Int. Agrophysics, 1994, 8, 607-610

STABILITY OF EGG SHELL DEPENDS ON NUTRITION OF LAYING TYPE OF HENS

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A b s t r a c t. The fortification of feed mixtures by Lactiferm L-5 is shown as a one of the possibilities for increasing of consumer egg shell quality at the end of first phase of laying cycle, when the utilization of nutrients by layers organism is decreasing and shell quality is getting worse.

K e y w o r d s: egg shell, stability, quality

INTRODUCTION

The quality of the egg shell is one of the most important properties of an egg. It has been observed closely for a long time by breeders of hens and egg producers. High loss of eggs, caused by low egg shell quality, still has a direct economical effect in todays egg producing industry.

The loss of eggs with damaged and broken shells on the way from producer to customer is 6-8 % of all amount of produced eggs. As a result, more than 600 mln U.S. dollars of financial loss are estimated around the world (without the states of former USSR, South America, and Asia besides of Japan [2].

Simeonova and Vyslouzil [11] observed selection of low quality shell eggs and they found that the average loss caused by mechanical damage was 4.3 % while picking eggs up, 3.9 % during storage, and 6.9 % during transportation and selection. These are the reasons why they pay attention to egg shell quality in many places around the world. One of the most important conditions for firm egg shell is the structure of it, which has been observed for more than 100 years (it was described by J. E. Purkyne as soon as in 1855). New possibilities of study were offered with the development of electron raster microscopy [12,13]. The other way of research involves using of mathematical modelling and computer graphics, calculation of formulas of egg shape, creation and evaluation of three-dimensional models and application of method of terminal elements. A theoretical level of pressure, thickness, shape, and structure was calculated (elastical model of deformation). It was also observed that more spherical-shaped eggs are less deform [2].

The methods of egg shell quality observation demand lots of time and special equipment. The destructive and non-destructive methods of egg shell quality evaluation [14] are used in common laboratory evaluation. Both of them are based on direct or indirect estimation of quality indicators and correlations. The quality indicators are: broken stability of egg shell, which is the resistance to pressure up to the moment of burst, thickness of egg shell, the ratio of weight of shell and whole egg weight, the weight of exactly

determined area of shell, specific gravity of egg, shell deformation and back diversion of β-particles and others [15].

The quality of egg shell is influenced by large number of factors: nutrition [1,6], age [9,10], weight of egg [4,5], laying performance [3].

Keeping these problems in mind the influence of probiotic preparation 'Lactiferm' involved in feed mixture, on some egg shell quality factors was observed. Lactiferm shows genetical stability and fermentation activity of *Streptococcus falcium* M 74. The manufacture stock M 74 is stored and registrated in National Collection of Industrial Bacteria, Torry Research Station, Aberdeen, Scotland with identifical number NCIB 11181 and at the same time in Czech collection of microorganisms at the University of J.E. Purkyně in Brno with identifical number CCM 6226 (Kocur 1983 in Mican [8]).

Probiotics have a character of the stimulators of physiological functions of animal organism and through this they increase the production potential of animals [7,8].

MATERIALS AND METHODS

Feeding experiment with laying hens Shaver Starcross 288 during the first phase of lying period has been conducted. The experiment lasted 69 days and layers were divided to two groups: 1) the control group, in which the layers were given the feeding mixture NV RM (rational mixture with metionine according to balance formula from 1990), and 2) the experimental group, in which the layers were given the same feeding mixture fortified by probiotic preparation Lactiferm L-5 (30 g 100 kg^{-1}).

The following parameters have been ivestigated:

- the weight of egg and shell (balances Sartorius 1364 MP);
- the share of shell (calculated from weights);
- the power needed for shell burst, in relation to the age of layers (INSTRON 1112, Photos 1 and 2);

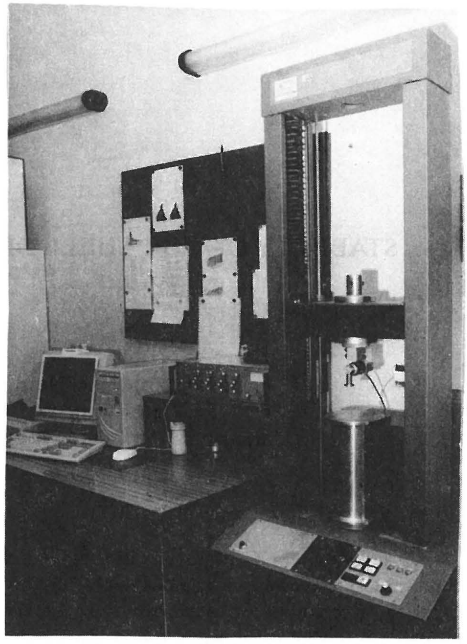

Photo 1. The equipment for measurement and evaluation of destructive power.

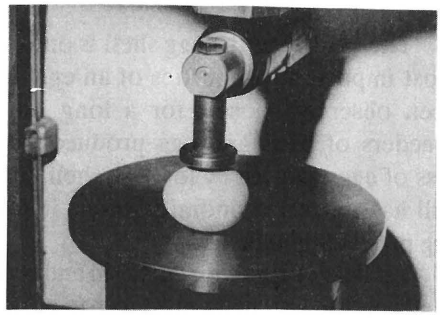

Photo 2. Measurement of the power needed for burst of egg shell.

