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EGG QUALITY OF THE NATIVE CHICKENS OF FARS PROVINCE-IRAN[1]

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ABSTRACT

Eggs were collected over a 15-day period from a flock of native Fars chickens kept on deep litter at the Animal Research Station, College of Agriculture, Shiraz University, Iran. Albumen height, Haugh unit, yolk index, shape index and shell thickness were determined, using published methods. The degree of translucent areas and the shell color were evaluated by subjective scoring. The number of eggs with blood spots was also recorded. Albumen height, Haugh unit and yolk index averaged 5.82 mm, 80.5 and 48.0, respectively. Mean shape index was 73.7 and the shell thickness was 0.37 mm. Mean score for translucent areas (1: no translucent area to 5: many translucent areas) and shell color (1: white to 5: brown) were 2.6 and 1.9, respectively. About 7% of all eggs examined contained blood spots. Regressions of the egg quality characteristics on the egg weight were calculated and the equations of best fit have been presented. There were wide variations in the quality measures under investigation indicating the need for production of uniform eggs of high quality.

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کیفیت تخم مرغهای بومی استان فارس - ایران

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خلاصه

از یک گله مرغ بومی که در ایستگاه دامپروری دانشکده کشاورزی دانشگاه شیراز در بستر نگهداری میشود به مدت ۱۵ روز تخم مرغ جمع آوری گردید. ارتفاع سفیده ،واحد "هو" (Haugh)،شاخص زرده ،شاخص شکل وضخامت پوسته با روشهای معمول اندازه گیری شد درحالیکه میزان نقاط شفاف ورنگ پوسته با نمره دادن مشخص گردید. هم چنین تعداد تخم مرغهائی که لکه خونی داشتند تعیین گردید. ارتفاع سفیده ،واحد "هو" وشاخص زرده

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به‌ترتیب برابر ۵/۸۲ میلیمتر، ۸۰/۵ و ۴۸/۰ بود. میانگین شاخص شکل وضخامت پوسته به‌ترتیب ۷۳/۷ و ۰/۳۷ میلیمترمحاسبه‌شد. میانگین نقاط شفاف پوسته ۲/۶ وبیشتر تخم مرغها مایل به‌سفیدبودند. حدود ۷ درصدازتخم مرغها دارای لکه‌های خونی بودند. معادلات رگرسیون خصوصیات کیفی تخم‌مرغ برروی وزن تخم مرغ محاسبه‌ومناسب‌ترین معادله‌ها ارائه‌شده‌است. دامنه‌تغییرات ویژگیهای کیفی تخم مرغهای بومی فارس زیادبودکه‌نشانگرلزوم وامکان اصلاح مرغها درجهت تولیدتخم‌مرغهای باکیفیت بالا میباشد.

INTRODUCTION

In evaluating egg quality, interior as well as exterior characteristics should be considered. This will result in production of high quality eggs ensuring consumer acceptance and profitability for producers.

It has been established that Haugh unit and yolk index are suitable measures for evaluation of the interior egg quality (22). Higher percent hatchabilities of both fresh and stored eggs were reported for eggs having fresh Haugh unit values of 80 or more (9). Better albumen quality, measured by Haugh unit, was reported for the Rhode Island Red as compared with the native Iraqi (2) and Egyptian (Fayoumi and Dandarawi) chickens (4).

Low yolk index is associated with stale eggs. Therefore, even a newly-laid egg is considered poor in quality if its yolk index is low (19). Presence of meat and blood reduces consumer acceptance and it is important that eggs be devoid of such spots.

Shape index and shell thickness affect shell strength with shell thickness being a good indicator of shell strength (17). Washburn (21) has recently reviewed relative importance of the factors which affect shell breakage. Shell thickness and porosity have been reported to differ among breeds and strains of chicken (10, 17). The shell occasionally shows translucent areas, sometimes easily observable, but usually seen upon candling. The degree of translucence is characteristic of the individual hen (1, 5).

There are no reports of egg quality for Iranian native chickens. In a previous paper we examined the egg components

of the native chickens of the Fars province, Iran (16). The present paper reports on some parameters of egg quality of the same birds.

