

## Eggs quality of Oravka breed hens depending on hen's age

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The objective of this study was to compare some internal and external quality parameters of eggs during laying period at 7, 8 and 13 months of hen's age. Hens of genetic animal resources of the Oravka breed from NAFC-RIAP Nitra were included in experiment. In our experiment the average egg weight was significantly increased with the age of the laying hens ( $P < 0.0001$ ,  $P = 0.0076$ ). There were significant differences in egg length and egg width, but no significant differences in egg shape index. The thickness of eggshell was demonstrably thinner in all measured positions of the egg with increasing age of laying hens. The average eggshell thickness decreased from  $429.30 \pm 1.25 \mu\text{m}$  to  $420.98 \pm 1.30 \mu\text{m}$  ( $P < 0.0001$ ) during the laying. The albumen weight during laying varied from  $31.29 \pm 0.36 \text{ g}$  to  $33.22 \pm 0.35 \text{ g}$ . Albumen height and Haugh unit measure the viscosity of the thick albumen. The Haugh unit in Oravka breed were lower in the oldest hens ( $69.17 \pm 1.36$ ). All yolk characteristics increased with age. The yolk weight increased from  $14.64 \pm 0.21 \text{ g}$  at the age of 7 months to  $19.67 \pm 0.27 \text{ g}$  at the age of 13 months ( $P < 0.0001$ ). We found significant differences in yolk colour only between hens of 8 and 13 months age ( $P = 0.0021$ ).

**Keywords:** egg, external quality, internal quality, eggshell, Oravka hens, age

### 1 Introduction

Current trends in food production are moving from the quantitative to the qualitative position, which is related to new knowledge about the rational nutrition of the population and thus to the growing interest of the population in quality food. More and more people are realizing that nutrition can directly affect their health. Eggs are one of the most nutritious foods. Egg protein includes all the essential amino acids in a high content and in an ideal ratio. In general, the characteristics of egg quality have genetic basis. Egg quality is factor which contributes for better economy price of fertile and table eggs. Egg quality was defined by Stadelman (1977) as characteristics important for consumers. Economic success for a production flock is measured with total number of produced eggs (Monira et al., 2003). Egg quality is presented by its weight, percentage of eggshell, thickness and strength of eggshell. Egg quality is composed of those characteristics of an egg that affect its acceptability by consumers. From the point of view of consumers, egg weight is the most important quality trait. Among many quality characteristics, external factors including cleanliness, freshness, egg weight and shell weight are important in consumer's acceptability of shell eggs (Adeogun and Amole, 2004; Dudusola, 2010). On the other hand, internal characteristics such as yolk index, Haugh unit, and chemical composition are also important in egg product industry (Scott and Silversides, 2001). Egg weight has great economic importance mainly in poultry breeding and is considered one of the major breeding objectives and research goals in different countries (Islam and Dutta, 2010; Savegnago et al., 2011). Egg production is affected by both genetic and environmental factors. The mean laying in a flock of hens of a particular age is determined by the individual patterns of sequential laying at that time (Johnston and Gous, 2003). Van den Brand et al. (2004) demonstrated that the weight of eggs from outdoor layers was lower at an early age, but increased more with age. The age of hens is an important factor affecting the weight of eggs. Tůmová and Gous (2012) found that the significant

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interaction between the hen type and age was apparent in laying ( $P \leq 0.001$ ). This study was designed to determine the effect of age on some internal and external quality characteristics of Oravka breed eggs.

