Comparison of two Different Breeding Systems of Laying Hens in Relation to Egg Damage and Dirty

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Abstract

The aim of work was to follow up and statistically evaluate the damage and dirty eggs and egg weight, depending on two different breeding systems and different ages of laying hens. Object of investigation were table eggs, their damage and dirty in the laying hens of the final hybrid ISA Brown reared in enriched cage system, and the free range system. In both rearing systems were ensured the conditions for laying hens in accordance with legislation establishing minimum standards for the laying hens minimum standards for the protection of laying hens, protection of animals kept for farming purposes in accordance with the principles of the so-called five freedoms. That was used to feed a complete feed mixture HYD 10 in both breeding systems. The feeders were supplemented with feed by hand every day and the same day were supplemented water to drinking troughs. Egg collection was hand in both breeding systems. This paper is a contribution to the solution of optimal breeding hens and production of high quality and safe of table eggs. Based on the results was formulated conclusion, which shows that to the damage and dirty eggs are not affected by the age of the breeding system and age of laying hens. Statistically significant difference ($p \leq 0.05$) in the egg weight was observed between breeding cage system and breeding free range system and between age 30 and 40 weeks of laying hens.

Keywords: table egg, damage, dirty, laying hen, breeding system, age.

1. Introduction

Even though the information was known to prohibit the use of conventional breeding system for laying hens by the European Union in 1999, Research in safety of table eggs production and research programs, projects, respectively and their financing have emerged only recently. The European Union noted that research in this area takes place [1]. Furthermore, the producers and consumers of table eggs all over the world are increasingly interested in the quality of production, because it is directly related to hygiene, health safety and mainly welfare of laying hens. In recent decades, concerns about animal comfort and welfare increased significantly, mainly with regard to physiological and behavioural needs [2]. This opinion confirms the conclusions [3], by which Salmonella and other bacteria can permeate through the egg shell and egg membranes, and thus to contaminate the internal contents of the egg. Different breeding systems may affect the relative efficacy of measures of bio-safety and level of potential vectors of Salmonella on the farm, and thus to affect the overall success of remedial and preventive measures. It is especially important to apply the measures of bio-safety in the breeding system of laying hens in outdoor free range. The laying hens spend part of their time outdoors, where is increased their interaction with wildlife animals. Furthermore, an environment of contaminated soil is difficult to disinfect for ensure of the bio-safety of the flock. These rearing conditions can serve as a continuing source of Salmonella for future reintroduction flock of laying hens on the farm. The potential

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contamination of soil and water from outside sources is a significant problem and is an open problem for research [4]. Similarly, old breeding systems of laying hens or accumulation of droppings or dust may be a potential risk of contamination [5]. New European Union legislation on the animal welfare intended to food production has changed the philosophy of risk assessment and food safety. Examples are the table eggs, which were the object of research our work.

In response to this problem, we established our research, the results of which we present in this work.

2. Materials and methods

Object of investigation were the table eggs, their damage and dirty, and egg weight in laying hens of final hybrid ISA Brown reared in enriched cage system in an experimental device of Slovak University of Agriculture, Faculty of Biotechnology and Food Sciences, Department of Food Hygiene and Safety, no. SK P 1001, and in the free range system in small-breeder. In every breeding system was placed 36 laying hens. In both breeding systems were ensured the conditions for laying hens in accordance with legislation that sets minimum standards for the protection of laying hens and the protection of animals kept for farming. Sampling of eggs to measure was carried out in the age 30 and 40 weeks, each time on two consecutive days. Number of samples for each measurement was 60 eggs for each breeding system, and each studied age. In the cage system, the laying hens were housed individually with unlimited access to feed and water. The laying hens kept in small-breeder were placed in the hall with deep litter and no windows. The laying hens went out freely from the hall through the door, which is opened daily at 6:00 am in the morning and the evening closes at 5:00 pm. Day length was prolonged depending on the length of the outer light. A complete feed mixture HYD 10 was used to feed in both breeding systems. The feeders were supplemented by hand daily and the same was supplemented water to drinking troughs. Egg collection was hand in both farming systems always at 4.00 pm. Egg damage and dirty was monitored in the laboratory of the Department of Food Hygiene and Safety. Egg was laid on white writing paper clip desk lamp with a 100 W lamp. The eggs were rotated along the equator, blunt and sharp end. Egg weight was determined on the instrument type KERN 440-35N, with an accuracy of 0.01 g and a maximum weight of 400 g. Data from measurements of the samples were evaluated on the basis of the basic statistical characteristics (arithmetic mean, standard deviation, coefficient of variation). For statistical comparison of the differences between groups was used Scheffe's test ANOVA in SAS software system, version 8.2 at significance level $P_{0.05.}$