MATERIALS AND METHODS

The experimental hens were from a flock established at the Animal Research Station, College of Agriculture, Shiraz University, as part of a project to study productive characteristics of the native Fars chickens (16). The College of Agriculture is located about 15 km north of Shiraz. During the experimental period maximum and minimum temperatures were 13 and -7°C respectively, and relative humidity varied between 21 and 78%. The ration contained 15% protein and 2750 kcal metabolizable energy per kg, 3.5% Ca, 0.5% P and food and water were freely available. Eggs were collected over a 15-day period from hens of similar ages (32-34 wk) kept on deep-litter. Average hen-house production during the period of egg collection was about 34%. A total of 335 eggs was used for the study of Haugh unit, yolk index, shell thickness, shell index and shell color. Shape index, degree of translucent areas and presence of meat and blood spots were determined on 815 eggs.

Each egg was weighed to the nearest 0.1 g. The maximum diameter and length were measured to the nearest 0.1 mm with calipers and the shape index (maximum diameter as a percent of maximum length) was computed. The egg was then broken onto a petri dish and albumen height was measured with a tripod micrometer to the nearest 0.01 mm for determination of Haugh unit (15). Yolk width and height were determined with calipers and yolk index (height as a percent of width) was calculated. Shell thickness, including membranes, was measured to the nearest 0.01 mm using a micrometer and shell index (ratio of shell to egg weight) was also calculated (8).

Shell color was subjectively scored from 1 (white) to 5

(brown), and upon candling eggs, the degree of translucent areas was scored on a scale of 1 (no translucent area) to 5 (many translucent areas).

Mean (±SE) and ranges were calculated. First and second degree polynomial equations were computed for regressions of some characteristics on egg weight. The equations of best fit were determined on the basis of the coefficients of determination (R^2) and reduction of the error variance in regression analysis (14).

RESULTS AND DISCUSSION

Means (±SE) and ranges for several characteristics related to egg quality of the native Fars chickens are shown in Table 1. Mean albumen height of the native Fars chickens

Table 1. Means (±SE) and ranges for egg quality characteristics of the native Fars chickens.

Characteristic	Mean ±SE	Range
Albumen height (mm)	5.82 ± 0.05	3.75- 8.80
Haugh unit	80.50 ± 0.33	65.10-98.10
Yolk index	48.00 ± 0.01	37.90-57.00
Shape index	73.70 ± 0.22	52.74-90.60
Shell thickness (mm)	0.37 ± 0.02	0.25- 0.48
Translucent areas	2.60 ± 0.05	1.00- 5.00
Shell color	1.86 ± 0.06	1.00- 5.00

was 5.82 mm. Amer (4) found values of 5.74, 5.66 and 6.4 mm for the egg of 5 to 7-month old Dandarawi, Fayoumi and Rhode Island Red chickens, respectively. Al-Rawi and Amer (2)

reported values of 7.16, 7.89 and 7.00 mm for the albumen height of 10 to 12-month old Leghorn, New Hampshire and Iraqi chickens, respectively.

Average Haugh unit of the native Fars chickens was 80.5, whereas the reported values for the purebreds were 77-92 and for the native Iraqi and Egyptian chickens were 85 and 80, respectively (2, 3, 4, 6, 7, 11). Many characteristics affecting albumen quality are known to be genetically controlled, and crossbreeding of the native Iraqi chickens with the New Hampshire breed resulted in increased albumen height (2). Higher percent hatchabilities were reported for eggs having fresh Haugh unit values of 80 or more (9).

In the present work, the average yolk index (48.0) was lower than values for the Rhode Island Red (51.2), Fayoumi (50.0) and Dandarawi (49.3), but it was higher than reported indices for the native Iraqi and several purebred chickens (2, 4, 7). The value of yolk index is fairly constant in the eggs produced by a particular hen, but it may differ widely from one hen to another (19). No significant differences were found in the yolk index among the native Egyptian and Rhode Island Red chickens (4), but Iraqi chickens had a lower yolk index than Leghorn and New Hampshire breeds (2). Crossbreeding of Iraqi hens with New Hampshire roosters increased whereas the reverse crosses lowered the yolk index (2).

