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# The Effect of Breed and Housing System on the Egg Quality of White Baladi and Fayoumi Hens in the Subtropics

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THIS STUDY included 140 White Baladi and 62 Fayoumipullets in cages and 148 White Baladi and69Fayoumi pullets on the floor. Samples of eggs were tested for outer and inner quality during February to determine the effect of the breed and the housing system. Results indicated that the egg shape index for White Baladi and Fayoumi in cages and on the floor was about 76%. No significant differences were found for egg weight, egg length, and egg width between housing systems. There were no significant differences in shell thickness between housing systems. However, the shells of White Baladi eggs were thicker than those of Fayoumi eggs. The highest albumen index was found in White Baladis housed in cages while the lowest index was found in Fayoumis housed on the floor. Yolk weight was highest for White Baladis on the floor (17.9g), while it was lowest for Fayoumis in cages (15.32 g). The highest yolk index was found in the Fayoumis housed on the floor (56.1%) while the lowest index was found in the White Baladis in cages (54.7%). There were no significant differences in yolk index, yolk measurement, and yolk weights due to housing systems.

Egg quality is one of the major factors in profitable egg production. The interior quality of the egg influences the consumer's acceptance of the different brands of table eggs. Although the type of housing may affect the egg quality, very few publications are available on this subject. No differences have been reported in egg shape between eggs laid by hens kept in individual cages or in deep litter. However, there were significant differences between strains in egg shape index (Kotaiah *et al.*, 1977). The shape index of Fayoumi eggs reared on the floor was 77 % and that of the white Baladi was 75% (Stino *et al.*, 1977). They also found that the shell thickness of Fayoumi eggs was 0.329 mm and that of the White Baladi was 0.321 mm. Kotaiah *et al.* (1977) foundthat birds raised on deep litter had a greater egg albumen height than caged birds.

Chand *et al.* (1976) compared White Leghorn, White Cornish and White Plymouth Rock pullets housed in either individual battery cages or in floor pens. In all breeds, yolk weight was higher in eggs produced by the caged

hens than the floor hens. Basharova (1975) reported that yolk weight from eggs of New Hampshire x Leghorn hens reared in cages was 18.79 g and those on the floor was 18.18 g. On the other hand, Al-Shahwany (1976) reported that there were no significant differences between different housing systems in egg yolk weight. Stino *et al.*, (1977) found that the yolk weights of Fayoumi and White Baladi eggs were 15.1 g and 16.4 g respectively. They also stated that the yolk percentage for both for breeds were 32.0% and 33.4% respectively. The yolk index was46.9 Fayoumi and 47.4 for White Baladi eggs. There were no differences in yolk shape index between the two breeds. Kicka *et al.* (1979) reported the yolk weight of White Baladi and Fayoumi hens to be 15.3 and 16.3 respectively.

The purpose of this study was to determine the influence of the type of housing on egg quality. This was achieved by using the Fayoumi and White Baladi breeds, raised either in individual cages or in floor pens.

## Material and Methods

This experiment was carried out at the Poultry Research Station, Faculty of Agriculture, Cairo University, Giza, Egypt. Eggs from Fayoumi (F) and White Baladi (WB) hens that were reared either in individual cages or in floor pens were broken within 24 hr after being laid to study their quality. For complete management of the layers, see Goher *et al.* (1982). The following characteristics were measured.

1. Egg weight : the eggs were weighed to the nearest tenth of a gram.
2. Egg witdth and egg length were measured in centimeters using a Vernier-caliper.
3. Egg shape index was calculated according to Romanoff and Romanoff (1949).

$$\text{Breadth/length} \times 100 = \text{egg shape index}$$

4. Albumen height was measured in millimeters using a tripod micrometer at the highest region of the thick albumen connected with the yolk (Wilgus and Van Wagenen, 1936).
5. Albumen width was measured by a Vernier-caliper to the nearest mm. Breadth and length were measured and divided by two to obtain the average width.
6. Albumen index was calculated according to Romanoff and Romanoff (1949):

$$\frac{\text{Height}}{\text{Average Width}} \times 100$$

7. Yolk was weighed (in grams) using a Mettler scale.
8. Yolk height was measured in millimeters using a tripod micrometer.
9. Yolk width was measured in millimeters using a Vernier - caliper.