3. Results and discussion

From processed the knowledge of the available scientific and specialized literature on the assessment of the effects of breeding systems on the quality parameters of the improved living conditions of laying hens, we found that there is little literature sources substantiated by experiments and the conclusions resulting from many works are inconsistent. The food safety is not enough experimental researched from aspect of effect of factors breeding conditions in applying the welfare principles, as reported Silva (2001)[2].

The cracked eggs

In our experiment, the samples of eggs which have been subject of research, it was not present with cracked shell. The cracked eggs were not produced in cage systems or free range systems. On the market to consumers are permitted only table eggs with an intact shell. The cracked egg and the eggs with broken shell membranes are unfit for human consumption, and they should be disposed of. The cracked eggs represent an increased risk for microbial contamination of the internal egg mass. Impaired the integrity of the egg shell is an economic loss in the production of table eggs. Based on the research were obtained different results in terms of occurrence of cracks in the shells of eggs according to the different breeding systems [6]. Guesdon and Faure (2004) [7] found a higher percentage of cracked eggs in laying hens in enriched cage system compared to eggs of laying hens kept in conventional cages system. However, in assessing the shell quality of the eggs, which were laid in the nest of conventional cage system and system enriched

cages were no differences in the number of cracked eggs. The eggs with cracked shell are characterized by cracked shell visible with the naked eye or candling shell cracks and intact shell membranes [8].

The dirty eggs

No dirty samples of eggs were observed in our experiment. There were not dirty eggs with droppings and blood in the cage system as well as in the free range system. They are not produced in cage system or in free range system. A lot of works are published with a focus of the impact of breeding system on dirty of eggs. The conclusions of these works are inconsistent. Abrahamsson and Tauson (1995) [9] and Abrahamsson et al. (1996) [10] state that a higher percentage of dirty eggs was in the aviary breeding system compared to the system in the conventional breeding cages. The laying hens laid the eggs in the aviary breeding system out of the nest, because they have been dirty. In the more authors prevalent the conclusions that the incidence of dirty eggs is in the breeding system with enriched cages compared with breeding system in conventional cages [6, 7, 11]. Souza et al. (2002) [12] summarize existing knowledge about the possibilities of contamination of eggs in their work. They reported that origins of contamination must be searched on the farm. Contamination of egg shell begins with droppings which excrete laying hens before or after lying of the eggs, respectively. It is droppings with which the egg contacts on the litter, in the nest or directly in the contaminated cages. The bacteria enter in the egg mass through the pores of the egg shell and can multiply in it. Dirty eggs are those whose shell is contaminated by droppings, soil or other materials (without label, sticker or ink stamp) [8]. De Reu et al. (2008) [13] reported that the difference in prevalence between cage system and in the hall without cages it was not significant in comparison to the period for the consumption of eggs. According to these authors, significantly different risk of external or internal contamination of eggs between breeding systems is when the egg is laid on the floor. This argument can be accepted in part. In the breeding free range system is typical activity a burrowing. The burrowing a contaminated litter with excreted dropping may be a by natural activity laying hens affixed to egg shell. The management of the farm also includes limiting exposure of laying hens to potential Salmonella vector, such as insects and wild living birds [14, 15, 16, 17, 18; 19, 20, 21, 22]. In many scientific studies and specialized studies is confirmed conclusion, it may be a reduced potential for the transfer of risk and danger of Salmonella in the flock, if their effect is prevented, namely admixing of individuals from the old flock between individuals of new flock or between individuals of existing flock after cleaning and disinfection [14, 15, 16, 17, 18, 19, 20, 21, 22]. In our experiment, we worked with the standing flock of laying hens in breeding cage system and with the standing flock of laying hens in breeding free range system. A disease of laying hens has occurred during the reporting period.

Average egg weight

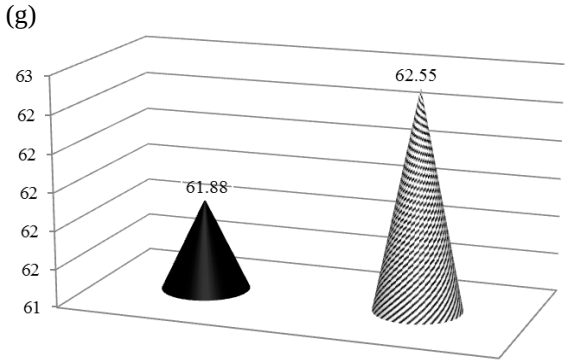

Figure 1. Average egg weight in breeding cage system and in free range system (g)
61.88 = cage system, 62.55 = free range.

