

TABLE QUALITY OF LAYER EGGS FROM VARIOUS PRODUCTION SYSTEMS

ZLATICA PAVLOVSKI, ZDENKA ŠKRBIĆ, MILOŠ LUKIĆ
Institute for Animal Husbandry, Autoput 16, 11080 Belgrade – Zemun, Serbia

Quality of table eggs is a feature of dynamic character and it depends on numerous factors. Quality of eggs is influenced by biological factors, mostly by genotype, sex and age, and some of the major factors of zootechnical nature are housing system, nutrition and health condition of layers. Today, with abundance of eggs on the market, the price is not the only factor influencing the competitiveness of eggs, but also special guaranteed quality for which the consumers are willing to pay higher price.

Alternative (non-conventional) housing systems are introduced into production because of the welfare aspect on one hand, and, on the other, because of the egg quality, i.e. correlation between the quality of life of layer hens and quality of the product is established [5].

Defining of the rearing and egg quality programmes in special, non-conventional housing systems in our country, was the subject of study of only few researchers [2, 4, 5, 6, 7, 9, 10]. Increased demand for new alternative systems arose subsequent to adoption of the Rulebook on animal welfare in Serbia in February 2010, banning housing of layers in battery cages starting from 2012.

In production of eggs in extensive system as one of the alternative systems, domestic native layers are used – Naked-neck hen, domestic populations of breeds Rhode island, New Hampshire, Amrock, Plymouth rock, as well as crosses obtained from crossing of these breeds, i.e. coloured plumage layers, rather than hybrids.

Since there are no data on the quality of eggs produced by naked-neck hens in our country, objective of this study was to determine the differences in quality of eggs obtained from hens of different

genotypes (Hy Line and Naked-neck hen) reared in different housing systems (battery and extensive).

MATERIAL AND METHODS

Study was carried out using native breed of Naked-neck hen and Hy-Line hybrid, at the age of 24 to 54 weeks, reared in two production systems (battery and extensive) on Experimental farm of the institute for Animal Husbandry, Belgrade-Zemun.

Battery system: layers of hybrid Hy-Line were reared in battery system. There were four hens in each cage, total of 240 hens in a battery. Feeding, watering and collecting of eggs were done manually. Production technology was according to norms of standard technology applied in modern production of table eggs.

Extensive system: 40 Naked-neck hens were reared in a facility where feeders, waterers and nests were placed, starting from the age of hens of 22 to 54 weeks.

Hens in both system were fed same mixture containing 17% of protein.

In the period from 24 to 54 weeks of age, every 4 weeks, sample of eggs – 30 eggs (Naked-neck) and 60 Hy-Line eggs, was used to investigate major external (egg mass, colour and cleanliness of eggshell, shape index), internal egg quality properties (yolk colour, egg-white height, Haugh units, egg-white/yolk ratio) and eggshell quality properties (mass, thickness, deformation and breaking force). Said properties were investigated according to the method of **Pavlovski et al.**, 1997, and breaking force according to method of **Pavlovski and Vito- rović** (1996), on apparatus „IS-96“ which is modi-

fication of the apparatus Wolotkijevich (Institute for Animal Husbandry, Belgrade-Zemun). The data were analyzed by method of variance analysis and Tukey test (Stat.Soft,Inc. STATISTICA, version 6).

RESULTS AND DISCUSSION

In Table 1. the average values of studied properties of external quality for all seven 4-week periods are presented.

Eggs deriving from hybrid Hy Line had statistically greater egg mass (64.54; 53.77). Obtained shape index indicated that eggs from Naked-neck hen were more pointy compared to eggs from Hy-Line hybrid.

In the investigations [6] of eggs obtained from Prelux – R hens reared in extensive system, results showed similar shape index (74.64). Hens Prelux – R were bred in Slovenia and intended for rearing in extensive system and have similar egg quality traits as native populations, in this case naked-neck hen. Eggs obtained from naked-neck hen reared in extensive system had lighter eggshell colour, similar to results of studies [1, 4, 5, 6, 7]. Based on presented data it can be concluded that housing system and

genotype had effect on investigated properties of external egg quality.