10. Yolk index was calculated according to Funk (1958):

$$\text{Yolk index} = \frac{\text{Yolk height}}{\text{Yolk width}} \times 100$$

Yolk was fed from the albumen and the traces of albumen were removed by filter paper; then yolk was weighed using a Mettler scale. The shell was also weighed using a Mettler scale. Albumen weight was calculated by the difference.

11. Shell thickness was determined with membranes included in three parts (both tips and in the middle region) according to Brant and Shrader (1952). Readings were taken by averaging the 3 measurements. All egg quality measurements were taken in February.

*Statistical analysis*

The data were analyzed by the least squares method of Harvey (1960). The separation of means were carried out according to Duncan (1955).

## Results and Discussion

*Egg weight*

Eighty- seven WB and 65F eggs produced in cages, and 93 WB 56 F eggs produced on the floor were broken during February to determine their quality. The egg weight of the WB kept in cages was 46·1, while those on the floor weighed 43·6 g. The WB eggs were significantly ($P \leq 0.01$) heavier than the F eggs laid on the floor. There was no significant difference in egg weight due to the housing system. However Oluyemi and Roberts (1975) and Kuznetsova (1977) found that cage birds laid heavier eggs than floor birds. On the other hand, Bhagwat and Craig (1975) and Chand *et al.* (1976) found that the egg weights of floor-raised birds were higher than those of caged birds.

*Egg length, width and egg shape index*

The lengths of WB eggs produced in cages and on the floor were 5·12 and 5·18 cm respectively, while the lengths of F eggs were 5·05 and 5·04 cm respectively (Table 1). There was no significant difference in egg length between the two breeds. The widths of WB eggs produced in cages and in the floor were 3·92 and 3·94 cm respectively. The widths of F eggs laid in cages and on the floor were 3·87 and 3·83 cm respectively. The WB eggs were significantly ($P \leq 0.01$) wider than the F eggs produced on the floor.

There were no significant differences in either egg length or width due to the housing system. The egg shape index of both breeds were similar (Table 1). However, those eggs produced in cages had a slightly higher egg shape index. Kotaiah *et al.* (1977) found no difference in egg shape index between eggs produced in individual cages or on deep litter.

*Shell thickness (with membrane)*

The shell thicknesses of the eggs of the F and WB produced in cages and on the floor are presented in Table 1. The shell thickness of WB eggs reared in cages and on the floor was 0·43 mm. Those for F reared in cages and on the floor were 0·42 and 0·40 mm respectively. Obeidah (1974) reported that the shell thickness of Fayoumi eggs reared on the floor was 0·34 mm. Stino *et al.* (1977) stated that the shell thickness without membrane of F eggs reared on the floor was 0·33 mm, and that for WB eggs was 0·32 mm. There was a highly significant difference between the 2 breeds in their shell thickness (Table 1). However, housing the hens in either individual cages or on the floor did not affect shell thickness. These results agreed with those stated by Gleen *et al.* (1958) ; Funk *et al.* (1958) ; and Rauch and Vogt (1969). They found no significant difference between the shell thickness of caged and floor reared birds.

*Albumen height*

The average albumen heights of the eggs of the F and WB produced in cages and on the floor are presented in Table 2. The albumen heights of WB eggs were 4·50 mm and 4·32 mm for those produced in cages and on the floor. Albumen heights of F reared in cages and on the floor were 4·35 and *et al.* 4·30 mm respectively. Gleen *et al.* (1958) reported that the thick albumen height was higher in eggs from caged layers than floor layers. Kotaiah *et al.* (1977) found that birds raised on deep litter had a greater egg albumen height than caged birds.

