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In the name of Allah

EGG COMPONENTS OF THE NATIVE FARS CHICKENS IN CAGES AND ON DEEP-LITTER[1]

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ABSTRACT

To study changes in the egg components of the native Fars chickens, a total of 851 eggs were collected over a 15-day period from the hens of approximately similar ages originated from four regions of the Fars Province. Average weights of the egg (44.0 g), albumen (24.3 g), and yolk (14.2 g) were lower than the published values for exotic pure-bred chickens, some native hens of the Middle Eastern region, and/or their crosses with exotic pure breeds.

Albumen percentage of egg weight (12.4%), yolk percentage of egg weight (32.4%), and yolk percentage of albumen (59.0%) were higher in the present study as compared with the published results for the native and pure-bred chickens.

The egg, albumen, shell, and total liquid weights as well as the shell percentage of liquid weight were higher for the caged birds in comparison with the deep-litter hens. The average

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بنام خدا

اجزای تخم‌مرغهای بومی استان فارس درقفس وبستر

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خلاصه

بمنظور مطالعه تغییرات در اجزای تخم‌مرغ مرغهای بومی استان فارس، تعداد ۸۵۱ عدد تخم‌مرغ طی مدت ۱۵ روز از مرغهای تقریبا" همسن متعلق به چهار ناحیه استان جمع‌آوری گردید. نتایج حاصله نشان داد که میانگین وزن تخم‌مرغ (۴۴ گرم)، سفیده (۲۴/۳ گرم) وزرده (۱۴/۲ گرم) در مرغهای بومی استان فارس کمتر از آمار مربوط به نژادهای اصلاح‌شده وبعضی از نژادهای بومی خاورمیانه ویا آمیخته‌های آنها با نژادهای اصلاح شده بود. درتخم‌مرغ مرغهای استان فارس در مقایسه با نتایج منتشرشده در مورد نژادهای اصلاح شده وسایر نژادهای بومی، درصد سفیده نسبت به وزن تخم‌مرغ (۵۵/۱) کمتر ولی وزن پوسته (۵/۵ گرم)، درصد پوسته (۱۲/۴)، درصد زرده (۳۲/۴) ونسبت زرده به سفیده (۵۹/۰ درصد) بیشتر بود.

وزن تخم‌مرغ، سفیده، پوسته ومواد مایع تخم‌مرغ (تفاوت وزن تخم‌مرغ ووزن پوسته) وهمچنین درصد وزن پوسته به مواد مایع در مرغهای قفس بیشتر از مرغهای بستر بود. میانگین وزن زرده بین دوگروه اختلافی نشان نداد اما درصد زرده در مرغهای قفس بطور بسیار معنی داری کمتر از مرغهای بستر بود. میانگین وزن درصد اجزای مختلف تخم‌مرغ در مرغهای متعلق به چهار ناحیه مورد مطالعه اختلاف معنی داری با یکدیگر نشان ندادند.

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yolk weights were not different between the two systems, but yolk percentage of egg was lower in the caged hens as compared with the deep-litter ones ($P < 0.01$). There were no differences in these characteristics amongst the birds from different regions.

INTRODUCTION

Yolk is the most nutritious component of the chicken egg, comprising about one third of the egg weight (7, 17). It contains higher proportions of proteins and fats as compared with other nutrients. The yolk contains about 17 and 33% by weight of proteins and fats, whereas the corresponding values for the albumen are approximately 11 and 0% (7, 17). Therefore, in assessing egg quality, the yolk size is a major criterion (11, 17).

It has been reported that percentages of different egg components differ among strains of chicken as well as among the individuals of the same strain (1, 3, 10). In these reports, variations due to environmental factors such as nutrition and season were not significant.

The weights and percentages of yolk, egg white, and shell were affected by the egg weight; large eggs had a higher albumen ratio than the small ones. The weights of the individual components from eggs of similar weights laid by different hens were also different (3). Increased egg weight was accompanied by increased weight of albumen and a decreased yolk to albumen ratio (13). In Fayoumi chickens (8) percent albumen decreased but percent yolk increased with increasing egg weight. In another study, percent shell as well as percent egg white increased significantly, although the size of yolk decreased during a nine year test period (2). For each gram increase in egg weight, the albumen increased by 0.2% but the yolk decreased by a similar amount (13).

