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Changes in External Egg Traits of Chickens during Pre- and Post-Molting Periods

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Abstract
481 fresh fertilized eggs of three Kurdish local chickens (Black with brown neck, White with shank feathering, and White with non-feathering shank) were collected at pre-molting (355 eggs) and post-molting (126 eggs) stages to evaluate external egg traits. A venine caliper was used to determine the length and breadth of eggs to calculate Shape index. Results indicated that egg weight increased in all genetic groups (P < 0.05) at post-molting stage compared with pre-molting stage. There was a significant difference in egg length between pre- and post-molting periods from the black chicken with brown neck and white chicken with shank feather, but not from the white chicken with non-feathering shank. Also, egg breadth was similar between pre- and post-molting periods from black with brown neck and white with shank feather, but was different from white with non-feathering shank. Shape index was also similar between pre- and post-molting periods for white with shank feather, but were significantly different (P < 0.05) for black with brown neck and white with non-feathering shank. The results of this study indicate that egg external traits improved during post-molting period than pre-molting, and variations between egg layers for external traits could be due to the genetic makeup.

Introduction

Molting is a major event in the annual life cycle of most avian species including wild and domestic birds (Koelkebeck and Anderson, 2007). Birds usually experience molting during winter due to short daylight, at which point there is periodic shedding and replacement of plumage (Berry, 2003). This process, which represents a rejuvenation of the reproductive system (Svihus *et al.*, 2002), occurs after sexual maturity, and is associated with a pause in egg production, which can be lengthy and asynchronous with others in the flock. Molting and its effects may be important in understanding the reality of hen care and egg production (La Brash and Scheideler, 2005).

Molting is a technique that is employed commercially to cease egg production in laying and breeding hens to recycle them for another season of egg production. After the molting, egg production and quality may improve significantly compared to pre-molt period. Since 2005, four genetic groups of Kurdish local chickens were established that differ in many physical traits like feather color, shank feather appearence, and egg traits. Up to date, it is not clear if there are significant differnces between both molting periods and egg external traits. The objective of this study is to evalute the external traits of eggs before and after molting by using three genetic groups of Kurdish local hens.

Materials and Methods

The experiment was carried out between

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February 2015 to February 2016 in the Poultry Production Department, Agricultural Research Center in Sulaimani, Ministry of Agriculture and Water Resource in Kurdistan, Iraq (35° 32 30 N 45° 21 00 E) at an altitude of 737.5 m above sea level. Three genetic groups of Kurdish local chickens were used: Black with brown neck (BBN), White with shank feathering (WSF), and White with non-feathering shank (WNFS). 481 fresh fertilized eggs were collected at two periods: 355 eggs at pre-molting (62-72 weeks of age) and 126 eggs at post-molting (after 80 weeks of age). After collection, eggs were weighted to the nearest 0.01 g. A venine caliper with accuracy of 0.01 mm was used to determine the egg length and breadth to calculate Shape Index (SI) using the equation below (Reddy *et al.*, 1979):

Shape index (SI) = Breadth / Length × 100

General linear model (GLM) with SPSS v18 program was used to assess the effects of genetic lines, pre- and past-molting. Duncan multiple range test was used to test the difference between means (Duncan, 1955).

Results and Discussion

Results regarding egg traits at pre- and post-molting periods are shown in Table 1. Egg weight at pre-molting period from BBN and WSF (59.94 ± 0.31 and 59.17 ± 0.35 g, respectively) were significantly higher than eggs from WNFS (57.41 ± 0.47 g). In contrast, at the post-molting period, egg weight was significantly higher from WNFS (63.85 ± 0.35 g) than BBN and WSF (61.96 ± 0.83 and 61.02 ± 1.05 g, respectively) (P < 0.05). Egg weights for all genetic groups were significantly higher at post-molting compare to pre-molting period (P < 0.05) (Fig. 1), consistent with previous works (Nakazawa *et al.*, 1970; North and Bell, 1990; Rolon *et al.*, 1993; Ahmed *et al.*, 1995; Akram, 1998; Aygun, 2013; Ahmad *et al.*, 2014b).

