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EFFECT OF DIFFERENT LINES OF LOCAL IRAQI CHICKEN AND ISA BROWN ON EGG INTERNAL QUALITY

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ABSTRACT

A total of 500 eggs was obtained from three Iraqi local chickens distributed as feather colors and Isa Brown to determine the internal egg quality and their correlation. Pure Black= group1; Black with Brown Neck= group 2; White= group 3 and Isa Brown = group 4 at 70-80 weeks age old were reared under similar management. Statical analysis of data in this study shows significant ($p<0.05$) differences in egg weight, yolk weight and shell weight between lines. While, differences between groups in yolk percentage, albumin percentages, shell traits (weight, thickness and percentage) were not significant. The positive correlation coefficients between egg weight were significant ($p<0.01$) with yolk and albumin weight, and ($p<0.05$) with shell weight. Also, the correlation between yolk weight and shell weight was significantly ($p<0.01$) positive, while the correlation between albumin weight with shell weight was negatively non significant. The positive correlation was observed between egg weight with yolk and shell percentages, while, the correlation between yolk with albumin percentages, and albumin percentages with shell percentages were negatively significant ($p<0.01$). The results from this study indicated that the different groups of local chickens and Isa brown significantly affected egg weight and some internal egg traits.

Key words: *Egg quality, local chickens, correlation, Isa Brown, egg weight.*

INTRODUCTION

In general, the characteristics of egg quality have a genetic basis (McFerran and Adair, 2003; Jones, 2006; Hermiz *et al.*, 2012; Hanusová *et al.*, 2015). This difference between strains was reflected in the percentages of the components (Scott and Silversides, 2000). Genetic differences in eggshell quality characteristics exist between species, and between breeds, strains and families within the lines (Buss, 1982). Egg weight is very different between various lines and eggshell thickness is under great influence of line (Pandey *et al.*, 1986). Genotype has direct influence on egg weight and eggshell characteristics. Many studies showed that hens with colored feathers lay bigger eggs than hens with white feathers (Halaj and Grofík, 1994; Vits *et al.*, 2005; Halaj and Golian, 2011). The difference between strains was reflected in the percentages of the components (Scott and Silversides, 2000). Egg weight is genetically linked to all three of the major components: shell, albumen, and yolk. Likewise, Washburn (1990) summarized literature to show that the link between egg weight and albumen weight is higher than those between egg weight and shell or yolk weight. Fletcher *et al.* (1981 and1983) showed that as egg size increases, so does the percentage of albumen. Zita *et al.* (2009) reported that genotype also affected mainly egg weight. Some of the authors have also shown a correlation between egg weight and egg quality parameters including yolk percentage, yolk weight and albumin weight (Hartmann *et al.*, 2000; Zhang *et al.*, 2005).

This study aimed to determine the effect of different groups of Iraqi local chickens grouped by the color of feathers with Isa Brown on egg weight and egg internal quality and their correlations coefficient.

MATERIALS AND METHODS

Eggs internal quality was determined of three groups of Iraqi local chickens (Pure Black= group1; Black with Brown Neck= group2; White= group 3) and Isa Brown at 70-80 weeks old were used in the present study. Chicken groups were reared under same

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management condition at Sulaimani Research Station–Director of Agricultural Research. A total of 500 eggs were collected immediately after lay and weighted individually, After the eggs were broken egg shells were weighted (with membrane) after dried, and its percentage were measured using the equation:
Shells percentage = (shells weight / egg weight) X 100.

Shell thickness (with membrane) was measured at the three parts sharp poles, blunt poles and equatorial parts of each egg and obtained from the average values of these parts. Yolk weight with accuracy balance was determined and its percentage proportion was calculated by this equation:
Yolk percentage = (yolk weight / egg weight) x100.

The albumen weight was calculated from the difference between the egg weight, and the yolk and shell weight. The percentage proportion of the albumen in the egg was also determined by this equation:
Albumin percentage = (albumin weight / egg weight) x 100.

Statistical Analysis

The analysis of variance was done for all recorded Data to find out the differences between lines Statistical Program PASW Statistics Student Version 18 SPSS. An ANOVA using the general linear models procedure included the main effects of strains on some external eggs traits. Duncan Multiple Range Test (Duncan, 1955) was used to test the significant differences between the means of the levels. The simple correlations between external eggs traits were estimated by SPSS computer program.