A negative correlation was found between percent hatchability, but no relationship was found between the latter and the amount of yolk or shell (18).

No information is available on the components of the egg from the native Iranian chickens. In this study variations of the egg components from the hens of the Fars province under two systems of management (cage and deep-litter) were investigated.

MATERIALS AND METHODS

The experimental hens were from a flock established in the Animal Research Experiment Station, as a part of a project to study production characteristics of native Fars chickens. Eggs were initially collected from a number of villages, transported to the station and were incubated in the station incubators. The term "region" in this paper refers to a group of villages in close proximity, located in a particular provincial area.

Day- old chicks from each region were raised separately on deep-litter, and at two months of age, a group of chickens from each region was transferred to individual cages. The remainder of chikens were reared in quarters having access to a fenced block of land, cultivated with alfalfa, through a gate. The experimental birds were fed indentical diets and feed and water were freely available. Other experimental conditions including the light regime were similar for all birds.

Hens of approximately similar ages (32-34 weeks) from four regions were used for comparison of changes in the egg components. Forty- three caged hens were selected randomly from the four regions, and a total of 334 eggs were collected from them daily at 10 A.M. over a two week period and transferred to the laboratory. Similarly, 516 eggs (8-12 per region per day) were randomly selected from the birds on deep-litter. The eggs were weighed to the nearest 0.1 g and broken onto a dry petri-dish for determination of the shell, yolk, and albumen weights. The albumen was drawn into a 10-ml pipette and the yolk weight was determined. The shell was carefully cleaned with a filter paper to remove remains of the albumen and was then weighed with the two shell membranes attached. The albumen weight was then determined.

Statistical analyses were performed using a computerized SPSS Program (14) and first and second degree polynomial equations were computed. The equations of best fit were determined on the basis of the coefficients of determination (R^2) and the variability of the error variance in the regression analysis.

RESULTS AND DISCUSSION

Region had no effect on components of the egg; therefore, the results for different regions are not reported separately. The means, standard errors, and ranges for different components as influenced by the rearing system are shown in Table 1. The mean egg weight (44.0 g) was lower than values reported for the purebred exotic (54.0 g) and the native Iraqi (52.0 g) chickens and their crosses (56.0 g) with foreign pure-breds (1, 9, 10, 12, 15, 16); however, it was similar to the values for the Egyptian native Fayoumi (42.0 g) and Dandarawi (46.0 g) hens (1, 8, 16). Similar trends were found for yolk weight, albumen weight, and albumen to egg ratio. Shell weight and the ratio of shell weight to egg weight were higher than values reported for other breeds (1, 9, 10, 11, 13, 16). The yolk to egg weight ratio was higher for our chickens as compared with other breeds. These findings are in agreement with several reports showing a higher percentage of yolk in small eggs (1, 8, 13, 16); however, this higher yolk percentage is probably only a reflection of the small egg size (13).

The yolk to albumen ratio was higher in the eggs studied as compared with other breeds except for the Brown Leghorn. Similarly, eggs from Iraqi native hens had a higher yolk to albumen ratio as compared with the White Leghorn and

Table 1. Egg components of the native chickens reared in cages and on deep-litter (mean, standard error, range).

Character*	Cage	Deep-litter	S.E.	Range
Total egg weight (g)	45.1	43.3	0.2	31.7-57.2
Egg liquid weight (g)	39.2	38.0	0.2	27.9-49.5
Albumen weight (g)	25.1	23.7	0.2	15.7-35.1
Yolk weight (g)	14.1	14.3	0.1	10.1-18.0
Shell weight (g)	5.8	5.3	0.04	3.6- 8.5
Albumen:egg ratio (%)	55.7	54.8	0.1	45.0-68.8
Yolk:egg ratio (%)	31.4	33.0	0.1	21.2-39.8
Shell:egg ratio (%)	12.9	12.2	0.04	8.9-17.3
Yolk:albumen ratio (%)	56.7	60.7	0.4	31.0-81.4
Albumen:liquids ratio (%)	64.0	62.4	0.1	50.5-76.5
Yolk:liquids ratio (%)	36.1	37.6	0.1	23.5-44.9

*For all characters, except the yolk weight, the differences between the two systems of rearing were highly significant ($P < 0.01$).

