

# Quality traits of eggs from HyLine White and HyLine Brown hens kept in cages and on litter

S. WEŻYK\*, J. KRAWCZYK, J. CALIK and K. POŁTOWICZ

National Research Institute of Animal Production, 31-083 Balice n. Krakow, Poland

\*Corresponding author: [wezyk@interia.pl](mailto:wezyk@interia.pl)

---

A total of 125 HyLine White (W) and 125 HyLine Brown (B) hens were kept from 18 to 57 weeks of age in cages or on litter to evaluate production traits and egg quality traits over 4-week periods. Feather picking and cannibalism occurred in hens kept on litter, which contributed significantly to poor health and lower productivity in hens. In the litter system, mortality was 14% for W hens and 35% for B hens, while in the cage system, mortality did not exceed 6% for either hen breed. Mean body weight ranged from 1896 g (litter) to 1850 g (cage) for B hens, and from 1621 g to 1623 g for W hens, with large differences between brown- and white-feathered layers within a housing system. The mean egg weight increased with increasing hen body weight. The correlation between these two traits was highly significant ( $r=0.864$  for B hens and  $r=0.847$ ) for W hens in the cage system, compared to  $r=0.522$  and  $r=0.737$ , respectively, in the litter system.

No significant differences were found in egg quality traits between the groups of hens kept on litter or in cages except in shell density and thickness between the group B hens only.

Litter B hens, whose laying rate was <30%, laid eggs that were 3.7 g heavier compared to caged hens. Caged hens laid more eggs that were lighter and had poorer shell quality parameters and a less intense yolk colour.

---

**Keywords:** laying hens; cage; litter; egg quality

## INTRODUCTION

In many countries of the world, particularly in the European Union, consumers are show an increasing preference for organic or free-range eggs rather than eggs produced by intensively reared hens in multi-tier cage batteries. They firmly believe that eggs laid in more hen-friendly conditions are characterized by higher egg content and egg shell values, in accordance with the motto “happy eggs from happy hens”. This resulted in the implementation of restrictive Council Directive 1999/77/EC, which stipulates that after 2012, hens in EU countries can only be kept in alternative or enriched cage systems, with the complete elimination of conventional cages (Horne and Bondt, 2003; Fisher and Bowles, 2002; Fiks-Van Niekerk et al., 2003). The rate at which this regulation is implemented should be reconsidered not only due to the risk of avian influenza, but also for economic and health reasons related to egg safety. The aim of the present study was to evaluate the egg content and egg shell traits of eggs from HyLine White and HyLine Brown hens kept in cages and on litter.

## Materials and methods

The study covered two commercial lines of hens: 250 HyLine White (W) and 250 HyLine Brown (B) laying hens aged 18 weeks, kept in a 3-tier battery of cages and on straw bedding. After a 7-day adaptation period, pullets were weighed and this procedure was repeated every 4 weeks between 20 and 57 weeks of age. Throughout the experiment, layers were fed a standard diet for laying hens and feed intake was recorded in groups once a week. The health status of hens was observed every day and reasons for mortality were determined by a veterinarian.

In the groups studied, the number of eggs, average egg weight (EW) and weight of eggs laid were determined every day, and 30 eggs were randomly taken from each experimental group every 4 weeks to evaluate quality traits using EQM (Egg Quality Measurements) electronic equipment, to determine egg quality traits such as egg weight and colour, shell density and thickness, height of dense albumen and Haugh units, as well as the egg shape index, shell strength (kg) using an egg crusher, yolk weight and colour, and the presence of meat and blood spots in the egg content. The results were analysed statistically using analysis of variance and Duncan's test using Statgraphic 4.0 Plus software.

## Results and Discussion

In both groups of hens kept on litter, there were symptoms of feather-picking and cannibalism, which accounted for 14% of mortality in W layer and as much as 53% of mortality in B layers. During the same period, hens from both groups kept in cages had a survival rate of 94%. The highest mortality was found at the peak of egg production (approx. 35 weeks of age) in W and B layers kept on litter.

