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FORMING EGG SHAPE INDEX AS INFLUENCED BY AMBIENT TEMPERATURES AND AGE OF HENS[1]

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Abstract: The effects of ambient temperatures and hen's age were investigated on poultry farm on the south of R.Macedonia, where annually average temperature was higher then other regions. In nine-month period of testing were included summer, autumn and winter season. Two groups of hens (ISA-BROWN) were used; the first one was younger (to 45-week age) and second was older (above 45-weeks). Once a month, about 100 eggs were examined, so the final number of tested eggs was 877. Average shape index was 75.19% for all eggs. High significance ($p<0.01$) showed both factors: age and season. Eggs from younger hens had index value of 76.16%, which is pointed on eggs with rounded shape, while older hen's eggs had index 74.20% with elongated shape. In summer and autumn season, most of eggs were with elongated shape, while rounded shape had eggs in winter season.

*Key words***:** hen, ambient temperatures, age, shape index, egg.

Introduction

There have been mixed views regarding the influence of egg shape on the ability of the egg to resist load. Most authors are agreed that shape cannot be considered in isolation from the effect of, for example thickness, porosity and chemical composition. They believe that the factor shape should always be included when discussing the strength of eggshells.

The whole of avian eggs are typical oval shaped, however, they are different in dependence of bird species and race. The hen's eggs are some elongated with more sharpen peak usually abreast with eggs of other bird species. It was conclusion that egg shape is important factor about packing eggs intended for market, incubation of fertile eggs and hatching the chicks (*Romanoff and Romanoff, 1949*).

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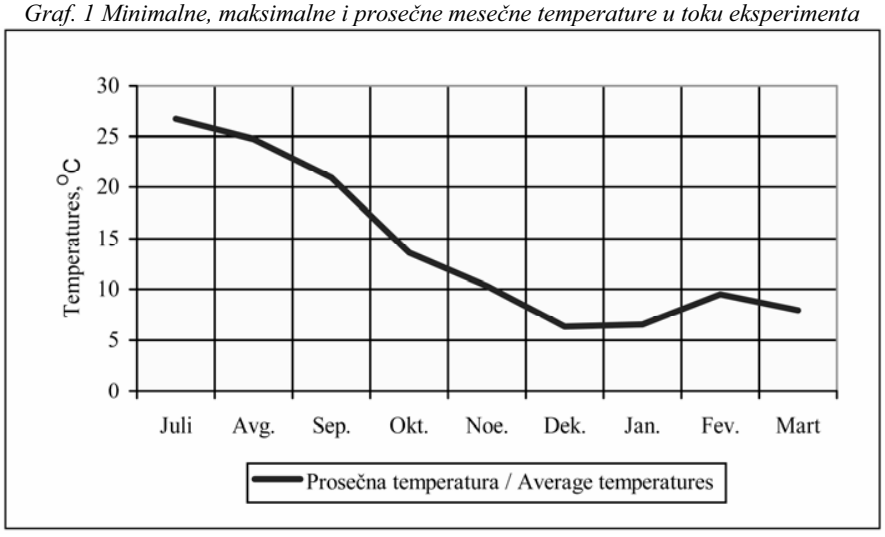
Genetic selection for egg size, together with market pressure for uniformity in shape and colour, has served to minimize extremes in egg shape. In most of case, eggs have elongated and rounded shape and still account for a significant percentage of all eggs laid (*Solomon, 1991*).

The shell shape and weight of hen's eggs are dependent on heredity, age of bird, season of the year and diet. To meet high quality standards of market eggs, commercial flocks have been selected through extensive breeding program and nutritional adequacy of the birds has been established (*Stadelman and Pratt., 1989*).