RESULTS

Effect of lines on egg weight, egg yolk and albumin was significantly ($p<0.05$), while, the yolk and albumin percentages did not affected by different lines (Table 1). Egg weight of line 2 and 3 (62.30 and 62.29) was heavier than strain 1 and 4 (59.56 and 58.40g), respectively. Chickens in line 3 revealed significantly ($p<0.05$) heavier egg yolk weight (20.47g) than line 1 and line 4 (18.59 and 18.85g), respectively. While, the albumin weight was significantly ($p<0.05$) higher in local lines compared with Isa Brown. Yolk and albumin percentages of eggs did not significantly differ between lines.

Table 1: Effect of different groups on egg weight, yolk weight, albumin weight, yolk percentage and albumin percentage.

Traits	Groups	N	Mean*	± Std. Error	Minimum	Maximum
Egg Weight (g)	1	4	59.56^{b}	0.41	58.90	60.69
	2	4	62.30^{a}	1.16	59.97	65.36
	3	4	62.29^{a}	0.50	61.16	63.60
	4	4	58.40^{b}	0.61	57.31	59.53
	Total	16	60.65	0.55	57.31	65.36
Yolk Weight (g)	1	4	18.59^{b}	0.51	17.76	20.05
	2	4	19.73^{ab}	0.57	18.15	20.82
	3	4	20.47^{a}	0.26	19.91	21.12
	4	4	18.85^{b}	0.50	17.72	20.11
	Total	16	19.41	0.29	17.72	21.12
Albumin Weight (g)	1	4	35.65^{a}	0.42	34.85	36.79
	2	4	36.75^{a}	0.51	35.87	38.04
	3	4	36.06^{a}	0.21	35.56	36.43
	4	4	34.03^{b}	0.55	33.08	35.46
	Total	16	35.62	0.33	33.08	38.04
Yolk %	1	4	31.28	0.69	30.18	33.12
	2	4	31.67	0.48	30.28	32.39
	3	4	32.88	0.20	32.51	33.25
	4	4	32.26	0.59	30.95	33.77
	Total	16	32.02	0.28	30.18	33.77
Albumin %	1	4	59.87	1.00	57.43	62.32
	2	4	59.02	0.96	57.44	61.81
	3	4	57.90	0.38	57.22	58.63
	4	4	58.25	1.22	55.89	61.68
	Total	16	58.76	0.47	55.89	62.32

$*^{a-b}$ For each means of same traits in each column with different letters differ significantly ($P<0.05$).

The results of egg shell weight, shell thickness and shell percentage of different lines were shown in (Table 2). Non-significant effects of lines were observed on egg shell quality. However, the line 2 and 3 (5.83 and 5.76g), respectively followed by line 4 (5.57g) numerically higher than line 1 (5.32g).

Table 2: Effect of different groups on egg shell weight, thickness and percentage.

Traits	Strain	N	Mean*	± Std. Error	Minimum	Maximum
Shell Weight (g)	1	4	5.32	0.32	4.48	5.86
	2	4	5.83	0.43	4.75	6.53
	3	4	5.76	0.28	5.20	6.38
	4	4	5.57	0.44	4.31	6.20
	Total	16	5.62	0.17	4.31	6.53
Shell Thickness (mm)	1	4	0.40	0.01	.38	.42
	2	4	0.41	0.01	.39	.44
	3	4	0.31	0.09	.04	.42
	4	4	.4197	.00817	.40	.44
	Total	16	.3868	.02370	.04	.44
Shell %	1	4	8.9319	.49905	7.59	9.83
	2	4	9.3288	.54900	7.92	10.41
	3	4	9.2385	.41882	8.35	10.27
	4	4	9.5172	.68637	7.50	10.43
	Total	16	9.2541	.25066	7.50	10.43

*[a–b] For each means of same traits in each column with different letters differ significantly (P<0.05).

There were a positive values of correlation (0.88) and (0.63) (p<0.01) and (0.59) (p<0.05) between egg weight with yolk, albumin and shell weight, respectively. Yolk weight correlation with shell weight was significant (p<0.01), while non-significant negative correlation was found between albumin weight and shell weight. However, the negative coefficients correlation between shell thickness and all parameters except shell weight (Table 3).

Table 3: Simple coefficient correlations of egg, yolk, albumin, and shell weight and shell thickness.

Traits	Yolk weight	Albumin weight	Shell weight	Shell thickness
Egg weight	0.83**	0.63**	0.59*	-0.01
Yolk weight		0.15	0.67**	-0.06
Albumin weight			-0.14	-0.09
Shell weight				0.23

**.Correlation is significant at the 0.01 level (2-tailed).
*. Correlation is significant at the 0.05 level (2-tailed).

Table (4) shows that the correlation between egg weight and its component percentages positively high except with albumin percentage. The correlations between yolk percentage with albumin percentage and albumin percentage with shell percentage negatively significant (p<0.01).