## 2 Material and methods

Internal and external parameters of eggs quality were evaluated at 7, 8 and 13 month of age hens within 24 h of collection in Oravka breed. Eggs were collected during three days consecutively. The hens of Oravka breed kept in National Agricultural and Food Centre – Research Institute for Animal Production in Nitra were included in experiment. The hens were kept in a heatless hen-house with a covered yard and free range. During the egg production period, hens were fed *ad libitum* commercial feed mixture (crude protein 207.6 g/kg, metabolic energy 11.7 MJ/kg, fat 57.7 g/kg, linoleic acid 16 g/kg, lysin 10.6 g/kg, fiber 42.4 g/kg) and water had by automatic drinking system available. The hens were exposed to the natural light with the addition of artificial light (14 hours light + 10 hours dark). The analyses of eggs were done in laboratory of NAFC-RIAP Nitra. The data were analysed using the ANOVA Procedure with the help of the SAS software (version 9.3, by application Enterprise Guide 4.2). Mean values and standard error ( $s_x$ ) are reported in tables. Differences between treatments were tested for significance. The level of significance was established at  $P \leq 0.05$  until  $P \leq 0.0001$ . The evaluated variables were submitted to analyses of variance (ANOVA) using Statistical Analysis System software package.

## 3 Results and discussion

Egg quality characteristics of chickens have been investigated in several studies (Roberts, 2010; Kocevski et al., 2011; Cath et al., 2012; Hanusova et al., 2015). The results of internal and external egg quality characteristics of Oravka breed during different age of laying are given in Table 1.

The most important parameters not only for consumers, but for egg producers as well is egg weight (Tůmová and Gous, 2012, Hanusova et al., 2015). In our experiment the average egg weight was significantly increased with the age of the laying hens ( $P < 0.0001$ ,  $P = 0.0076$ ). The egg size is influenced by hen's breed, genetic factors, age of laying hen, season, climatic conditions, nutrition, egg account in series and individuality of laying hens. There were significant differences in egg length and egg width, but no significant differences in egg shape index. Egg shell quality in laying hens is influenced by a range of factors including strain of chicken, age of bird, nutrition including protein source, moult status, water quality, general stress, heat stress, disease, housing, production system, environmental contaminants and use of proprietary products. The most important quality traits of the egg shell are its strength and thickness. As we can see from the table, the thickness of shell was demonstrably thinner in all measured positions of the egg with increasing age of laying hens. The average shell thickness decreased from  $429.30 \pm 1.25 \mu\text{m}$  to  $420.98 \pm 1.30 \mu\text{m}$  ( $P < 0.0001$ ) during the laying. The egg shell thickness values were somewhat higher in comparison to Hanusová et al. (2015) and Hrnčár et al. (2016).

The internal quality of egg is influenced by many factors (egg storage, bird strain and age, induced moult, nutrition, ingestion of contaminants, disease etc.).

Egg weight is genetically linked to all three of the major components: shell, albumen, and yolk. Washburn (1990) showed that the link between egg weight and albumen weight is higher than those between egg weight and shell or yolk weight. Fletcher et al. (1981) and Fletcher et al. (1983) showed that as egg size increases, so does the percentage of albumen. In our experiment the albumen weight during laying period varied from  $31.29 \pm 0.36 \text{ g}$  to  $33.22 \pm 0.35 \text{ g}$ . The highest weight was at 8 month of hen's age. This weight was significant higher compare with 7 and 13 months of age.

Albumen height and Haugh unit measure the viscosity of the thick albumen. The Haugh unit in Oravka breed were the lowest in the oldest hens ( $69.17 \pm 1.36$ ,  $P < 0.0001$ ).

All yolk characteristics increased with age. The yolk weight increased from  $14.64 \pm 0.21 \text{ g}$  at the age of 7 months to  $19.67 \pm 0.27 \text{ g}$  at the age of 13 months ( $P < 0.0001$ ). Yolk colour is affected many factors (genetic, nutrition, age, etc.). The animals were fed the same feed mixture and the hens came from the same line. We found significant differences in yolk colour only between hens of 8 and 13 months age ( $P = 0.0021$ ). The yolk colour was from 10.58 to 11.27 °HLR. The similar value found Hanusová et al. (2015) in Oravka breed.