Table 1 .Egg characteristics of three genetic groups at pre and post-molting periods[†]

	Pre-molting				Post-molting			
	Egg weight (g)	Egg length (mm)	Egg breadth (mm)	Egg shape index (%)	Egg weight (g)	Egg length (mm)	Egg breadth (mm)	Egg shape index (%)
BBN[‡]	59.94 ± 0.31[a]	57.68 ± 0.23[a]	43.38 ± 0.13[a]	75.44± 0.55[b]	61.96±0.83[b]	59.77± 0.34[a]	43.32 ± 0.24[b]	72.53 ± 0.42[b]
WSF[#]	57.41 ± 0.47[b]	57.16 ± 0.23[a]	42.80 ± 0.16[b]	74.98± 0.45[b]	61.02±1.05[b]	60.27± 0.64[a]	43.17 ± 0.39[b]	71.67 ± 1.16[b]
WNFS[*]	59.17 ± 0.35[a]	56.41 ± 0.21[b]	43.60 ± 0.11[a]	77.42± 0.31[a]	63.85± 0.35[a]	56.86± 0.27[b]	45.14 ± 0.11[a]	79.55 ± 0.44[a]
Mean	58.84 ± 0.21	57.08 ± 0.12	43.26 ± 0.07	75.95 ± 0.23	63.27± 0.33	57.72 ± 0.24	44.61 ± 0.12	77.50 ± 0.44
P-value	<0.001	<0.001	<0.001	<0.001	0.02	<0.001	<0.001	<0.001

[†]Data are presented as Mean ± SEM.
[‡]Black with brown neck, [#]White with shank feather, [*]White with non-shank feather.
Means with different superscripts in each column differ significantly (P < 0.05).

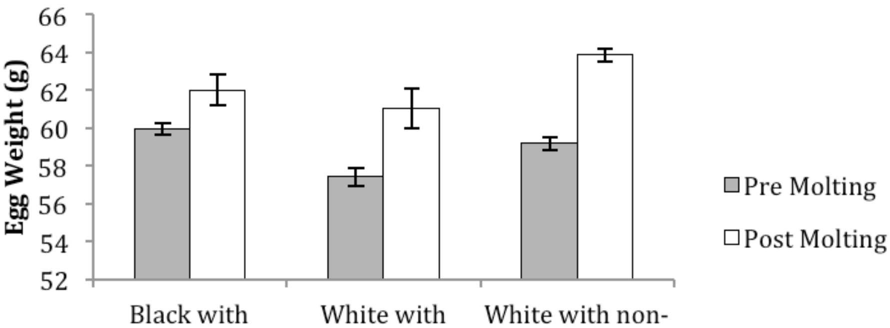

Figure 1. Egg weight of three genetic groups at pre- and post-molting periods.

Egg length in BBN and WSF groups (57.68 ± 0.23 and 57.16 ± 0.23 cm, respectively) was significantly higher than WNFS group (56.41 ± 0.21 cm) at pre-molting period (P < 0.05; Table 1). A similar trend was observed at post-molting period too. Highly significant differences (P < 0.001) were observed between pre- and post-molting periods for BBN and WSF groups, while the difference was insignificant in WNFS chickens (Fig. 2). Ahmad *et al*. (2014a) found no significant differences between pre- and post-molting periods for egg length from Aseel hens varieties. This could be attributed to different strains that lay eggs with different weights and sizes, resulting in variations in egg length (Arafa *et al*., 1982; Bell and Weaver, 2002).

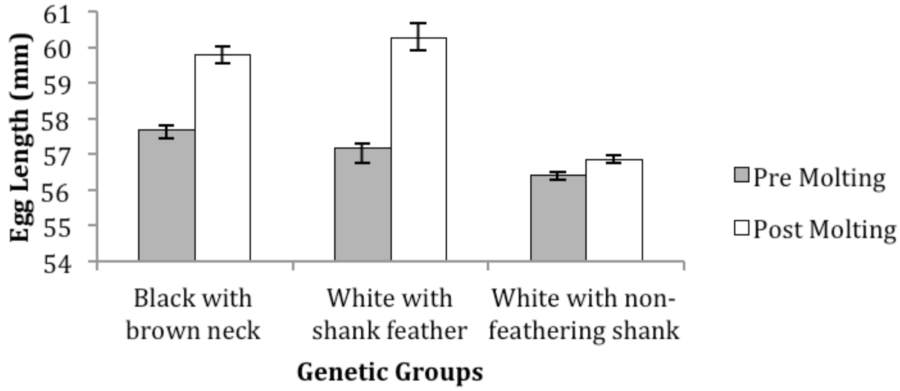

Figure 2. Egg length of three genetic groups of chickens at pre- and post-molting periods.