In Table 2. the data on investigated properties of internal egg quality are presented. Eggs obtained from Hy Line hybrid hens had statistically significantly greater egg-white height and number of haugh units, which is evidence of significantly better quality of egg-white and more favourable egg-white/yolk ratio, whereas eggs from Naked-neck hens had more intensive yolk colour.

Obtained data was not in accordance to data [1, 2, 3, 4, 5, 6, 7, 9] where better egg quality was established in case of hens reared in extensive system compared to battery aviar system regardless of the studied hybrid, i.e. significant effect of the housing system was expressed. Investigated hen housing systems had significant effect on yolk colour, i.e. hens reared in the extensive system has access to limited range where they consumed green grass mass which had impact on improvement of the yolk colour. For other investigated properties it can be concluded that genotype had not demonstrated significant impact.

Obtained data on egg shell quality (mass, deformation, thickness and breaking force) are presented in Table 3.

Table 1. External egg quality traits

Genotype	No. of eggs	Egg mass, g	Egg shell colour, points	Egg shell cleanliness, points	Shape index
Hy Line	480	64.54±5.42**	3.37±0.60	4.58±0.88**	77.89±2.98**
Naked-neck	240	53.77±6.84	2.25±0.61	4.24±1.31	74.68±3.20

** $P \leq 0.01$

Table 2. Internal egg quality traits

Genotype	No. of eggs	Yolk colour. Roche	Egg-white height. 0.1mm	Haugh units	Egg-white/yolk ratio
Hy Line	480	11.52±1.57	84.20±15.07**	89.63±8.80**	2.27±0.27**
Naked-neck	240	13.03±0.58**	68.83±16.01	83.39±10.54	1.67±0.25

** $P \leq 0.01$

Table 3. Egg shell quality traits

Genotype	No. of eggs	Egg shell mass. g	Egg shell deformation. 0.001mm	Egg shell thickness. 0.01mm	Breaking force, kg
Hy Line	480	8.87±1.18**	21.57±4.06**	34.88±3.00**	17.84±3.45**
Naked-neck	240	6.97±1.12	24.82±4.42	24.82±4.42	15.96±2.87

** $P \leq 0.01$

Based on all studied egg shell quality properties it can be concluded that poorer quality of egg shell was determined in eggs obtained from naked-neck hen reared in extensive system. Obtained data are in accordance with researches [4, 5, 7] where hens reared in extensive system had thinner egg shell regardless of the investigated genotype. Reasons for such results can be in the fact that all modern studies in the field of nutrition have significantly influenced the increase of egg shell thickness in case of hens reared in battery system or that areas where rearing of hens is organized in the extensive system show deficit in lime content in the soil, therefore hens are not able to satisfy the need of their organism for Ca. Contrary to these results are researches [1] where hens reared in the extensive system had eggs of thicker egg shell.