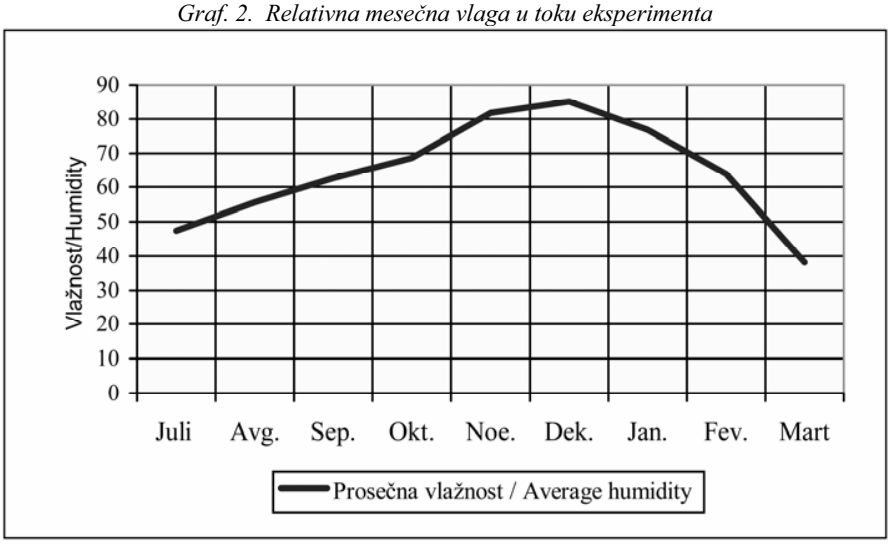
Material and methods

During the nine-month experiment which lasted three seasons (summer, autumn and winter), eggs were gathered from a poultry farm located in the southern part of the Republic of Macedonia where Mediterranean climate is influencing. In this region annual average temperatures always are higher and summer temperatures are regularly over 35-40ºC with plenty sunlight. The material was gathered once a month and it consisted of 100 eggs; 50 eggs were from layers (Isa-Brown) up to 45 weeks of age and remaining 50 from layers (Isa-Brown) more then 45 weeks of age, so in total 877 eggs were examined. During the experiment the highest, lowest and average temperatures were recorded as well as relative humidity daily in this region.

Graph. 1 Minimum, maximum and average monthly temperatures in the course of experiment
Graf. 1 Minimalne, maksimalne i prosečne mesečne temperature u toku eksperimenta



Graph. 2 Relative humidity monthly in the course of experiment
Graf. 2. Relativna mesečna vlaga u toku eksperimenta



The shape of the egg was determined by measuring maximum length and width of each egg. Egg shape index was calculated using the following formula given by Panda (1996):

Egg shape = (egg width / egg length)*100

The obtained data was processed statistically by applying different models of Least Squares Method (*Harvey, 1990*).

Results and discussion

During the experimental year the highest daily temperature was in July, 41.7ºC, while the lowest daily temperature was in January and March, –8ºC. The highest average temperature was in July, 26.7ºC and the lowest average temperature was in December, 6.3ºC (shown Graph.1). Average relative humidity was the highest in December, 85.2%, while lowest humidity was in March, 38.2%, the main cause was deficiency of spring rains (shown Graph.2).

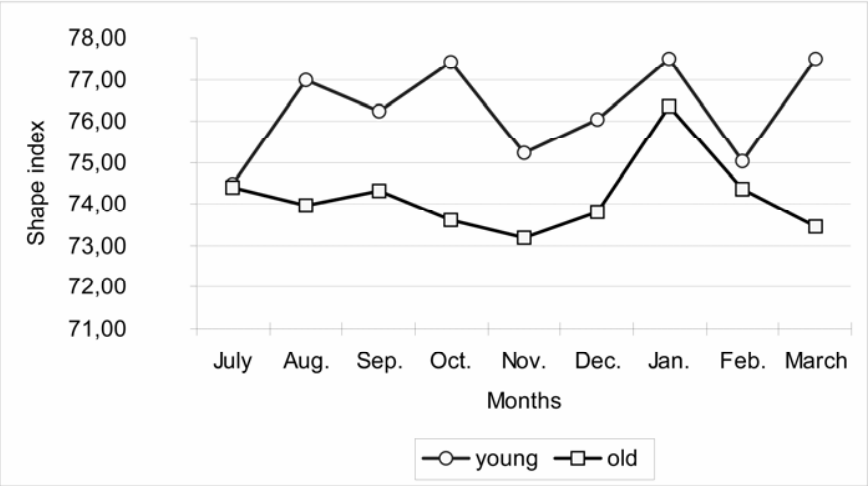
The zone of thermal neutrality for adult birds has been reported to be in the range of 14º to 26ºC. High temperature (above 26ºC) depresses production and adversely affects shell quality and egg size. Relative humidity of 40 to 60% is preferred (*Stadelman, 1995*).

Table 1. Results obtained by measuring shape index of eggs from young and old hens monthly
Tabela 1. Rezultati dobiveni merenjem indeksa kokošjih jaja mesečno kod mladih i starih kokošaka

Months Meseci	Average temperature, ºC Prosečne temperature, ºC	Average humidity, % Prosečna vlaga, %	Shape index,% Indeks oblika, %	
			Young hens (< 45 weeks) Mlade kokoške (< 45 nedelja)	Old hens (> 45 weeks) Stare kokoške (> 45 nedelja)
1	2	3	4	5
July Jul	26.7	47.5	74.49	74.41
August August	24.7	55.6	77.00	73.99
September Septembar	20.9	62.6	76.24	74.33
October Oktobar	13.6	68.6	77.43	73.63
November Novembar	10.3	81.7	75.24	73.19
December Decembar	6.3	85.2	76.03	73.82
January Januar	6.5	76.7	77.48	76.34
February Februar	9.5	63.8	75.01	74.36
March Mart	7.9	38.2	77.50	73.48
Median average Srednji prosek	14.04	64.43	76.27	74.17

In this experiment (tab.1), shape index values ranged from 74.49 to 77.50% for eggs from young birds, with median average of 76.27%, while values from old birds ranged from 73.19 to 76.34% with median average value of 74.17%. Difference between two age groups was 2.10%. The higher shape index of eggs from younger hens showed presence of more eggs of rounded shape, while lower shape index of eggs from older layers showed more percentage of eggs of elongated shape which is typical for hens in deep age. According to previous results graphic is created (Graph.1) which shows various shape values between younger and older layers in last three seasons (summer, autumn and winter).