Table 4: Simple coefficient correlation between egg weight and yolk, albumin and shell percentages.

Traits	Yolk %	Albumin %	shell %
Egg weight	.356	-.408	.339
Yolk %		-.876**	.484
Albumin %			-.846**

**. Correlation is significant at the 0.01 level.

DISCUSSION

Effect of lines on egg weight, egg yolk and albumin was significantly, while, the yolk and albumin percentages did not affected by different lines. Egg weights of lines 2 and 3 were heavier than lines 1 and 4 (Table 1), which attributed to difference of genotype as reported by Halaj and Grofík (1994); Vits *et al.* (2005); Halaj and Golian (2011) whom found that the genotype has direct influence on egg weight and hens with coloured feathers lay bigger eggs than hens with white feathers. In addition, Pandey *et al.* (1986) reported that egg weight is much differed widely between various lines. Hermiz *et al.* (2012) also found that Black with Brown Neck have heavier egg weight than Pure Black and Isa Brown, but in contraries about egg weight produced by White line. In study by Hanusová *et al.* (2015) observed that the egg weight was significantly ($P \leq 0.01$) affected by the breed. The genetic differences between strains for egg weight were reported by Carter and Jones (1970); Potts *et al.* (1974); Arafa *et al.* (1982); Scott and Silversides (2000); Monira *et al.* (2003). Chickens in line 3 revealed significantly ($p<0.05$) heavier egg yolk weight (20.47g) than line 1 and line 4, While, the albumin weight was higher in local lines compared with Isa Brown. Olawumi and Ogunlade (2009) and Kabir *et al.* (2014) attributed the significant ($P<0.05$) difference in the two lines of yolk and albumin weight to variation in genetic. Hanusová *et al.* (2015) reported that yolk and albumin weights significantly differed ($P \leq 0.01$) between breeds. Although, albumin weight significantly differs between strains and the yolk weights of eggs did not differ (Tharrington *et al.*, 1999). Yolk and albumin percentage of eggs did not significantly differ between strains. Hanusová *et al.* (2015) also found no significant differences between breeds on yolk and albumin percentage. In contrasts, significant differences were shown between lines (Hermiz *et al.*, 2012) and between strains (Tharrington *et al.*, 1999) in yolk and albumin percentage.

Non-significant effects of lines were observed on egg shell quality (Table 2), these results were in contrasts with Hanusová *et al.* (2015) who found that egg shell quality in laying hens is influenced significantly by strain of chicken. Tharrington *et al.* (1999) found although shell weight significantly affected by strains while, the shell percentage did not affected. Pandey *et al.* (1986) and Monira *et al.* (2003) attributed the significant differences in shell thickness to breeds differences. Strain effect was significant ($P<0.05$) for all egg shell weight and thickness (Kabir *et al.*, 2014).

There were a positive values of correlation (0.83) and (0.63) ($p<0.01$) and (0.59) ($p<0.05$) between egg weight with yolk, albumin and shell weights, respectively (Table 3). Yolk weight correlation with shell weight was significant ($p<0.01$), while non-significant negative correlation was found between albumin weight and shell weight. However, the negative correlation coefficients between shell thickness and all parameters except shell weight. Kul and Seker (2004) found significant positive phenotypic correlation between shell weight and shell thickness. Likewise, Scott and Silversides (2000) show that the albumen weight was closely associated egg weight. The correlation coefficients between egg weight and yolk and shell weights were lower than that between egg weight and albumen weight (Scott and Silversides, 2000) and between egg weight and albumin percentage (Hermiz *et al.*, 2012). Several studies reported a significant correlation between egg weight and its components (Scott and Silversides, 2000; Silversides and Scott, 2001; Ali, 2010).

The correlation between egg weight and its component percentages were positively high except with albumin percentage. The correlations between yolk percentage with albumin percentage and albumin percentage with shell percentage were negatively significant ($p>0.01$) as showed in (Table 4). Hermiz *et al.* (2012) also found negative correlation between albumin and yolk percentages. Egg weight is genetically linked to all three of the major components: shell, albumen, and yolk. Washburn (1990) summarized literature to show that the link between egg weight and albumen weight is higher than those between egg weight and shell or yolk weight. Fletcher *et al.* (1981 and 1983) showed that as egg size increased, increase the percentage of albumen. The data presented here demonstrate that within a strain, variation in egg weight is determined largely by variation in albumen weight. Selection for albumen weight as an individual trait should be possible because the heritability is moderate to high (Washburn, 1979). The heritability of shell strength (Hunton, 1982) or thickness (Poggenpoel, 1986) is also moderate to high, but that for yolk weight is lower (Washburn, 1979).