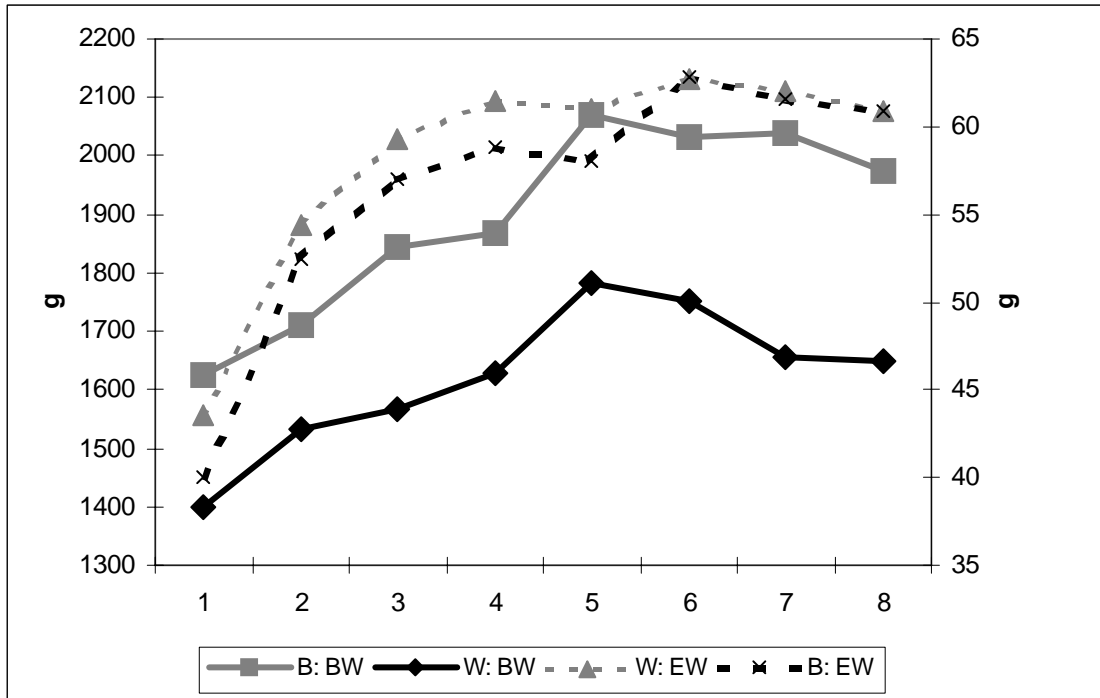
Despite the improvement in layer's health with age, the undesirable symptoms of feather-picking and cannibalism that persisted throughout the egg production period reduced the rate of egg production to approx. 65% in B hens and 70% in W hens. The genetic background of differences in the frequency of these two vices was reported by Jensen et al. (2005) and Weitzenbürger et al. (2005), and the better status of caged hens than those in the litter system was reported by Hung CheMing et al. (2005) and Tauson (2005).

The egg laying curve of caged W and B layers had a natural shape, with a peak between 32 and 34 weeks of age. In the same hens on litter, following the peak of egg production the curve showed a varying pattern, with differing degrees (5-15%) of decreases in egg production.