**Table 1** Egg quality of Oravka hens by age

Parameter	Hens age			Probability
	7 months $\bar{x} \pm s_x$ $n = 33$	8 months $\bar{x} \pm s_x$ $n = 32$	13 months $\bar{x} \pm s_x$ $n = 31$	
Egg weight (g)	50.74 ±0.77	55.57 ±0.73	58.89 ±0.72	7 : 8, 13 $P < 0.0001$ ; 8 : 13 $P = 0.0076$
Egg length (mm)	54.21 ±0.34	55.56 ±0.31	57.74 ±0.32	7 : 8, 13 ; 8 : 13 $P < 0.0001$
Egg width (mm)	40.33 ±0.34	41.72 ±0.25	42.77 ±0.18	7 : 8 $P = 0.001$ ; 7 : 13 $P < 0.0001$ ; 8 : 13 $P = 0.0064$
Egg shape index*	1.35 ±0.27	1.33 ±0.01	1.35 ±0.01	
Eggshell weight (g)	5.01 ±0.08	5.25 ±0.16	5.18 ±0.08	7 : 8 $P = 0.0157$
Eggshell percentage (%)	9.88 ±0.09	9.43 ±0.27	8.79 ±0.07	13 : 7, 8 $P < 0.0001$
Eggshell thickness – blunt end (µm)	423.03 ±1.35	419.63 ±1.74	412.97 ±1.42	7 : 8, 13 $P < 0.0001$
Eggshell thickness – sharp end (µm)	436.45 ±1.22	435.88 ±1.64	429.87 ±1.62	7 : 8 $P 0.0011$ ; 7 : 13 $P < 0.0001$ ; 8 : 13 $P = 0.0019$ ;
Eggshell thickness – centre (µm)	428.42 ±1.26	427.34 ±1.68	420.10 ±1.29	7 : 8, 13 $P < 0.0001$ ; 8 : 13 $P = 0.0090$ ;
Average eggshell thickness (µm)	429.30 ±1.25	427.61 ±1.58	420.98 ±1.30	7:8, 13 $P < 0.0001$ ; 8:13 $P = 0.0119$ ;
Albumen weight (g)	31.29 ±0.36	33.22 ±0.35	31.28 ±0.36	7 : 8 $P = 0.0008$ ; 8 : 13 $P = 0.0007$
Albumen percentage (%)	61.18 ±0.34	61.42 ±0.41	57.78 ±0.31	7 : 13, 8:13 $P < 0.0001$
Albumen height (mm)	7.88 ±0.11	5.84 ±0.17	5.06 ±0.14	7 : 8, 13; 8 : 13 $P < 0.0001$
Albumen width (mm)	73.33 ±0.46	69.19 ±0.43	77.42 ±0.74	7 : 8, 13; 8 : 13 $P < 0.0001$
Albumen index**	107.52 ±1.56	84.54 ±2.44	65.60 ±1.90	7 : 8, 13; 8 : 13 $P < 0.0001$
Haugh unit	91.31 ±0.67	76.73 ±1.28	69.17 ±1.36	7 : 8, 13; 8 : 13 $P < 0.0001$
Yolk weight (g)	14.65 ±0.21	16.17 ±0.23	19.67 ±0.27	7 : 8, 13; 8 : 13 $P < 0.0001$
Yolk percentage (%)	28.72 ±0.44	29.15 ±0.34	33.43 ±0.32	7 : 8 $P = 0.0571$ ; 13 : 7, 8 $P < 0.0001$
Yolk height (mm)	18.52 ±0.10	17.13 ±0.49	22.74 ±0.22	7 : 8, 13; 8 : 13 $P < 0.0001$
Yolk width (mm)	38.15 ±0.17	37.91 ±0.23	42.90 ±0.062	7 : 8 $P = 0.0189$ ; 13 : 7, 8 $P < 0.0001$
Yolk index (%)	48.56 ±0.33	45.28 ±1.36	53.05 ±0.34	7 : 13 $P = 0.0074$ ; 8 : 13 $P < 0.0001$
Yolk colour (o HLR)	10.98 ±0.14	11.27 ±0.13	10.58 ±0.14	8 : 13 $P = 0.0021$

\*length/width, \*\* height/width × 1,000

#### 4 Conclusions

Our results show statistically significant differences during laying period of Oravka hens in external and internal characteristics of the egg quality. In our experiment, the weight of the eggs was significantly higher with age. The differences were found for all external and internal egg quality characteristics except for egg shape index.

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