*Albumen index*

The average length, width, and indices for albumen are presented in Table 2. The albumen indices for WB eggs produced in cages and on the floor were 0·64 *et al* 0·59 respectively. The albumen indices of F eggs were 0·63 and 0·62 for those produced in cages and on the floor respectively. Rauch and Vogt (1969) noticed no significant differences in albumen index between eggs laid by caged hens and those on litter.

*Yolk weight, yolk percentage, and yolk index*

The average yolk weight of WB reared in cages and on the floor were 16·77 g and 17·09 g respectively. The yolk weights of F eggs produced in cages and on the floor were 15·3 g and 15·6 g respectively. The yolk weights of the floor-produced eggs were slightly higher than those of the caged produced eggs for both breeds. These results indicate that yolk weights and percentages of the WB eggs were higher than those of the F eggs. Similar results were reported by Stino *et al.* (1977).

Differences between housing systems were not significant (Table 3). Similar results were obtained by Al-Shahwany (1976). He found no significant differences in yolk weights of White Leghorn eggs produced in cages or on the floor. The yolk percentage of WB eggs produced in cages or on the floor were 36.4% and 37·2% respectively. El-Samra (1970) reported that the yolk percentage of F eggs produced on the floor was 30·9%. Abdel-Kadier (1973) found that

the yolk percentage of F eggs was 30·9%. Stino *et al.* (1977) found the yolk percentages of F and WB eggs produced on the floor to be 33·4% and 32·9% respectively. These results show that the WB eggs have a higher yolk percentage than F eggs (Table 3). They also show that the birds reared on the floor laid eggs with higher yolk percentages than caged birds.

*Yold index*

The yolk indices for WB and F eggs are presented in Table 3. The yolk indices for WB eggs produced in cages and on the floor were 54·7% and 55·4% respectively. The yolk indices of F eggs were 55·8% and 56·1% for eggs produced in cages and on the floor. The yolk index of the F eggs was a little higher than that of the WB eggs. Eggs laid in cages had a slightly lower yolk index than those laid on the floor. Kotaiah *et al.* (1977) also found that eggs laid by birds on deep litter had a higher yolk index than eggs laid in cages. Abdel-Kadier (1973) found that the yolk index of F eggs produced on the floor was 47%. Stino *et al.* (1977) found that the yolk indexes for F and WB eggs produced on the floor were 46·9% and 47·4% respectively. Yolk index is affected by yolk height and yolk width. Yolk height and width were higher for F eggs than for WB eggs (Table 3).

TABLE 1. **Egg and shell quality of White Baladi and Fayoumi hens housed on the floor and in cages (×±SE).**

| Trait | White Baladi | | Fayoumi | |
|---|---|---|---|---|
| | Cage | Floor | Cage | Floor |
| Egg weight (g) | 46.1±0.5$^{a}$* | 45.9±0 5$^{a}$ | 44.9±0.6$^{ab}$ | 43.6±0.6 |
| Egg length (cm) | 5.12±0.04$^{a}$ | 5.18±0.04$^{a}$ | 5.05±0.04$^{a}$ | 5.04±0.04$^{a}$ |
| Egg width (cm) | 3.92±0.02$^{a}$ | 3.94±0.02$^{a}$ | 3.87±0.03$^{ab}$ | 3.83±0.02$^{b}$ |
| Egg shape index % | 76.6 | 76.1 | 76.6 | 76.0 |
| Shell thickness (mm) | 0.427±0.005$^{a}$ | 0.426±0.005$^{a}$ | 0.415±0.006$^{ab}$ | 0.399±0.006$^{b}$ |

* Values with different superscripts within trait differsigni ficantly ($P \leq .01$) from each other (Duncan, 1955).

