INFLUENCE OF REARING SYSTEMS OF LAYING HENS ON EGGS MICROBIOLOGICAL INDICATORS

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Abstract

The quality of foodstuffs, in particular of eggs is a very important element for public health. The aim of the current paper is to compare the microbial load of eggs from two operating systems for laying hens (EU approved battery and free range). Were taken in study15 eggs from those two systems of rearing which were stored in refrigerating conditions over a period of 21 days .We determined the eggshell TNGMA rapid method Tempo TVC and content by the method of decimal dilutions and inoculation with Plate Count Agar Petri plates; Salmonella also cause the contents of the egg using selective culture medium. Following these determinations TNGMA on the eggshell recorded the highest level of contamination in eggs obtained from free range system (4.8 log CFU / eggshell in fresh and 5.01 log cfu / eggshell refrigerated for 21 days). The situation was available for TNGMA of egg contents. For Salmonella spp., the determination performed, did not reveal the presence of it, which indicates that laying hens are free from Salmonella. Higher microbial load in the eggs from free range system can be explained through contact of birds with less healthy areas (the shelter with permanent litter and its associated paddock).

Key words: bacterial contamination, conventional, free range, egg, public health

INTRODUCTION

Egg, is a complete food that plays a critical role in daily nutrition, irrespective of the trade vessels has been obtained. Alternative rearing systems for laying hens have become priority, from 1 January 2012, the classic batteries when were banned and replaced with approved batteries, where the notion of welfare is respected, and free range systems that allow access to the external environment hens (7), which brings pluses on welfare, but without drawbacks in terms of food safety. Hygiene and biosecurity are very important concepts, not only on the health of laying hens, but also in terms of consumer health. In alternative systems, where the birds have access to the outside, accumulate a significant amount of dust, particularly in bedding area standing with the consequence of a microbial and endotoxin contamination of the air. In 2005, De Reu has shown that alternative systems improvements produced 10 times more bacteria in the existing microclimate and 20-30 times more microorganisms on the mineral shell compared to hens in battery operation. Eggs produced in alternative systems are generally shell contamination of aerobic bacteria (2). Messens et al, in 2007, demonstrated that the microclimate high microbial load, increase the number of microorganisms on mineral shell, which leads them to penetration inside the egg. In this study, the main objective was to determine the microbiological quality of eggs from two farming systems (EU approved battery and free range), expressed by the results obtained both mineral shell and the egg contents.

MATERIALS AND METHODS

For the evaluation of the microbiological quality, we used a total of 30 eggs collected from chickens reared in the two operating systems approved battery EU and free range.

They were divided into two groups 15 eggs from free range growth Batch A and the other 15 eggs from hens battery operated Batch B. Eggs subjected to microbiological analysis

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come from hybrid Isa Brown, aged 43 weeks. Samples of both batches were stored refrigerated (4°C, relative humidity = 90%) by determining the microbiological indicators made every 7 days throughout the period of validity of 21 days. To determine TNGMA was used decimal dilution method, which involves weighing 10 g of the product to be tested, mix with 90 mL of sterilized diluent and titration of the sample to give the first dilution (10-1 or 1/10); still be achieved successive decimal dilutions. From each dilution determined for each 1mL sowing partitioned in the center of two Petri plates. In order to achieve the inoculated pour plate culture medium 15 mL and cooled to 45-50°C melted and then mixed Plate Count agar inoculated by moving forward and backward, right, left. After solidification environment Petri plates are inserted into the unit with the cover down at 30°C. After 48 hours the thermostat, are removed and the Petri dishes are developed colonies (between 10-300 colonies). TNGMA alternative method used to determine the mineral shell is TEMPO TVC is an automated test using rapid system analysis; Tempo allows enumeration of mesophilic aerobic bacterial count in food after 24-48 hours. Tempo TVC uses a vial with medium and a card with a system of tubes and microtubes, which is basically the technique MPN (most probable number). During incubation, mesophilic aerobic microorganisms present in the card reduces the substrate from the culture medium and favors the appearance of a fluorescent signal that is detected by the tempo reader. Tempo working steps of the method are:

1. preparing dilutions;
2. distribution in vialuri;
3. inoculated medium mixing;
4. seal cards;
5. enrollment data on cards and evidence;
6. incubation cards 22 to 24 hours at 37°C;
7. while reading and interpreting the results of the analysis issue.

The advantage of this method is the timeliness of the results of the TNGMA, the total time of the analysis method being 24 hours. Determination of *Salmonella* in foods must provide environmental conditions that allow them to resume normal growth processes and simultaneously inhibit competing flora. Selective enrichment media was incubated at 30-37ºC for 48 hours. After 24 and 48 hours of incubation are passages on selective isolation media. To confirm the presence or absence of *Salmonella* is the slide agglutination, which are used serotype-specific serum.

RESULTS AND DISCUSSION

The analysis carried out in the three phases of shelf life, there was a higher microbial load in eggs from free range system; so that the 7 days of storage at 4°C and relative humidity of 90%, for the contents of eggs (melange) from the free range system have been 2.15 ± 0.18 cfu / g, and the increase in battery eggs from 1.77 ± 0,51ufc / g. At the end of the validity period 21 days higher values (2.76 ± 0,58ufc / g vs 2.29 ± 0.21ufc / g) found in free range systems compared to the conventional one may be due to microclimate factors, contact less salubrious areas inside the hall, and air microbial load in the halls free range, as confirmed by the literature (7).

