

Effect of genetic and rearing system of laying hens on indicators of egg quality and eggshell microbial contamination



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Context

The rearing of laying hens is in the process of transitioning to alternative systems to cage. Cage system is 100% controlled to optimize laying while the alternative system favors the expression of behavior and interactions with the environment, distributing energy between movement, immune defense and laying.

Which impact for egg quality ?

Material & methods

Eggs collected in 26 flocks of 2 strains of hens at an average age of 58 weeks distributed in the 3 different rearing systems.

Quality of eggs was compared with a Digital Egg Tester (DET6000) from a batch of 30 eggs per farm.

The microbial contamination of egg surface was evaluated by counting the total aerobic mesophilic flora, enterococci and presumed enterobacteria. Measures were made from 5 batches of 3 eggs per farm.

Objectif of the study

The objective of the ELEV'OP project is to assess the impact of different rearing systems (cage, barn system and free-range) on microbiological contamination and on the macrostructure of eggs



Sample distribution according to hen strain and breeding system

System	Lohmann Brown (LB)	Lohmann White (LW)
Cage	5	4
Barn	3	2
Free-range	5	7
Total	13	13

Results

The weight of eggs and yolks showed a strong inter-farms variability with a significant difference between the 2 strains. LW eggs and yolks are on average heavier ($p < 0.01$) in agreement with the Lohmann genetic reference data.

Shell resistance was stronger in LB than LW and it was also impacted by the rearing system for both strains (cage > barn & free-range).

A strong difference in Haugh units was shown between strains (LB < LW) in addition to the rearing system. The yolk index was impacted by hen's age and strain but not by the rearing system.

Impact of the farming system

(difference compared to cage system estimate with Tukey test)

Egg quality	LB	LW
Egg weight	Cage > Free-range (-2.21 g)	none
Yolk weight	Cage > Barn/Free-r. (-0.9 g)	none
Shell index	Cage > Barn (-0.23) > Free-r. (-0.39)	
Shell resistance	Cage > Free-range (-2.09 N)	
Haugh unit	Cage < Free-r. (+2.18) < Barn (+2.31)	
Yolk index	none	none



Impact of the farming system on the microbial contamination of egg surface

	Total aerobic mesophilic flora	Presumed Enterobacteria (<i>E. coli</i> , <i>enterobacter</i> , <i>klebsiella</i> , <i>salmonella</i> ...)	Enterococci		
System	Average quantity (log10 UFC/cm ²)	Number of positif flock	Number of positif eggs batches	Number of positif flock	Number of positif eggs batches
Cage	2.65 ± 0.6	8/9 (89%) *	11/45 (24%)	4/9 (44%)	5/45 (11%)*
Barn	3.34 ± 0.7	3/5 (60%)	7/25 (28%)	4/5 (80%)	6/25 (24%)
Free-range	3.28 ± 0.7	4/12 (25%)* $p = 0.02$	10/60 (17%)	6/12 (50%)	23/60 (38%)* $p = 0.002$

Free-range flocks were less contaminated by presumed enterobacteria than flocks in cage system, but inversely more batches of eggs from free-range hens were contaminated by enterococci than eggs of cage hens.

No difference was observed between hen strains.

Perspectives

This study shows **little impact of the rearing system on the physical characteristics of the egg** and the contamination of the shell. It has been observed a **high variability between farms** unrelated to the rearing system, which can be attributed to the management of the farm (nutritional & light programs, animal density, cleaning plan for breeding rooms & eggs conditioner ...).

Some free-range farms have better results than cage systems that have fully controlled farming conditions. This also showed the importance of farm management, and that the **transition to alternative systems would not have an impact on the quality of eggs production.**