REFERENCES

Ali, S.H. (2010): Effect of strain and storage period on some qualitative and quantitative traits of table eggs. Diploma, College of Agriculture, Salahaddin University, Kurdistan Region-Iraq.

Arafa, A.S.; Harms, R.H.; Miles, R.D.; Christmas, R.B. and Choi, J.H. (1982): Quality characteristics of eggs from different strains of hens as related to time of Oviposition. Poult. Sci., 61: 842-47.

Buss, E.G. (1982): Genetic differences in avian egg shell formation. In Poult. Sci., vol. 61, pp. 2048–2055.DOI:http://dx.doi.org/10.3382/ps.0612048.

Carter, T.C. and Jones, R.M. (1970): The hen's egg shell shape parameters and their interrelations. Br. Poult. Sci., 11: 179-87.

Duncan, D.B. (1955): Multiple Range and Multiple Test. Biometrics, 11, 1-42.

Fletcher, D.L. Britton, W.M.; Rahn, A.P. and Savage, S.I. (1981): The influence of layer flock age on egg component yields and solids content. In Poultry Sci, vol. 60, no. 5, pp. 983–987.

Fletcher, D.L. Britton, W.M. and Pesti, G.M. (1983): The relationship of layer flock age and egg weight on egg component yields and solids content. In Poultry Sci, vol. 62, no. 9, pp.1800–1805.

Halaj, M. and Golian, J. (2011): Table eggs characteristics. Nitra: Garmond, pp. 37–62 (in Slovak).

Halaj, M. and Grofik, R. (1994): The relationship between egg shell strength and hens features. In Živočišnávýroba, vol. 39, pp. 927–934.

Hanusová, E.; Hrnčár, C.; Hanus, A. and Oravcová, M. (2015): Effect of breed on some parameters of egg quality in laying hens. Actafytotechn. Zootechn, 18, (1): 20–24.

Hartmann, C.; Johansson, K.; Strandberg, E. and Wilhelmson, M. (2000): One-generation divergent selection on large and small yolk proportions in a white Leghorn Line. British Poultry Science, 41: 280-286.

Hermiz, H.N.; Abas, K.A.; Al-Khatib, T.R.; Amin, Sh.M.; Ahmed, A.M.; Hamad, D.A. and Denha, H.P. (2012): Effect of strain and storage period on egg quality characteristics of local Iraqi laying hens. Research Opinions in Animal and Veterinary Sciences. pp: 98-101.

Hunton, P. (1982): Genetic factors affecting egg shell quality. World's Poult. Sci. J. 38: 75–84.

Jones, D.R. (2006): Conserving and monitoring shell egg quality. Pp. 157-165 in Proc. 18th Ann. Australia. Poult. Sci. Symp. Australia.

Kabir, M.; Sulaiman, R.O.; Idris1, R.K.; Abdu, S.B.; Daudu, O.M.; Yashim, S.M.; Hassan, M.R.; Adamu2, H.Y.; Eche, N.M.; Olugbemi, T.S. and Adedibu, I.I. (2014): Effects of strain, age and the interrelationships between external and internal qualities of eggs in two strains of layer chickens in northern guinea savannah zone of nigeria. Iranian Journal of Applied Animal Science. 4(1), 179-184.

Kul, S. and Seker, I. (2004): Phenotypic correlations between some external and internal egg quality traits in the Japanese quail. Int. J. Poult. Sci. 3(6), 400-405.

McFerran, J.B. and Adair, B.M. (2003): Diseases of Poultry. Iowa State Press, Ames, Iowa. USA.

Monira, K.N.; Salahuddin, M. and Miah, G. (2003): Effect of breed and holding period on egg quality characteristics of chicken. International Journal of Poultry Science, 2 (4): 261-263.

Olawumi, S.O. and Ogunlade, J.T. (2009): The effect of genotype and age of layer breeds on egg quality traits. Nigerian J. Anim. Prod. 36(2), 228-236.