The results in Table 1 show that egg breadth of WNFS and BBN groups (43.60 ± 0.11 and 43.38 ± 0.13 cm, respectively) was significantly higher than WSF group (42.80 ± 0.16 cm) at pre-molting period (P < 0.05). In the post-molting period, higher egg breadth was observed for WNFS group (45.14 ± 0.11 cm) than BBN and WSF groups (43.32 ± 0.24 and 43.17 ± 0.39 cm, respectively) (P < 0.05). Egg breadth was similar between pre- and post-molting periods for BBN and WSF groups, while the difference in WNFS group was statistically significant (P < 0.05, Fig 3). Ahmad *et al*. (2014a) found significant difference between pre- and post-molting periods for egg breadth. This difference could be due to genotypic variation (Arafa *et al*., 1982; Bell and Weaver, 2002).

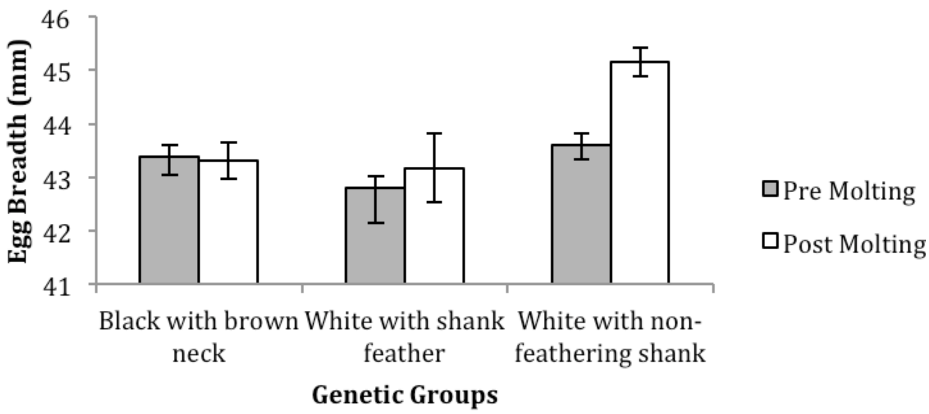

Figure 3. Egg breadth of different genetic groups of chickens at pre- and post-molting periods.

The greatest egg shape index in pre-molting period was from eggs of the WNFS group (77.42 ± 0.31%), which was significantly higher than WSF and BBN groups (74.98±0.45 and 75.44±0.55 %, respectively) (P < 0.05). A similar trend was seen in post-molting period where the greatest egg shape index was also from the WNFS group (79.55 ± 0.44%), followed by the BBN (72.53 ± 0.42%) and WFS (71.67 ± 1.16%). Shape index was similar between pre- and post-molting periods in WSF group, but was significantly higher during post-molting than pre-molting in BBN and WNFS groups (P < 0.05, Fig 4). The increase in shape index in WNFS could be due to increased egg breadth after molting (Nakazawa, *et al*., 1970; Aygun, 2013; Ahmad *et al*., 2014a), since egg shape index is directly proportional to egg breadth (Günlü *et al*. 2003; Monira *et al*. 2003; Brand *et al*. 2004).

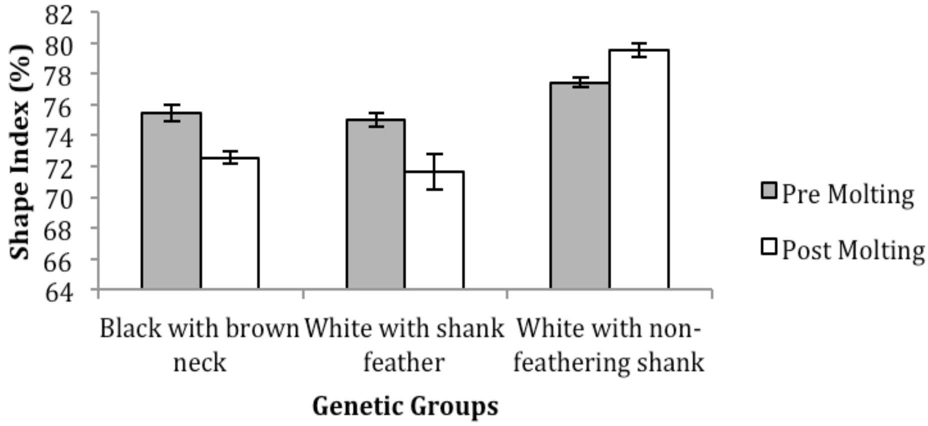

Figure 4. Egg shape index of different genetic groups of chickens at pre- and post-molting periods.

Conclusion

The results of this study indicate that egg external traits improve during post-molting period compared to pre- molting period, and these traits vary between egg layers, likely due to genetic makeup.

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