TABLE 2. **Albumen quality of Fayoumi and White Baladi eggs produced on the floor and in cages ($\bar{x}$ ± SE).**

| Trait | White Baladi | | Fayoumi | |
|---|---|---|---|---|
| | Cage | Floor | Cage | Floor |
| Egg weight (g)* . . . . | 46.1 ±0.5 $^{a}$ | 45.9 ±0.5 $^{a}$ | 44.9 ±0.6 $^{ab}$ | 43.6 ±0.6 $^{b}$ |
| Albumen length (cm) . | 8.27±0.15$^{a}$ | 8.89±0.15$^{a}$ | 8.04±0.18$^{a}$ | 8.06±0.17$^{a}$ |
| Albumen width (cm) . | 5.78±0.07 $^{a}$ | 5.76±0.07$^{a}$ | 5.75±0.08$^{a}$ | 5.88±0.09$^{a}$ |
| Albumen height (mm) . | 4.50 | 4.32 | 4.35 | 4.30 |
| Albumen index . . . . | 0.64 | 0.59 | 0.63 | 0.62 |

* Values with different superscripts within trait differ significantly (P≦.01) from each other (Duncan, 1955).

TABLE 3. **Yolk quality of White Baladi and Fayoumi eggs produced on the floor and in cages ($\bar{x}$ ± SE).**

| Trait | White Baladi | | Fayoumi | |
|---|---|---|---|---|
| | Cage | Floor | Cage | Floor |
| Egg weight (g) . . . . | 46.1 ±0.5 $^{a*}$ | 45.9 ±0.5 $^{a}$ | 44.9 ±0.6 $^{ab}$ | 43.6 ±0.6 $^{b}$ |
| Yolk width (cm) . . . | 3.80±0.03$^{ab}$ | 3.70±0.03$^{a}$ | 3.82±0.04$^{ab}$ | 3.78±0.04$^{b}$ |
| Yolk height (cm) . . . | 2.08±0.2 $^{ab}$ | 2.05±0.2 $^{b}$ | 2.13±0.2 $^{a}$ | 2.12±0.2 $^{a}$ |
| Yolk index % | 54.7 | 55.4 | 55.8 | 56.1 |
| Yolk weight (g) . . . . | 16.77±0.5 $^{ab}$ | 17.09±0.6 $^{a}$ | 15.32±0.6 $^{b}$ | 15.61±0.6 $^{b}$ |
| Yolk % . . . . . | 36.4 | 37.2 | 34.1 | 3.68 |

* Values followed by different superscripts within trait differ significantly (P≦.01) from each other (Duncan, 1955).

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# تأثير النوع ونظام الاسكان على صفات البيض فى الدجاج البلدى الأبيض والفيومى فى المناطق شبه الحارة.

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استخدم فى هذا البحث ١٤٠ فرخة بلدى أبيض و ٦٢ فرخة فيومى ربيت فى أقفاص معلقة وكذلك ١٤٨ فرخة بلدى أبيض و ٦٩ فرخة فيومى ربيت فى مساكن أرضية .

تم فحص عينات من البيض بالنسبة لصفات البيضة الخارجية والداخلية خلال شهر فبراير لمعرفة تأثير النوع ونظام الاسكان على صفات البيض .

أظهرت النتائج عدم وجود فروق معنوية بين نظام الاسكان من حيث دليل شكل البيضة ووزن البيضة وطول البيضة وعرض البيضة وسمك قشرة البيضة وطول البياض وعرض البياض وارتفاع البياض ودليل شكل البيضة وعرض الصفار وارتفاع الصفار ودليل الصفار ووزن الصفار وكذلك أظهرت النتائج أن قشرة البيضة الدجاج البلدى الأبيض كانت أسمك من قشرة بيض الدجاج الفيومى . أما دليل الصفار فلقد كان أعلى فى البيض الفيومى عنه فى البيض البلدى الأبيض اما دليل البياض فلقد كان اعلا فى بيض الدجاج البلدى عنه فى بيض الدجاج الفيومى .