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Physico-chemical properties of eggs

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I. - Introduction

Eggs are very important for feeding people as they have high nutritive value and are suitable for processing. 100 g of the edible part of a hen egg contains 72.5-75.0 g of water, 12.5-13.3 g of protein, 10.7-11.6 g of fat, 0.7 g of carbohydrates and 1.0-1.1 g of mineral substance. The human body also makes good use of the nutritive value of eggs : proteins are utilized at 97%, fats 95%, carbohydrates 98% and minerals 76%. The content of essential amino acids in eggs is also very important, specially leucine, isoleucine, lysine, arginine, valine and phenylalanine. Eggs are also rich in vitamins - specially A, D, E, K and B complex - and also in different micro- and macro-minerals.

The consumption of eggs per inhabitant in Yugoslavia has increased remarkably during the last 30 years. While eggs were used only as food for children and patients in the past - today they are regularly consumed by most people-. The consumption of eggs per inhabitant was 41 pcs in 1950, 69 pcs between 1961-1968, 155 pcs between 1971-1975 and in 1985 it reached 190 pcs. This level of consumption is still low compared to many developed countries which have levels of 210-250 pcs per inhabitant.

After production in a poultry house, eggs demand special treatment in packing, transport and care. The purpose of this paper is to show the changes in eggs which occur after 21 days of storage at different temperatures. It shows some physico-chemical properties which change with the age of eggs and are indicators of their quality.

II. - Material and methods

The physico-chemical properties were analysed on 90 fresh eggs, and after 21 days of storage at $18 \pm 2^\circ$ C (room temperature) or $4^\circ\text{C} \pm 1^\circ\text{C}$ (refrigerator). The analyses included : Haugh units, value number, degree of oldness and content of inorganic phosphorus in egg white.

Haugh units were determined according to the method of Haugh worked out by Eisen and coll..

$$\text{HU} = 100 \text{ LOG} (L + 7.77 - 1.7 W 0.37)$$

whereby:

L = height of thick egg white (mm)

W = weight of egg (g)

"Value number" (VN) and "degree of oldness" (DO) were determined according to the Janke and Jirake ; method based on determination of index fraction of egg white and yolk with application of the following formula :

$$\text{VN} = 1\,000 (i_{\text{DY}} - n_{\text{Dew}})$$

$$\text{VN} = 1\,000 (i_{\text{DY}} - n_{\text{Dew}})$$

$$\text{DO} = 1\,000 (1.4184 - n_{\text{DY}})$$

whereby:

n_{DY} = index of yolk fraction

n_{DEW} = index of egg white fraction

1.4184 = index of standardized yolk fraction

The inorganic phosphorus level was determined by spectrophotometric method at 750 nm. The determined parameters were worked out by the usual variational-statistical methods and were showed by arithmetic mean (\bar{x}) and standard deviation (s).

III. – Research results

The results are shown in **Table 1**. In fresh eggs the Haugh unit value was 84 and after three weeks of storage in a refrigerator decreased to 79 ; for the same time period the value of eggs stored at room temperature was decreased to 40. This shows that higher temperature provoked faster decomposition of thick egg white component. In such eggs, the egg white spreads considerably over a glass surface ; the middle thick layer is partly disintegrated and the proportion external liquid layer is increased. Balls and Swenson emphasize that in egg white, under influence of triptical proteinase, a proteolyse is developed, and afterwards the mucinic threads are riven and release fixed water (1). The established data are in accordance with the statements of Ordynski, Brixius and Kralik.

The fresh eggs had a "value number" equal to 63.14, eggs stored in the refrigerator 61.63 and those stored at room temperature 58.24. The recorded "value number" is a result of the changes in the part of yolk and egg white which occur during the storage of eggs. The index of egg white fraction increases with oldness of eggs, what is brought together with the loss of water from egg white. One part of water is evaporated through the egg's pores and one part passes through the yolk membrane where it remains. The evolution of yolk index is opposite : the index of fraction is decreased during the storage of eggs.

