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PRODUCTIVITY AND EGG QUALITY OF TWO HEN GENOTYPES KEPT IN FREE-RANGE SYSTEM

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Abstract

The purpose of this study was to compare the performance and egg quality parameters of two hybrids of laying hens (Lohmann Brown and Atak-S) reared in free-range system. The experiment was carried out with a total of 300 laying hens. From 18 to 50 weeks of age Lohmann Brown (LB) and Atak-S (AS) were housed in two groups of 150 hens in a poultry house with a stocking density of 7 hens/m^2. Feed intake and feed conversion rate during the all laying period were 111.2 g vs 124.3 g, and 2.46 vs 2.58 respectively for LB and AS genotypes ($P<0.05$). The AS had a significantly higher body weight (2200.5 g and 2022.2 g respectively) than LB hen at week 50 ($P<0.05$). There was no a significant difference concerning the egg production between two genotypes ($P>0.05$). However, egg weight was significantly higher in LB genotype than AS genotype ($P<0.05$). Similarly, no significant difference was found between two genotypes on egg quality characteristics throughout the experiment ($P>0.05$). In conclusion, our results showed that strain selection is important for productivity of laying hens rearing in free-range system.

Keywords: *productivity, egg quality, free-range system, Lohmann Brown, Atak-S.*

INTRODUCTION

Egg production system is probably one of the most important challenges for the egg producing industry in the last decade. There are various factors including diseases, behavior, nutritional value, genetics and air conditions in house affecting the level of welfare laying hens (Denli et al., 2016).

The great majority of egg chickens are grown in cages in the world. However, the results obtained from scientific studies in recent years have revealed that chickens raised in traditional cages may not meet the physiological and behavioral requirements (Bozkurt, 2009). After finding that the breeding conditions in conventional cages affected the animal welfare negatively. The European Parliament passed the decision "to ban the use of cages" in 1999 and it was decided to be implemented until 2012. After this directive (1999/74 / EC), it is permitted for the use of enriched cages (Lumvery, 1999). After the ban in 2012, the search for alternative breeding systems for laying hens has accelerated. Animal welfare is a definition that prescribes the quality of life of an animal by creating the conditions that animals can show their natural behavior.

The use of cages enriched instead of the traditional cage system has come to the forefront. Other alternative breeding systems that keep animal welfare in the forefront are free-range and aviary systems. In some countries such as Germany and the Netherlands, the poultry industry has a tendency towards fully alternative breeding systems while the enriched cage system in the UK, Belgium and Sweden has come to the forefront (Rodenburg et al., 2005).

In alternative breeding systems, chickens are able to exhibit many natural behaviors, walking and have enough exercises. Among the factors influencing the selection of breeding systems are epidemic diseases, behavior, nutritional value, genotype and environmental conditions (Denli et al., 2016). However, due to some disadvantages and other problems in the animal welfare of the conventional cage breeding system, various alternative systems have been carried out in order to minimize negative effects of conventional cage. Free-range and enriched cage systems are acceptable alternative breeding systems in terms of alleviating the problems of conventional cage systems. Laying hen's performance and production parameters such as egg weight, feed

efficiency, daily feed consumption, and mortality may be influenced by the different housing systems (Taylor and Hurnik, 1996; Batkowska et al., 2014), genotype and age (Zita et al., 2009) and environmental conditions (Hester et al., 2005). Moreover, egg quality may also be affected by the housing systems (Vits et al., 2005) as well as the age of the laying hens (Silversides et al., 2006)

Up to now, the production performance and egg quality characteristics of many laying hens strains in different housing systems have been compared (Abrahamsson and Tauson, 1997; Van Den Brand et al., 2004; Mallet et al., 2006). Atak-S (AS) is a Turkish domestic egg laying strain has been developed by Ankara Poultry Research Institute in 2004 (Goger et al., 2016) and because of many reasons AS strains is preferred by farmers. However, there is no enough knowledge on the performance of Atak-S (AS) strain in different housing systems. In this study, we aimed to determine and compare indices of production and egg quality parameters of native (Atak-S) and foreign (Lohmann Brown) laying hybrids reared in free-range systems.