In the present study, 6.6% of all eggs contained blood spots with virtually no meat spots. Presence of meat and blood spots reduces egg quality, and the presence of blood spots has been associated with hemorrhage resulting from the rupture of ovarian follicles (13). Amer (3) reported a higher incidence of blood spots in the eggs of Fayoumi (11.2%) and Rhode Island Red (8.9%) compared with the eggs from White Leghorns (4.2%). King and Hall (11) reported significant differences in percent blood spots of the Single Comb White Leghorn (9.6-12.7%), New Hampshire (2.4-8.4%), Rhode Island Red (6.5-10.7%), Barred (2.7-3.0%) and White Plymouth Rock

chickens (2.0-9.0%). According to Dawson *et al.* (6) 5-14% of eggs from White Leghorn and 2-18% from Rhode Island Red hens contained blood spot.

Mean shape index in this study (Table 1) was similar to the values for the White Leghorn, New Hampshire, Rhode Island Red and Plymouth Rock eggs, but lower than values for the native Fayoumi (80.5) and Dandarawi (81.5) eggs (2, 4, 11). Genetic and environmental factors influence shape index, with normal eggs having a shape index of 70-73 (19). Crossbreeding of hens with elongated eggs and roosters from a group of chickens which laid round eggs resulted in production by offspring of eggs which were intermediate between parents (19).

King and Hall (11) did not find any differences in the shape index of different breeds. However, they detected differences among strains within breeds in this respect. Contradictory results have been reported for the effects of egg shape on hatchability (12).

Mean shell thickness of the native Fars chickens (0.37 mm) was similar to Fayoumi, Dandarawi, Iraqi (0.36-0.37 mm) (2, 4) and several purebreds reported by King and Hall (11). However, this value was greater than those reported for the same purebreds by Amer (4), Al-Rawi and Amer (2) and Dawson *et al.* (6). Crossbreeding of the native Iraqi chickens with Leghorn and New Hampshire breeds resulted in an increase in the shell thickness of the hybrid chickens (2).

Mean score for the degree of translucent areas was 2.6. The degree of translucence is characteristic of the individual hen (1, 5) and it is generally agreed that shell translucence is caused by local accumulation of moisture in the shell (20). Mean score for the shell color was 1.86 and the color varied from white to brown with majority of eggs being closer to white.

Regression coefficients of several egg quality measures on egg weight are shown in Table 2. The relationships

Table 2. Equations of best fit and multiple correlation coefficients (R) for the relationships between egg weight (X) and egg quality characteristics (Y).

Characteristic	Equation	R
Albumen height (mm)	$Y = 3.980 + 0.0408X^{**}$	0.196
Haugh unit	$Y = 85.276 + 0.1047X$	0.076
Yolk index	$Y = 0.425 + 0.0012X^{*}$	0.099
Shape index	$Y = 67.781 + 0.1373X^{*}$	0.102
Shell index	$Y = 0.754 + 0.0023X + 0.00002X^{2**}$	0.131
Translucent areas	$Y = 3.132 + 0.0125X$	0.05

*Significant at $P < 0.05$.

**Significant at $P < 0.01$.

between the albumen height ($P < 0.01$), yolk index ($P < 0.05$) and shape index ($P < 0.05$) and the egg weight were linear. The linear relationships of the Haugh unit and translucent areas with the egg weight were not significant. The relationship between the shell index and the egg weight was nonlinear and highly significant ($P < 0.01$). Shell index increased with increasing egg weight up to 44.2 g, but it decreased thereafter. The results indicate that for eggs heavier than 44.2 g the shell becomes thinner and, as a result, shell strength is reduced compared with the smaller eggs. Despite the high statistical significance, egg weight accounted for less than 20% of the variation observed in other variables (Table 2). This finding gives further support to published reports which regard the egg weight as a relatively poor indicator of other characteristics (21).

Richards and Swanson (17) believed shell thickness to be the best indicator of the shell strength as it accounted for about 56% of the total variation in crushing strength, with egg shape accounting for 15-35%. In another study (18), egg size had little relationship to shell thickness, but the increase in egg size for individual hens during the lay cycle without a concomitant increase in shell weight was the primary cause for the decline in shell thickness as the hen aged. The relationship of egg size to decreasing shell strength with age is not clear. When old hens are molted their return to lay is stronger than the premolt strength, but the egg size is just as large (21).

There were wide variations in different characteristics of eggs from the native chickens of the Fars province (Table 1). In an earlier paper (16) we also found wide ranges for the egg components of these chickens. The present results indicate the need for reducing such variations, through appropriate means if the production of more uniform high quality eggs, is to be achieved.

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