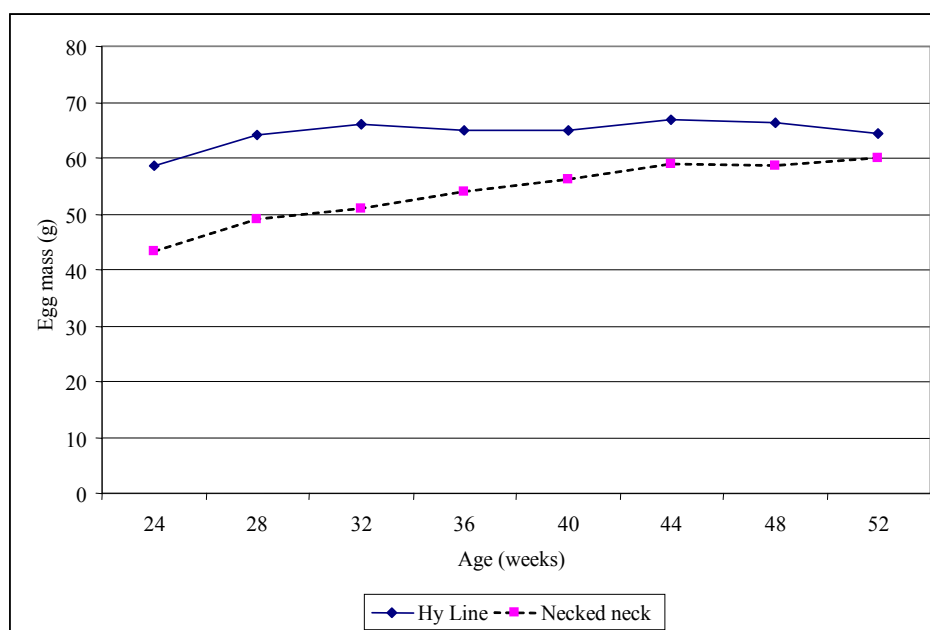
In Graph 1. the average values of the egg mass individually for all study periods of the production duration from 24 to 54 weeks of age of hens are presented. Hens of Hy-Line hybrid realized egg mass of 58.74g, in 24th and in the 28th week of age egg mass was 64.15g and to the end of the research this average egg mass was maintained. Naked-neck hens at the age of 24 weeks realized average egg mass of 43.42 g and with the age the egg mass increased and in the 52nd week it was 60.13 g. In this study,

hen genotype demonstrated different effect on average egg mass. Modern hybrids are selected in the direction to achieve at early age good egg mass and to maintain the persistence of this specific trait as long as possible during one production cycle.

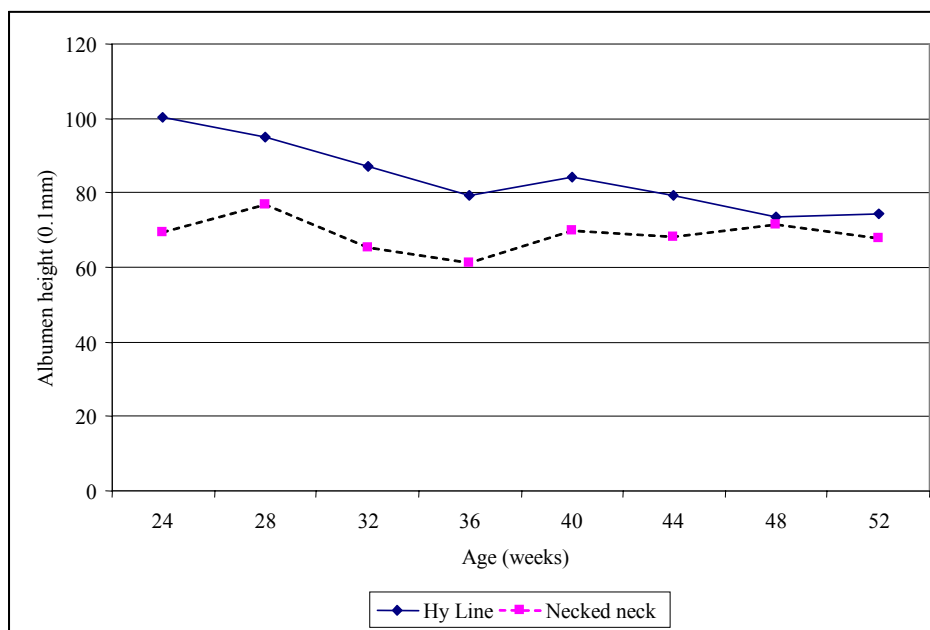
Naked-neck hens demonstrated the feature of the native populations, i.e. with the age of hens also the average egg mass increases.