MATERIALS AND METHODS

A totally three hundreds 18-wk-old Lohmann Brown and Atak-S hens were housed in free-range systems (n= 300; 10 houses; 15 hens per house; floor space 200 cm^2/hen) to 50 week of age. Hens were fed the same diet formulated was based on National Research Council (NRC) (1994) containing 17.5% CP, 2800 ME/kg, 3.6% Ca and 0.90% available P. Thought the experiment lights were on a 16L:8D schedule. Feeders were filled manually every day and egg collection was conducted daily during the morning hours. Egg weight, feed intake and feed efficiency were determined weekly throughout the experiment period. Egg production per group, per-house-hen-day production and quality parameters were performed at of 20, 30, 40 and 50 week of age on the random sample of 30 eggs per treatment. Totally 30 eggs were collected (in the morning) from each group for 2 consecutive days and stored at 4°C overnight and then broken onto a level surface. Percentage of cumulative mortality of laying hens were recorded during the rearing and laying periods. Egg height, width and shell thickness 8(mm) were measured by using micrometer screw from Mitutoya. The height of the albumen and yolk were measured by using tripod micrometer. The width of the albumen and yolk were measured by using a standard caliper. Yolk color was measured with a Roche yolk color fan scale (Roche scale). Statistical analysis was performed using the mixed model and t-test procedure of SPSS 15.0. Tukey's test was used to separate group means. A significant difference was at $P < 0.05$.

RESULTS AND DISCUSSIONS

Housing systems in layer have an important influence on the productive performance (Moorthy et al., 2000; Singh et al., 2009) and egg quality parameters of laying hens (Vits et al., 2005). Research results relating to hen-egg production, feed consumption, feed efficiency and mortality was presented in Table 1. LB had higher egg production than AS at week 20 and week 30, However, the egg production of AS hens was higher than that of LB hens at week 50 ($P<0.05$). Feed consumption of AS hens was found higher than LB at week 40 and 50 ($P<0.05$). The observation concerning egg production of LB hens made in this study was agree to those obtained by Küçükyılmaz et al. (2012). In addition, a significant effect of strain on feed efficiency was found in all periods of trial ($P<0.05$). On the other hand, the LB hens had a lower mortality rate (0.7% and 1.8% respectively) than AS hens at week 30 ($P<0.05$).

Shell and internal quality of egg is important for the economic success of a producer and also consumer demands (Singh et al., 2009). Egg quality may be influenced by several factors such as housing systems, hen strain and nutritional values. There are differences in egg quality parameters between different strains (Hocking et al., 2003). In this study, there was no significant difference between the egg shape index, shell weight and shell thickness regarding appearance from 20 to 50 week of age (Table 2). However, the egg weight of LB hens was higher than that of AS hens at week 30, 40 and 50 ($P<0.05$). Similar results were reported by Basmacıoğlu and Ergul (2005). However, results of shell thickness of egg was

shown difference from Küçükyılmaz et al. (2012) who found the egg shell thickness of eggs from LB hens were higher than that of eggs from AS layer hens in conventional and organic rearing systems.

The strain has effects on yolk and albumen quality characteristics of eggs (Tumova et al., 1993). The effects of strains on albumen height, albumen width, and yolk height and yolk width was shown in Table 3. In the study, no the significant differences was found between strains housed in furnished cages at week 20, 30, 40 and 50 (P>0.05). In contrast, Leyendecker et al. (2001) found significantly higher yolk weight in white egg chickens (Lohmann LSL) in comparison with the Brown Lohmann.

The strain influenced cracked and dirty egg numbers in a marked manner (Table 4). The cracked egg numbers from LB hens at 20 week was found higher than those from AS hens (P<0.05). Eggs from LB and AS hens have shown similar yolk color.

Table 1. Production performance of Lohmann Brown and Atak-S hens housed in free-range (20 to 50 week of age)