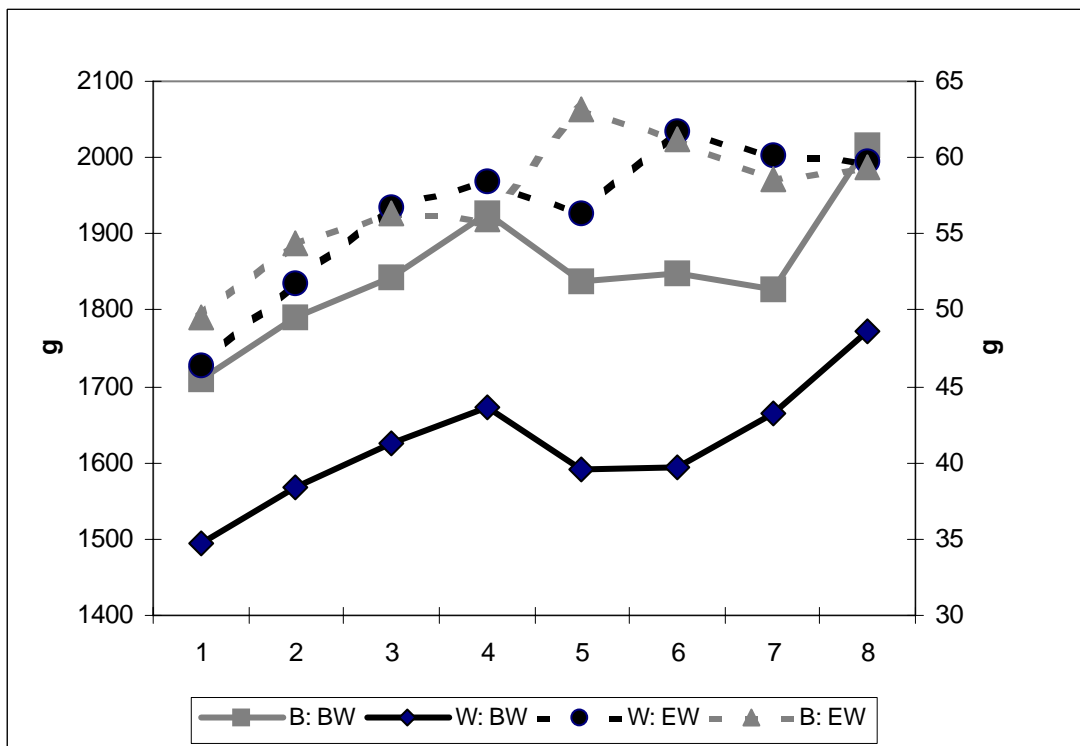
Analysis of Figures 1 and 2 shows a significant effect of the hen rearing system on the relationship between body weight (BW) and egg weight (EW). The average BW calculated for the whole egg production period was 1896 (litter) and 1850 g (cage) for B hens, and 1621 and 1623 g, respectively, for W hens. In both groups of layers kept on litter, the increase in BW was parallel to the increase in mean EW. Expressed as a coefficient of correlation, this relationship was  $r=0.864$  for B hens and  $r=0.847$  for W hens. In the cage system, the correlations were lower ( $r=0.522$  for B hens and  $r=0.737$  for W hens).

As is clear from Table 1, the groups of hens kept in the two different systems did not differ significantly in the values of egg content traits. Significant differences ( $P\leq 0.01$ ) were found in shell density and thickness, but only between B hens kept on litter and in cages. Eggs obtained from layers kept on litter were characterized by a  $3.2 \text{ mg/cm}^2$  higher density,  $14 \text{ }\mu\text{m}$  thicker shell and  $0.25 \text{ kg}$  greater (non-significantly,  $P\geq 0.05$ ) shell strength. An effect of genetic origin of hens and the management system on egg shell thickness was also reported by Basmacioğlu and Ergül (2005).

The B hen groups studied differed considerably but non-significantly ( $P\geq 0.05$ ) in terms of egg weight and yolk weight. Hens in the litter system, which had an egg laying rate of 30%, laid eggs that were an average of  $3.7 \text{ g}$  heavier compared to those of the caged hens, which during the same period were characterized by more intensive egg production, laying more but lighter eggs, with poorer quality parameters and less intense yolk colour. These relationships are well known and often cited in the literature (Akhtar-Uz-Zaman, 2003; Premavalli and Viswanathan, 2004; Roberts, 2004). B hens in both management systems laid eggs with greater albumen height ( $9.5 \text{ mm}$ ) and thus higher Haugh units ( $98.7$ ) compared to W hens ( $9.4 \text{ mm}$  and  $96.6 \text{ HU}$ , respectively). Similar results were also obtained by Pavlovski et al. (2004) who studied the effect of the hen management system on outer and inner egg traits. However, the better quality of the eggs obtained from the litter system does not compensate for losses resulting from the lower survival and poorer egg production of layers kept in this system.