Pandey, N.K.; Mahapatra, C.M.; Nerma, S.S. and Johari, D.C. (1986): Effect of strain on physical egg quality characteristics in White Leghorn chickens. International Journal Poultry Science, 21: 304- 307.

Poggenpoel, D.G. (1986): Correlated response in shell and albumen quality with selection for increased egg production. Poultry Sci. 65: 1633–1641.

Potts, P.L.; Washburn, K.W. and Hale, K.K. (1974): Shell evaluation of white and brown egg strains by deformation, breaking strength, shell thickness and specific gravity. Poult. Sci., 53: 2167-2174.

Scott, T.A. and Silversides, F.G. (2000): The effect of storage and strain of hen on egg quality. Poultry Science, 79: 1725-1729.

Silversides, F.G. and Scott, T.A. (2001): Effect of storage and layer age on quality of eggs from two lines of hens. Poultry Science, 80: 1240-1245.

SPSS (Version 18, IBM, USA). SPSS Inc. Released (2007): SPSS for Windows, Version 16.0. Chicago, SPSS Inc.

Tharrington, J.B.; Curtis, P.A.; Jones, F.T. and Anderson, K.E. (1999): Comparison of physical quality and composition of eggs from historic strains of single comb White Leghorn chickens. Poultry Sci. 78: 591–594.

Vits, A.; Weitzenbürger, D.; Hamann, H. and Distl, O. (2005): Production, egg quality, bone strength, claw length, and keel bone deformites of laying hens housed in furnished cages with different group sizes. In PoultSci, vol. 84, no. 10, pp. 1511–1519.

Washburn, K.W. (1979): Genetic variation in the chemical composition of the egg. Poultry Sci. 58: 529–535.

Washburn, K.W. (1990): Genetic variation in egg composition. In R. D. Crawford, ed. Poultry Breeding and Genetics. New York: Elsevier Scientific Publishers, pp. 781–798.

Zhang, L.C.; Ning, Z.H.; Xu, G.Y.; Hou, Z.C. and Yang, N. (2005): Heritability and genetic and genotypic correlations of egg quality traits in brown-egg dwarf layers. Poultry Science, 84, 1209–1213.

Zita, L.; Tůmová, E. and Štolc, L. (2009): Effects of genotype, age and their interaction on egg quality in brown-egg laying hens. Acta Veterinaria Brno, 78: 85–91.

تأثير مجاميع مختلفة من الدجاج المحلي العراقي وايزا براون على الصفات الداخلية للبيض

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استعمل في هذا البحث ٥٠٠ بيضة من ثلاثة مجاميع مختلفة حسب لون الريش من الدجاج المحلي العراقي ومجموعة ايزا بروان، استهدف هذا البحث معرفة الإحصاءات والمتوسطات الخاصة بالصفات النوعية الداخلية للبيضة. دجاج ذات الريش الاسود= مجموعة الاولى؛ دجاج ذات الريش الاسود مع رقبة بنية= مجموعة الثانية؛ دجاج ذات الريش الابيض= مجموع الثالثة ومجموعة الرابعة متمثلة بـ أيزا براون بعمر ٧٠-٨٠ اسبوع تم تربية الطيور تحت نفس الظروف الادارية. أشارت النتائج إلى وجود تباين معنوي ($p<0.05$) في متوسط الصفات: وزن البيضة، وزن الصفار ووزن القشرة بين المجاميع المختلفة، في حين التباين لم يكن معنويا بين المجاميع في نسبة الصفار والالبومين ، والصفات المتعلقة بقشرة البيضة (الوزن، السمك والنسبة المئوية). ان معامل الارتباط الوراثي بين وزن البيضة ايجابي بشكل معنوي ($p<0.01$) مع وزن الصفار والالبومين، و ($p<0.05$) مع وزن القشرة، وان معامل الارتباط الوراثي بين وزن الصفار مع وزن القشرة معنوي بشكل ايجابي ($p<0.01$) ايضا، بينما كان معامل الارتباط الوراثي بين وزن الالبومين مع وزن القشرة غير معنوي بشكل سلبي. في حين كان معامل الارتباط الوراثي بين وزن البيض مع نسبة الصفار والقشرة ايجابي، وان هذا المعامل بين نسبة الصفار مع نسبة البياض، ونسبة الالبومين مع نسبة القشرة كان معنويا بشكل سلبي ($p<0.01$). تشير النتائج في هذا البحث الى ان التاثير في وزن البيض وبعض الصفات الداخلية للبيضة كان معنويا بين المجاميع المختلفة من الدجاج العراقي المحلي وايزا بروان.