New Hampshire breeds (16). This may be due to lower egg weights in these native hens, since Marion *et al.* (13) have reported a decrease in yolk to albumen ratio with increasing egg weight. Crossbreeding of the native Iraqi chickens with the Leghorn and New Hampshire breeds resulted in an increased weight of the egg, albumen and shell, as well as increased albumen to egg ratio (16). Thid did not affect the yolk and shell weights, but it lowered the ratios of yolk to egg and yolk to albumen.

The differences between the rearing systems (cage vs. deep-litter) were significant ($P < 0.01$) for most characteristics investigated except for the yolk weight (Table 1). The egg, albumen, shell, and total liquid weights as well as the shell percentage, albumen percentage, and the ratio of albumen to liquid weights were higher for the caged birds in comparison with the deep-litter hens. However, the reverse was true for the yolk to egg, yolk to albumen, and yolk to liquids ratios. The higher weights of egg, albumen, and shell in caged hens were probably due to their lower activity in cages where more energy might have been available for productive purposes.

Increased egg and albumen weights have also been reported for the White Leghorn breed in cages (5). Higher ratio of the yolk to egg and albumen and liquid weights in the deep-litter system might be caused by their lower egg, albumen, and liquid weights as compared with the cage system. Thus, eventhough the yolk weights could be the same, the ratios of yolk to albumen and yolk to liquids would decrease with increasing egg weights (3, 13).

Regression coefficients of individual egg components on the egg weight are shown in Table 2. All the relationships were non-linear and highly significant ($P < 0.01$). The strongest relationship was found between the egg and egg liquid weights and the weakest between the shell and egg weights. The measurements related to the yolk such as

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

Egg components (Y)	Equation of best fit	R
Egg liquid weight	$Y = 3.800+0.7010X+0.0019X^2$	0.993
Albumen weight	$Y = 14.813+1.1431X-0.0057X^2$	0.931
Yolk weight	$Y = 18.600+0.4421X+0.0077X^2$	0.789
Shell weight	$Y = -3.770+0.2989X+0.0019X^2$	0.763
Albumen:egg ratio	$Y = 25.100+1.2000X-0.0110X^2$	0.327
Yolk:egg ratio	$Y = 67.357-1.4040X+0.0136X^2$	0.354
Shell:egg ratio	$Y = 7.542+0.2312X-0.0026X^2$	0.170
Yolk:albumen ratio	$Y = 1.600+0.4032X+0.0039X^2$	0.354
Albumen:liquid ratio	$Y = 25.500+1.5000X-0.0142X^2$	0.349
Yolk:liquid ratio	$Y = 75.520-0.5000X+0.0143X^2$	0.349

*All correlation coefficients and quadratic regression coefficients were significant ($P < 0.01$).

yolk percentage of egg and yolk percentage of total liquids decreased with increasing egg weight, but increased subsequently. These were minimal at values of 28.7, 51.6, and 27.5 g for the egg weight. This is because the increase in egg weight is accompanied by a greater relative increase in the weight of albumen as compared with other components.

The measurements related to the albumen and shell (except shell weight) increased with increasing egg weight to a certain point and decreased thereafter. The increase in the weight of the liquid portion of the egg was reflected to a greater extent in the albumen than yolk. The present results show that mean egg weights are much smaller as compared with the exotic purebred layers; however, the yolk percentage of the whole egg is higher for our hens than the latter group. Considering the large variation (32-57 g) in egg weights observed in the present study, it is possible to increase the egg size by proper breeding procedures.

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