In Graph 2. data on average values of egg-white height depending on the age of hens, i.e. investigation period are presented. In the first investigation, at the age of hens of 24 weeks, egg-white height was statistically significantly greater in hybrids (100.22; 69.57). With the age of hens, difference in the egg-white quality decreased significantly, in fact the quality of egg-white in Hy-Line hens decreased more rapidly, whereas eggs from naked-neck hens maintained the egg-white height at a similar level throughout the investigation period. In general it can be said that statistically significantly better egg-white quality was established in eggs from hybrid eggs.

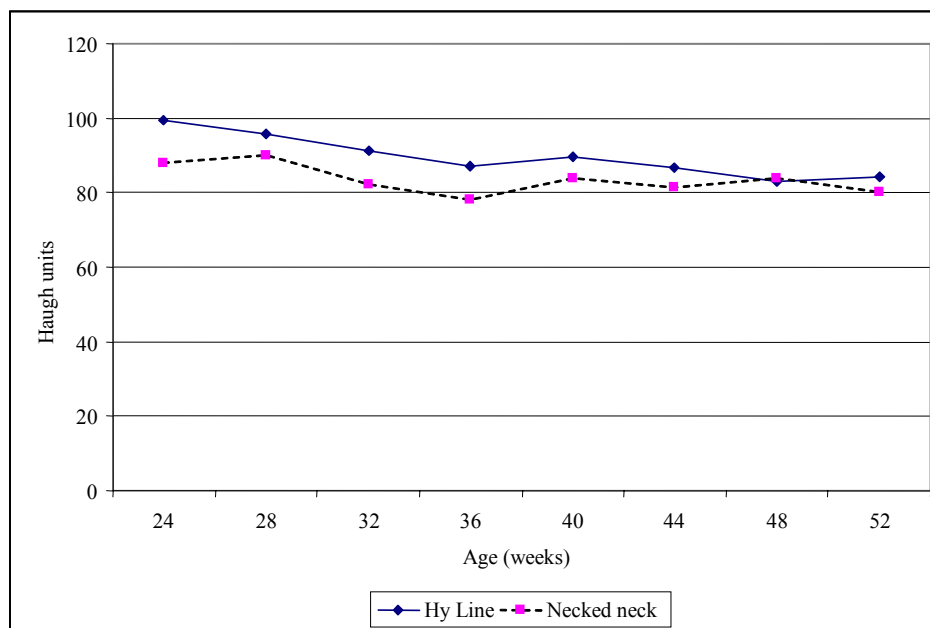
In Graph 3. average values of Haugh units of investigated are presented. Haugh units are calculated using logarithm function based on egg mass and egg-white height, and in this way eggs of lower mass are favored, which is why many researchers have disputed in their studies the Haugh units as objective



Graph 1. Egg mass, g during 28 weeks of laying



Graph 2. Egg-white height in investigated eggs, 0.1 mm



Graph 3. Haugh units of investigated eggs

assessment of the egg quality. Our research confirms this to certain extent. Comparison of egg-white height and number of Haugh units showed significant reduction in differences in quality of egg-white between studied systems and genotypes to the advantage of Naked-neck hens which had lower egg mass and in this way reduced difference in the quality of egg-white and Haugh units.

These studies are contrary to our previous researches [2, 3, 4, 5, 6, 7], which indicated better quality of eggs reared in extensive system of production, regardless of the studied genotype.

CONCLUSION

Based on obtained data in the research of the system of housing (battery and extensive) and geno-

type (Hy Line hybrid and Naked-neck native hen) the following can be concluded:

- Hybrid Hy Line reared in battery system gave eggs of better quality. Eggs had greater average mass, better egg-white quality and thicker and firmer egg shell.

- Naked-neck native hen reared in extensive system with limited range gave eggs of lower shape index (more pointy), significantly lighter egg shell colour (2.25; 3.37) and significantly more intensive yolk colour (13.03; 11.52).