**Fig. 1. Body weight (BW) and egg weight (EW) in B and W hens kept on litter**



**Fig. 2 Body weight (BW) and egg weight (EW) in caged B and W hens**

Clear differences in the egg shape index (ESI) were found between eggs laid by W hens kept in cages (75.7) and those kept on litter (76.2). In B hens these differences were small, with ESI values of 77.3 and 76.9, respectively. Highly significant differences ( $P \leq 0.01$ ) were noted between the ESI of W and B hens kept in cages, and only significant differences ( $P < 0.05$ ) between hens kept on litter.

**Table 1. Egg quality traits in HyLine White (W) and Hyline Brown (B) hens kept in cages (C) and on litter (L)**

Group	EW (g)	ESI	Shell			Yolk		White		Spots (%)	
			strength (kg)	density (mg/cm <sup>2</sup> )	thickness (µm)	weight (g)	colour (Roche)	height (mm)	Haugh unit	blood	meat
W-C	57.4	75.7aA	2.72	78.5b	367b	15.1	9.2	9.4	96.5	2.9	3.7
W-L	57.5	76.2	2.60	78.4b	360B	15.1	10.7A	9.4	96.5	0.7	1.5
x-W	57.5	76.0	2.66	78.5	363	15.1	10.0	9.4	96.5	1.8	2.6
B-C	56.4	77.3B	2.64	79.5b	369b	14.9	8.1B	9.8	98.2	6.6	6.1
B-L	60.1	76.9b	2.89	82.7a	383aA	15.7	9.9	9.2	99.1	6.3	5.9
x-B	58.3	77.1	2.77	81.1	376	15.3	9.0	9.5	98.7	6.5	6.0

EW- egg weight; ESI – egg shape index

In summary, it is concluded that the hen cage system is economically more effective than the litter system and does not reduce egg quality traits. In the alternative management systems, the withdrawal of meat-and-bone meals from hen nutrition favours the incidence of feather-picking and cannibalism. Meanwhile, the threat of avian flu calls into question the use of intensive management of laying hens on free range.

## References

- AKHTAR-UZ-ZAMAN M. (2003) Egg production performance of different breed/breed combination of chicken in semi scavenging system under Pldp. *MSc Thesis in poultry production and health:43-76* Royal Veterinary and Agriculture University. Foulum, Denmark.
- BASMACIOĞLU H. and ERGÜL M. Research on the factors affecting cholesterol content and some other characteristics of eggs in laying hens. The effect of genotype and rearing system. *Türk Veterinerlik ve Hayvancılık Dergisi* 29(1)157-164.
- FIKS-VAN NIEKERK T.G.C.M, VAN EMOUS R.A. and REUVENKAMP B.F.J. (2003) Experiences with production and egg quality in alternative systems and large enriched cages for laying hens in the NETHERLANDS. *Proc. of XVIth European Symposium on the Quality of Poultry Meat & Xth European Symposium on the Quality of Eggs and Eggs Products*. Vol.III:210-216
- FISHER C. and BOWLES D. (2002) Hardboiled reality – 2001-2012 – a dozen years crucial to agriculture and trade reform. Animal welfare friendly egg production in a global market. *EUROGRUP for animal welfare*.
- HORNE P.L.M. and BONDT van N. (2003) Impact of EU council directive 99/74/EC “Welfare of laying hens” on the competitiveness of the EU egg industry. *The Hague, Lei*.
- Pavlovski, Z., Škrbić, Z. and Lukić M. (2004) Influence of housing type on internal and external quality in small flocks of hens. *Živinarstvo* 39(6/7) 19-23.
- Roberts J.R. (2004) Factors affecting egg internal quality and egg shell quality in laying hens. *Journal of Poultry Science* 41(3)161-177
- PREMAVALLI K. and VISWANAGTHAN K. (2004) Influence of age on the egg quality characteristics of commercial white leghorn chicken. *Indian Veterinary Journal* 81(11)1243-1247
- PREMAVALLI K. and VISWANAGTHAN K. (2004) Influence of system of management on the external egg quality characteristics of commercial White Leghorn layers. *Indian Veterinary Journal* 81(12) 1364-1367
- WINDHORST H-W. (2001) Enriched layer cages and open markets for agricultural products – is there a chance for the European egg industry? *Papers of University of Vechta, Germany*