The "degree of oldness" of fresh eggs was just 0.92 ; for eggs stored in a refrigerator it increased up to 1.45 and for those stored at room temperature up to 4.52. Negative correlations exist between the "value number" and "degree of oldness". The decreasing "value number" provokes an increasing "degree of oldness".

The measures of inorganic phosphorus in 30 samples of egg white show that some transfer of phosphate-ions occurred during storage of eggs kept in refrigerator or at room temperature, but the diffusion process was faster on eggs stored at room temperature.

The fresh eggs contained 0.13 mg of phosphorus, eggs kept in a refrigerator 0.59 mg and eggs kept at room temperature 0.63 mg of phosphorus in 100 ml of egg white. Janke and Jirak, Hadorn and Junkunz, Kralik and Kralik *et al.* have established that the quantity of phosphorus in egg white is increased during oldness of eggs. This increase is slow at the beginning of the storage period and then becomes faster.

(1) Editor's note : It has been demonstrated that the physico-chemical evolution which occurs in the egg albumen is not explained by a proteolyse.

IV. – Conclusion

During the storage of eggs at temperatures of $4^{\circ}\text{C} \pm 1^{\circ}\text{C}$ and $18^{\circ}\text{C} + 2^{\circ}\text{C}$ some physico-chemical processes occur which disturb their "original" content. The decrease in Haugh units (HU) and "value number" (VN) is followed by an increase in "degree of oldness" (DO) and content of inorganic phosphorus in egg white. Higher temperature speed up these changes and it is therefore necessary to store eggs under particular conditions in order to maintain their quality.

References

- KRALIK, G., 1978. - Zbornik radova Paradarski dani.- *Opatija*, 271 p.
- HAUGH, R.R., 1937.- *U.S. Poultry Mag.*, **43**, p. 522.
- EISEN, E.J. ; Bohrer, B.B. ; McKean, 1962.- *Poultry Sci.*, **5**, p. 1461.
- JANKE, A. ; Jirak, Z., 1934.- *Biochem leit.*, pp. 309-323.
- BALLS, D. ; Swenson, K., 1930.- *Ing. Eng. Chem.*, **322**, p. 908.
- ORDYNSKY, G., 1961.- *Deut. Lebensm. Rundschau*, **4**, p. 103.
- BRIXIUS, L.S., 1969.- *Geflugelwirtschaft*, **38**, p. 1677.
- HADORN, V., Jungkunz, R., 1955.- *Mitt. Lebens, Untersuch.*, **46**, p. 168.
- KRALIK, G., 1978.- Zbornik radova Poljoprivrednog fakulteta.- *Osijek*, **2**, 121 p.
- KRALIK, G. ; Petricević A. ; Turk, D ; Komendanović, V., 1984.- *Tehnologija mesa*, **11**, p. 355.
- BARIĆ, S., 1985.- *Statističke metode primijenjene u stocarstvu*, Zagreb.
- HADORN, H. ; Henzi, M. ; Rauch, H., 1969.- *Eier und Eierkonserven*.
- KRALIK, G. ; Petričević, A. ; Kon, V. ; Senčić, D., 1983.- *Tehnologija mesa*, **12**, p. 361.

Table 1: Parameters of consumption – eggs quality

Parameter	Fresh eggs		Stored eggs (21 days)			
			Refrigerator (4°C)		Room temp. (18°C)	
	\bar{x}	s	\bar{x}	s	\bar{x}	s
Haugh units (HU)	83.96	8.52	79.35	5.75	40.22	13.15
Value number (VN)	63.14	1.28	61.63	1.02	58.24	1.45
Degree of oldness (DO)	0.92	0.06	1.45	0.08	4.52	0.13
Inorganic phosphorus mg %	0.13	0.03	0.59	0.05	0.64	0.04
Fraction index of yolk	1,4174		1,4169		1,4137	
Fraction index of egg white	1,3539		1,3552		1,3555	