Period	Hen-egg production (%)		Feed consumption (g/hen per d)		Feed efficiency (g of feed/g of egg)		Mortality (%)	
	LB	AS	LB	AS	LB	AS	LB	AS
Wk 20	36.4^{a}±1.41	22.8^{b}±1.18	100.2±0.9	100.1±0.6	2.61^{b}±0.07	2.78^{a}±0.01	0.0±0.00	0.0±0.00
Wk 30	95.4±1.22	95.2±1.42	113.4±0.1	118.8±0.7	2.49^{b}±0.06	2.62^{a}±0.08	0.7^{b}±0.05	1.8^{a}±0.01
Wk 40	95.7^{a}±1.18	93.9^{b}±1.46	118.6^{b}±0.7	126.4^{a}±0.1	2.37^{b}±0.01	2.56^{a}±0.08	2.8±0.07	2.5±0.03
Wk 50	85.3^{b}±1.16	87.3^{a}±1.36	113.4^{b}±0.5	124.3^{a}±0.2	2.33^{b}±0.01	2.42^{a}±0.09	4.8±0.10	5.0±0.06

[a,b]Means± SE within each period with different superscript letters are significantly different ($P < 0.05$).
LB = Lohmann Brown; AS= Atak-S

Table 2. Weight, shape index, shell weight and shell thickness of eggs of Lohmann Brown and Atak-S laying hens housed in free-range from 20 to 50 week of age

Period	Egg weight (g)		Shape index		Shell weight (g)		Shell thickness (mm)	
	LB	AS	LB	AS	LB	AS	LB	AS
Wk 20	46.3±0.12	44.1±0.12	78.2±0.31	77.0±0.29	5.10±0.04	4.85±0.02	0.34±0.007	0.33±0.007
Wk 30	58.4^{a}±0.22	54.8^{b}±0.33	78.1±0.42	75.8±0.29	6.38±0.04	5.90±0.07	0.33±0.008	0.34±0.006
Wk 40	64.9^{a}±0.28	60.1^{b}±0.52	76.1±0.38	74.9±0.46	7.17±0.07	6.38±0.05	0.34±0.005	0.36±0.004
Wk 50	65.4^{a}±0.42	61.8^{b}±0.38	76.2±0.62	76.3±0.42	7.16±0.12	6.71±0.15	0.32±0.004	0.31±0.006

[a,b]Means± SE within each period with different superscript letters are significantly different ($P < 0.05$).
LB = Lohmann Brown; AS= Atak-S

Table 3. Albumen height and width, yolk height and width of eggs of Lohmann Brown and Atak-S laying hens housed in free-range from 20 to 50 week of age

Period	Albumen height (mm)		Albumen width (cm)		Yolk height (mm)		Yolk width (mm)	
	LB	AS	LB	AS	LB	AS	LB	AS
Wk 20	9.6±0.10	9.8±0.12	6.4±0.12	6.6±0.12	18.5±0.13	18.7±0.16	37.2±0.32	38.2±0.31
Wk 30	9.6±0.11	9.3±0.11	6.7±0.15	6.7±0.18	18.9±0.15	18.3±0.13	39.0±0.14	38.6±0.28
Wk 40	9.5±0.09	9.8±0.10	6.5±0.12	7.0±0.23	18.8±0.11	18.8±0.11	40.2±0.15	40.5±0.18
Wk 50	9.3±0.09	9.5±0.11	7.3±0.20	7.8±0.12	18.7±0.13	18.8±0.14	41.7±0.28	42.4±0.38

[a,b]Means± SE within each period with different superscript letters are significantly different ($P < 0.05$).
LB = Lohmann Brown; AS= Atak-S

Table 4. Cracked, dirty eggs and yolk color of LB and AS laying hens housed in in free-range from 20 to 50 week of age

Period	Cracked eggs (%)		Dirty eggs (%)		Yolk color	
	LB	AS	LB	AS	LB	AS
Wk 20	2.44[a]±0.06	0.54[b]±0.01	0.00±0.00	0.00±0.00	11.0±0.14	11.2±0.08
Wk 30	1.04±0.05	1.14±0.01	0.12±0.001	0.19±0.001	11.4±0.16	11.8±0.13
Wk 40	0.10±0.01	0.78±0.01	0.00±0.001	0.00±0.000	12.1±0.12	12.0±0.13
Wk 50	0.85±0.02	0.89±0.01	0.0±0.00	0.0±0.00	12.0±0.14	12.2±0.11

[a,b]Means± SE within each period with different superscript letters are significantly different ($P < 0.05$).
LB = Lohmann Brown; AS= Atak-S

CONCLUSIONS

In conclusion, our results showed that strain selection is important for productivity of laying hens rearing in free-range system. Furthermore it can be concluded that performance of LB laying hens was better than AS hens in free-range system.

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