Average egg weight was in the breeding cage system 61.88 g and in breeding free range system 62.55 g.

Table 1. Statistical characteristic and statistical significance of difference in weight of eggs between breeding cage system and free range system

Breeding system	n	SD	CV	$P_{0.05}$
Cage	120	4.21	6.80	
Free range	120	5.06	8.09	$p \leq 0.05$

SD = standard deviation, CV = coefficient of variation
$p \leq 0.05$ = statistically significant difference.

Minor variations of egg weight was recorded in the breeding cage system of laying hens, and the results of the standard deviation were 4.21 g and coefficient of variation 6.80% compared to values of standard deviation 5.06 g, coefficient of variation 8.09% of eggs in the breeding free range system. The statistically significant difference ($p \leq 0.05$) in weight of eggs was observed between breeding cage systems and breeding free range system.

Average of egg weight in breeding cage system and free range system in age 30 and 40 weeks of laying hens

Average egg weight surveyed in age 30 weeks of laying hens was 60.87 g in the breeding cage system compared with an average egg weight 62.90 g of breeding free range system. Average egg weight reached in age 40 weeks of laying hens has increased from an average egg weight found at age 30 weeks while maintaining the upward trend in egg weight produced in breeding cage system and in breeding free range system. In age 40 weeks of laying hens was average egg weight in the breeding cage system 61.14 g and in the free range system 62.90 g.

Table 2. Average of egg weight in breeding cage system and free range system in age 30 and 40 weeks of laying hens (g)

Age of laying hens, weeks	Breeding system						
	Cage				Free range		
	n	$\bar{x}$	SD	CV	$\bar{x}$	SD	CV
30	60	60.87	4.69	7.70	62.25	4.29	6.89
40	60	62.90	5.91	9.40	63.96	5.13	8.02

$\bar{x}$ = mean, SD = standard deviation, CV = coefficient of variation.

Table 3. Statistical significance of difference in weight of egg between breeding cage systems and free range system depending on the age 30 and 40 weeks of laying hens

Breeding system, age of laying hens	Free range, week 30	Cage, week 40	Free range, week 40
Cage, week 30	$p \geq 0.05$	$p \leq 0.05$	$p \leq 0.05$
Free range, 30		$p \leq 0.05$	$p \leq 0.05$
Cage, week 40			$p \leq 0.05$

$p \leq 0.05$ = statistically significant difference,
$p \geq 0.05$ = no statistically significant difference.

No statistically significant difference ($p \geq 0.05$) in weight of eggs between breeding cage system and free range system was observed in age 30 weeks of laying hens and statistically significant difference ($p \leq 0.05$) was confirmed in age 40 weeks of laying hens. The average egg weight laid throughout the period was 61.88 g in breeding cage system and statistically significant higher ($p \leq 0.05$) 62.55 g in the free range system. These results are in conformity with the Hughes et al. (1985) [23] and Hidalgo et al. (2008) [24]. Commission Regulation (EC) no. 589/2008 [25] sets out criteria to ensure high quality table eggs, which are delivered directly to the final consumer, and the criteria to verify the inspection bodies. Class A eggs shall be supplied in natural packing. Their shell is clean, undamaged, and the normal shape. However, there is the literary knowledge, according to which the breeding system has no effect on egg weight [9, 26, 27, 28].

4. Conclusions

This article is a contribution to solving of optimal breeding system for laying hens and production of quality and safe table eggs.

Based on the results of experiment and statistical evaluation of damage and dirty of eggs, egg weight of laying hens in the age 30 and 40 weeks depending on the breeding system in enriched

cages and free range system can be stated as follows:

a) There was not found the effect on egg damage and dirty depending on the cage system and free range system, age 30 and 40 weeks of laying hens, respectively.

b) Statistically significant higher egg weight ($p \leq 0.05$) was observed in the free range system compared to the egg weight in the breeding cage system. Statistically significant higher egg weight ($p \leq 0.05$) was observed in age 40 weeks of laying hens in free range system and cage system compared to egg weight in age 30 weeks of laying hens.

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