- the thickness of shell, in relation to the age of layers (induction position scaner HBM W20TK with testing tip, Photo 3);
- the power needed for cut of shell, in relation to the age of layers (three pieces from equatorial area and one piece from both blunt and sharp ends of egg, INSTRON 1112 - pushing the cylinder with diameter 4.48 mm through sample, Photos 4,5).

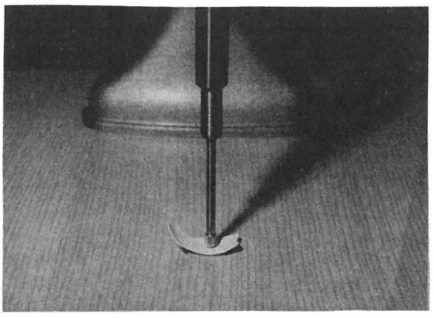

Photo 3. Shell thickness measurement.

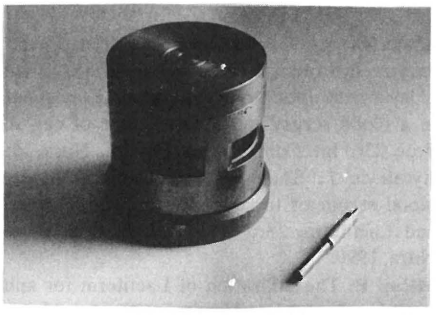

Photo 4. The cylinder for shell cut.

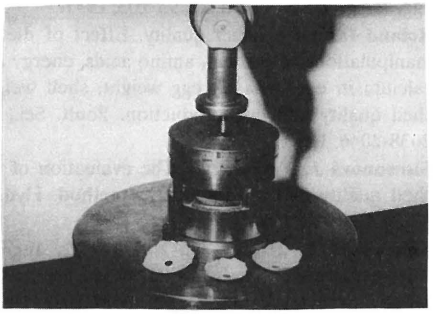

Photo 5. Measurement of the power needed for cut of shell.

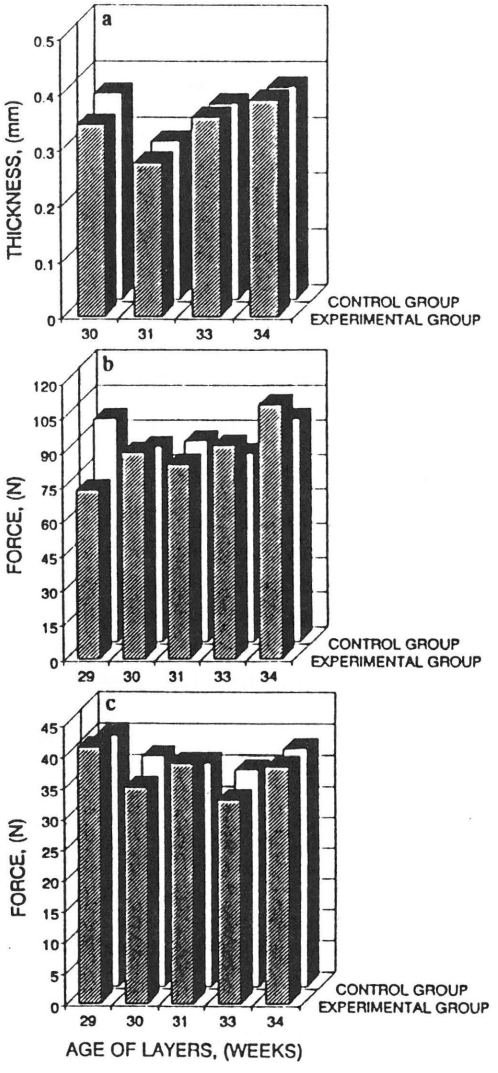

Fig. 1. The thickness of egg shell (a) and forces necessary to burst (b) and cut (c) egg shell in relation to the age of layers.

RESULTS AND DISCUSSION

The weight of egg and shell, share of shell and dependence of shell weight on the egg weight are given in Table 1. The general evaluation of egg shell weight and its share of egg weight showed the tendency of egg shell quality increasing through feed mixture fortification by probiotic preparation Lactiferm L-5. The influence of this preparation has showed more expressive effect on egg shell quality parameters at the end of first laying cycle phase, when the decreasing of nutrient utilization has begun. This is in good agreement with the results of egg shell quality investigation presented in various literature sources.

Table 1. Properties of eggs

Parameter	Group	n	x	s	F - test
Egg weight (g)	Control	131	59.85	4.72	P > 0.05
	Experimental	132	59.31	4.60	
Shell weight (g)	Control	131	5.63	0.65	P > 0.05
	Experimental	122	5.71	0.62	
Shell share (%)	Control	131	9.39	0.90	P > 0.05
	Experimental	122	9.62	0.81	
Shell dependence on egg weight	Control	122		r_{xy} = 0.58+++	
	Experimental	122		r_{xy} = 0.65+++	

+++P < 0.001; r_{xy} - correlation coefficient.

CONCLUSION

The fortification of feed mixtures by Lactiferm L-5 is shown as a one of the possibilities for increasing of consumer egg shell quality at the end of first phase of laying cycle, when the utilization of nutrients by layers organism is decreasing and shell quality is getting worse.

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