divided into six groups according to egg weight and the hatchability percentages were averaged for each group (Table 2). This table shows no general trend, the highest hatchability occurred in the group whose eggs ranged between 40 and 42 g and the lowest in the group ranging between 42 and 44 g. However, no significant differences were

found between groups. Godfrey (1963), using different breeds, found that egg weight has no appreciable linear effect on hatchability. Dunn (1922), found that lower weights of eggs have higher hatchability percentage than the higher weights. Jull and Hayness (1925), found also that the smallest egg weight class showed the highest hatchability percentage but the difference was not significant. Warren (1941), found that large egg size tends to reduce hatchability. However, Penionthkevich (1945). Skoglund *et al.*, (1948) and Kumanov (1948), reported that both the largest and the smallest eggs hatched less well than those of medium weight.

The data wre re-arranged according to shell weight (Table 3), shell percentage (Table 4) and shell thickness (Table 5). It may be seen that the group of the lowest shell weight showed the highest hatchability. With respect to the results in Table 4, it may still be true that the lower percentage of shell tends to be associated with higher hatchability. With respect to shell thickness (Table 5), it is clear that two intermediate groups showed higher hatchability percentage. However, the statistical analysis in all the three cases proved that the differences between groups are insignificant.

TABLE 2. **The relationship between egg weight and hatchability percentage.**

Item	Range of egg weight (g)					
	less than 40.00	40.00 to 41.99	42.00 to 43.99	44.00 to 45.99	46.00 to 47.99	48.00 and more
Number of hens . .	17	38	49	48	30	8
Means of H % . .	76.58	78.43	74.25	75.60	76.24	76.16

MS between groups was 78.9, and F value was 0.562 (NS).

TABLE 3. **The relationship between shell weight and hatchability percentage.**

Item	Range of shell weight (g)				
	less than 4.50	4.50 to 4.99	5.00 to 5.49	5.50 to 5.99	6.00 and more
Number of hens . .	15	54	71	38	12
Means of H% . . .	79.49	75.68	76.50	75.05	76.02

TABLE 4. The relationship between shell percentage and hatchability percentage.

Item	Range of shell percentage				
	less than 11.50	11.50 to 11.99	12.00 to 12.49	12.50 to 12.99	13.00 and more
Number of hens . .	50	55	39	25	21
Means of H% . . .	76.16	79.05	73.56	76.08	73.75

MS between groups was 210.89, and F value was 1.511 (NS).

TABLE 5. The relationship between shell thickness and hatchability percentage.

Item	Range of shell thickness (mm)			
	less than 0.30	0.30 to 0.32	0.33 to 0.35	0.36 and more
Number of hens	15	64	69	42
Means of H%	74.86	77.60	76.44	74.06

MS between groups was 116.23, and F value was 0.809 (NS).

The correlations between the hatchability percentage and arc $\sqrt{H\%}$ and all the egg characteristics studied were calculated and presented in Table 6. All the correlations were low and insignificant, and some were in fact very low (almost zero). The lowest correlations were found between the hatchability percentage and each of the following characters : egg weight, albumen weight and egg number (values ranging between -0.0060 to 0.0016). The highest correlations were found with shell characteristics (S%, SA, ST and S) and were all negative (values ranging between -0.0716 and -0.1147). Very few reports are available for comparison. Dunn (1922), found no correlation between mean egg weight of individual birds and mean hatchability percentage of the same individuals. Godfrey (1963),found low but significant negative correlation between albumen weight and hatchability. Bronkhorst (1933), Bronkhorst and Hall (1935) and Rudy and Marble (1939), found no relation between yolk weight and hatchability. Wilhem (1939), found a

correlation of 0.164 between thickness of the shell and hatchability. The corresponding correlation obtained in this study is in fact lower than this estimate, although it was the highest among the correlations examined. Thus if any of the egg characteritics is to be used by the poultry raiser, shell thickness would be the one.

TABLE 6. The correlations between hatching percentage (H%) and arc of $\sqrt{H\%}$ and the different characters of the egg.

Item	H%	Arc$\sqrt{H\%}$
E	0.0044	—0.0129
Y	0.0511	0.0385
A	—0.0060	—0.0195
S	—0.0716	—0.0738
ST	—0.0905	—0.0918
Y%	0.0464	0.0286
YA	0.0527	0.0531
A%	0.0473	0.0364
AA	0.0429	0.0314
S%	—0.1147	—0.1025
SA	—0.1141	—0.1037
EN	0.0344	0.0016
Y/A	0.0384	0.0405
A/Y	—0.0409	—0.0434

* All values are insignificant.

The three main characteristics of the shell (shell weight, shell thickness and shell percentage) were all used to arrive at indices with both H% and HA. The two indices calculated with respective order are as follows :

$$I_H = +0.1095\ S - 0.1594\ ST - 1.8570\ S\ \%$$
$$I_{AH} = -0.1451\ S - 0.3158\ ST + 1.1916\ S\ \%$$

The correlations coefficient for the two indices were 0.1203 and 0.1191 respectively. These are higher than all the simple correlations with the same characters. However, another index was calculated to augument the correlation coofficient with the hatchability percentage. The characters used for

this index were yolk weight, albumen percentage and shell percentage. The index was as follows :

$$I_H = + 0.0234\ Y - 0.4254\ A\% + 1.7924\ S\ \%$$

The correlation was 0.1355. The index calculated using the three foregoing characters with the HA gave only the correlation of 0.1037. It seems that the hatchability percentage as such may be used in the correlation rather than the arcsine $\sqrt{H\%}$.

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العلاقة بين نسبة الفقس وصفات البيضة فى الدجاج الفيومى

على عبيده

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قدرت نسبة الفقس لعدد من الدجاج الفيومى بلغ ١٩٠ دجاجة على عدد من البيض بلغ ٩٧٠٣ بيضة وحسبت معاملات التلازم بين نسبة التفريخ والصفات الخاصة بالبيضة وهى :

وزن البيضة ، وزن الصفار ، وزن البياض ، وزن القشرة ، سمك القشرة ، نسبة الصفار ،نسبة الصفار المحولة ونسبة البياض ، ونسبة البياض المحولة ،نسبة القشرة ، ونسبة القشرة المحولة ، وعدد البيض ونسبة الصفار للبياض ونسبة البياض للصفار ، وقد اتضح أن كل معاملات التلازم منخفضة ، وكان أعلى هذه المعاملات هى معاملات الارتباط مع صفات القشرة (الوزن والنسبة والسمك) ، وكانت هذه المعاملات سالبة الاشارة ، وقد قدم دليل معامل ارتباط أكثر ارتفاعا (= ١٣٥٥ر) مع نسبة الفقس باستعمال وزن الصفار ونسبة البياض ونسبة القشرة .