Table 1 Evolution of TNGMA contents eggs from EU approved systems

		n	$\overline{X} \pm S_{\overline{X}}$	V%	Min	Max
TNGMA 7 days	Batch A	5	2.15±0.18	8.35	1.99	2.32
	Batch B	5	1.77±0.51	28.68	1.09	2.32
Test Fisher				$\hat{F}$ = 2.069 <F 0.5% 5.317 *n.s*		
TNGMA 14 days	Batch A	5	2.40±0.42	17.36	2.01	2.99
	Batch B	5	2.27±0.53	23.19	1.82	2.91
Test Fisher				$\hat{F}$ = 0.228 < F 0.5% 5.317 *n.s.*		
TNGMA 21 days	Batch A	5	2.76±0.58	21.01	2.22	3.33
	Batch B	5	2.29±0.21	8.97	2.11	2.50
Test Fisher				$\hat{F}$ = 5.312 < F 0.5% 5.317 *n.s.*		

Regarding the bacterial contamination of mineral shell, the results indicate a higher rate of microorganisms present on the shell eggs from free range system both at 7 days of storage (4.80 log cfu / shell) unlike eggs produced in cages (4.77 log cfu / eggshell) and 21 days (5.01 log cfu / shell vs 4.95 log cfu / eggshell).

Table 2 Evolution TNGMA from the mineral shell eggs from EU approved system

	7 days log ufc/eggshell	14 days log ufc/eggshell	21 days log ufc/eggshell
Free range	4.80	4.87	5.01
EU approved battery	4.77	4.85	4.95

Table 3 indicates the values found in the literature for the two operating systems. From the analyzes, the results are lower than the values recorded by De Reu K., in 2006, on a free range 5.46 log cfu / eggshell and coil agreed highest value 5.06 log cfu / eggshell.

Table 3 Evolution of the TNGMA mineral shell eggs from EU agreed systems by different authors

	System of rearing	TNGMA log ufc/eggshell	Source
Mineral eggshell	Free range	4.86	Huneau-Salaün A., 2010 (3)
	EU approved battery	4.40	
	Free range	5.40	Vučemilo M., 2010 (7)
	EU approved battery	3.60	
	Free range	5.46	De Reu K., 2006 (2)
	EU approved battery	5.08	
	Free range	4.23	Protais, J., 2003 (4)
	EU approved battery	4.10	
	Free range	4.30	Schwarz G., 1999 (5)
	EU approved battery	3.90	
	Free range	5.06	Galiş Anca Maria and col., 2012 (1)

Eggs showed no Salmonella spp studied at any of the three dilutions performed microbiological examination which indicates that the flocks from which the eggs are free of salmonella.

Table 4 Evolution and identification of *Salmonella* from egg contents from EU approved systems

Control day	Batch	Serial dilutions		
		I (10)	II(100)	III (1000)
Day 7	Batch A	-	-	-
	Batch B	-	-	-
Day 14	Batch A	-	-	-
	Batch B	-	-	-
Day 21	Batch A	-	-	-
	Batch B	-	-	-

+ prezent; - absent

CONCLUSIONS

Following microbiological assays performed bacterial contamination was higher in eggs from free range system, unlike those from EU approved battery operation This occurred because the load with bacteria, endotoxins and dust microclimate of the permanent litter the hall.

So if TNGMA determination of egg content in the free range system at the end of life recommended (21 days) had a value of 2.76 ± 0.58 cfu / g, 2.29 ± 0.21 versus cfu / g recorded battery eggs.

Regarding the microbial load of the shell mineral, it is higher in eggs from alternative systems, in our case the free range system 4.80 log cfu / eggshell, unlike the battery which is 4.77 log cfu / eggshell.

For our study no evidence derived from free range or conventional systems did not reveal the presence of *Salmonella spp.* Knowing that horizontal transmission of Salmonella is influenced by the mineral shell (2), we can say that eggs have lots of experience of its particular quality.

Alternative systems of breeding and laying hens significant advantages in terms of animal welfare and ethologically, but not in terms of hygiene and food safety.

House environment, outdoors and permanent litter, creates opportunity horizontal contamination of eggs (6).

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REFERENCES

[1] De Reu K., Grijspeerdt K., Heyndrickx M., Uyttendaele M., Debevere J., Herman L. 2006. *Bacterial shell contamination in the egg collection chains of different housing systems for laying hens*, British Poultry Science, 17 (2), 163-172.

[2] Galiş Anca-Maria, Ilie Van, André Théwis, 2012. Organoleptic, chemical and microbiological quality of table eggs obtained in different exploitation systems for laying hens in Romania, Scientific Papers, Animal Science, Series D, vol. LV CD-ROM ISSN 2285-5769, ISSN-L 2285-5750

[3] Huneau-Salaün A., Michel V., Huonnic D., Le Bouquin S. 2010. *Factors influencing bacterial eggshell contamination in conventional cages, furnished cages and free-range systems for laying hens under commercial conditions*, British Poultry Science, 51(2), 163-169.

[4] Protais, J., Queguiner, S., Boscher, E., Piquet, J.-C., Nagard, B., Salvat, G. 2003. *Incidence du système d'élevage sur la flore aérobie mésophile des coquilles d'oeufs de consommation, Cinquièmes Journées de la Recherche Avicole*, Tours, 26-27.03.2003.

[5] Schwarz G., Kobe A. and Fries R. 1999. Microflora on egg shells from different housing system, Arch Geflügeld, 5, 220-224.

[6] Usturoi M. G, 2004 - Production of eggs. Publishing "Ion Ionescu de la Brad" Iasi

[7] Vučemilo M., Vinkovic B., Matkovic K., Stokovic I., Jaksic S., Radovic S., Granic K., Stubican D. 2010. *The influence of housing systems on the air quality and bacterial eggshell contamination of table eggs*, Czech Journal of Animal Science, 55 (6) 243-249.