In general it can be concluded that in this research the effect of the housing system on egg quality was not observed, and that the quality of eggs was more under the influence of layer hen genotype, i.e. Naked-neck hen laid eggs of poorer quality.

REFERENCES

1. **Horn P., Sato Z.:** *Influence of management factors on production traits of layers.* World Poultry, Misset (1997), 20-23.
2. **Mašić, B., Pavlovski, Z.:** Mala jata kokoši nosilja u različitim sistemima držanja. Monografija. Naučni institut za stočarstvo, Beograd, 1994, p 150.
3. **Pavlovski, Z.:** Spoljašnje i unutrašnje fizičke osobine konzumnih jaja na beogradskom tržištu s posebnim osvrtom na način prodaje i odnosa potrošača prema jajima kao prehrambenom proizvodu. Doktorska disertacija. Poljoprivredni fakultet, Sarajevo, 1982.
4. **Pavlovski Z., Cmiljanić R., Lukić M., Škrbić Z.:** Uticaj sistema držanja kokoši nosilja na kvalitet i neškodljivost konzumnih jaja. Biotehnologija u stočarstvu, 5-6, (2002), 121-127.
5. **Pavlovski, Z., Hopić, S., Lukić, M.:** Sistemi držanja kokoši nosilja i kvalitet jaja. Biotehnologija u stočarstvu, 5-6, (2001), 197-203.
6. **Pavlovski, Z., Mašić, B., Apostolov, N.:** Quality of eggs laid by hens kept on free range and in cages. Proc. II, 4th European Symposium on the Quality of Eggs and Egg Products, Doorwerth, 1981, 231-235.
7. **Pavlovski, Z., Mašić, B.:** Effect of free range and cage system on egg quality. Proc. 7th European Poultry Conference, Paris, 1986, 1326-1330.
8. **Pavlovski Z., Vitorović D.:** Direktno određivanje čvrstoće ljuske jaja. Nauka u živinarstvu, 3-4 (1997), 171-177.
9. **Pavlovski Z., Škrbić Z., Lukić M.:** Programs of natural food and alternative systems in production of table eggs, Proc. XIII, Symposium Feed Technology, 2009, 124-136.
10. **Žigić, Lj., Mašić, B., Marinković, V., Šrajber, L.:** Prvi rezultati ispitivanja fizičkih osobina i unutrašnjeg kvaliteta jaja različitih provenijencija. Zbornik radova domaćih autora, Simpozijum "Živinarski dani", Portorož, 1967, 25-42.

TABLE QUALITY OF LAYER EGGS FROM VARIOUS PRODUCTION SYSTEMS

Z. Pavlovski, Z. Škrbić, M. Lukić

Institute for Animal Husbandry, Autoput 16, 11080 Belgrade – Zemun, Serbia

SUMMARY

The quality of table eggs obtained from Hy Line hybrid layers reared in battery system and native population of Naked-neck hens reared in extensive system, was studied. The external properties (egg mass, shape index, cleanliness and eggshell colour), internal properties (egg-white colour, haugh units, egg yolk colour, egg-white/yolk ratio), properties of egg and egg shell quality (mass, thickness, deformation and breaking force) were observed. One trial was carried out on the Experimental farm of the Institute and it lasted 28 weeks, i.e. seven 4-week long study periods.

The results show that Hybrid Hy Line in battery system had eggs of better quality. Its eggs had higher average mass, better egg-white quality and thicker and firmer eggshell.

Naked-neck native hens reared in extensive system with limited range gave eggs with lower shape index (more pointy eggs), significantly lighter colour of egg shell (2.25; 3.37) and significantly more intensive yolk colour (13.03; 11.52).

Key words: *production system, layer hen, quality of eggs*

ACKNOWLEDGMENT

Study is part of the Project EVB: TR – 20021 financed by the Ministry of Science and Technological Development of the Republic of Serbia.