Graph. 3 Graphic account of the shape index of eggs from young and old hens, monthly
Graikon 3 Grafički prikazan indeks oblika jaja mladih i starih kokoška mesečno



According to *Romanoff and Romanoff* (1949), the standard eggs from hens had a shape index of 74% with blunt and pointed ends; shape index values ranging from 63.1 to 81.7%, with a median value of 70%, were observed for eggs from a flock of 262 Leghorn hens (*Stadelman and Cotteril, 1995*). The percentage of shape index, which is ranging from 70 to 77%, can be estimated as an optimal value. Other higher and lower quantities would point out more rounded, more elliptic or more elongated eggs. The elongated eggs have lower, while the rounded eggs have higher index shape. From 3 to 5 weeks of starting the laying can be achieved demand egg shape.

The measurement of 877 eggs has showed average shape index of 75.19%, so it can be concluded that this is ideal (shown tab.2). Highly significant effect ($p<0.01$) on the shape index had factor age (87.63%) and factor season (8.94%). Younger layers produced eggs with higher index, 76.12%, by more rounded shape, while older layers produced eggs with lower index, 74.20%, by more elongated shape. Statistically significant effect had factor season. In summer and autumn, the shape index was 74.88 and 74.83% with most elongated laying eggs. In winter the shape index was 75.85% and most of produced eggs were rounded.

Solomon (1991) is talking about authors, who have been suggested that rounder eggs are deform less and they are less resisted against breaking then elongate eggs.

Table 2. Effect of season and hen's age on egg shape index
Tabela 2. Uticaj sezone i uzrasta koka na oblik jaja

Fixed factor Fiksni faktor	Physical characteristic – shape index (SI) Fizičko svojsvo- indeks oblika (IO)		
	n	LSM – Least Squares Means	SE Standard Error
1	2	3	4
μ	877	75.19	0.103
AGEHEN (UZRKOK)			
1	438	76.17	0.147
2	439	74.20	0.147
Fexp		87.63** (p<0.01)**	
SEZ (SEZ)			
1	279	74.88	0.201
2	297	74.83	0.189
3	301	75.85	0.189
Fexp		8.94** (p<0.01)**	

Conclusions

The results obtained suggest that the age had highly significant effect ($p<0.01$) on shape index of eggs. Accordingly the layers (Isa-Brown) up to 45 weeks of age produced eggs with higher shape index (76.17%) and the most of rounded eggs. The layers more then 45 weeks of age produced eggs with lower shape index (74.20%) and the most of elongated eggs.

Season (summer, autumn and winter) also had a highly-significant variation between the shape index in summer period when most of eggs were elongated and the shape index in winter period with the most number of rounded eggs.

The measurement of egg shape index is necessary to give extreme estimation of eggshell quality. It will be show that hen's eggs have optimal egg shape without any defects, what is indispensable for effective incubation of chicks, good packing of eggs and their safe transport to the market.

UTICAJ SEZONE I UZRASTI KOKOŠI NA INDEKS OBLIKA KOKOŠIJIH JAJA

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Rezime

Uticaj faktora sezone i uzrasti kokoši ispitivan je u periodu od devet meseci, a bile su obuhvaćene letnja, zimska i prolećna sezona. Kao

materijal korišćena su jaja hibridne linije Isa-braon, a jaja su skupljana kod dve uzrasne grupe: jedna do 45 nedelja, a druga iznad 45 nedelja starosti. Jedanput mesečno ispitivano je oko 100 jaja od dve uzrasne grupe, tako što je ukupan broj ispitanog materijala bio 877 jaja. Živinarska farma od koje je uziman materijal smeštena je na jugu R. Makedonije gde su prosečne godišnje temperature uvek veće od onih u ostalim regionima države. Analiza uticaja faktora sezone i uzrasti obavljena je metodom najmanjih kvadrata (*Harvey,1990*). Dobijeni prosek merenja indeksa svih jaja iznosio je 75,19%. Visoku signjifikantnost ($p<0.01$) pokazao je faktor uzrast, tako su jaja mladih kokošaka imala vrednost indeksa od 76,17% što je ukazivalo na jaja sa ovalnijim oblikom, dok su jaja starijih kokošaka imala indeks 74,20% i bila su izduženijeg oblika. I uticaj sezone bio je visoko značajan ($p<0.01$) na indeks kokošijeg jajeta. U letnjoj i jesenjoj sezoni vrednost indeksa bile su 74,88% i 74,83% i jaja su bila izduženijeg oblika, dok se u zimskom periodu dobijala jaja sa prosekom od 75.85% i većinom su imala okrugliji (ovalniji) oblik.

Ključne reči: kokoš, sezona, uzrast, indeks oblika, jaje.

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