

STUDY OF FRESHNESS AND MICROBIOLOGICAL INDICES OF EGGS DEPENDING ON THEIR SHELF LIFE

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Abstract - Study was aimed to analyse microbiological indices of eggs for human consumption offered by the market, produced by several poultry factories from the country and to determine the safety of eggs for consumers' life and health. The objectives of the study were focused on defining indices of freshness and analysis of microbiological indices of eggs in different periods of shelf life. The experimental results proved the safety of the eggs for human consumption because the lack of contamination of their components and shell with pathogenic microorganisms throughout the storage period.

Keywords: eggs for human consumption, freshness, microbiological indices, safety.

INTRODUCTION

The role of nutrition for human life and health constitutes a priority of policies and strategies to ensure the quality of society life. By the development of market economy, the complexity and the diversity of food is growing. Consequently consumers' role is becoming increasingly important and their behaviour is affecting a large number of manufacturers. In the same context but within market relations, the consumers face many imbalances that affect them from different angles: economical, educational, of health safety, etc.

One of the objectives of General Product Safety Directive (GPSD) issued in 1992 and revised in 2001, confirms that only the safe products can reach markets, and the products should not affect consumers' health or their physical state.

Another important objective of the Directive is to ensure proper functioning of internal markets, in which consumers feel safe [1].

One of the valuable animal foods is poultry egg. Poultry egg is a food with high biological value that answers the almost all nutritional requirements of modern human being. Because of low egg ratio of calories/protein it may be recommended for diets with moderate caloric level [2,3].

The internal contamination of the egg occurs in the ovary or genital tract with germs of diverse origin, and the most dangerous of them may be Salmonella (*S. typhimurium*) [4]. As a result the egg contamination can occur throughout the chain from production to final consumption. In the production and marketing industry it is not uncommon for the withdrawal of thousands of eggs on the retail market on account of their contamination with salmonella in farm conditions [5].

The market accepts the products to circulate freely, without being subjected to multiple costly checks because of the lack of time and money.

In order to ensure consumers with safe eggs for human consumption, and to exclude the health risk that may be posed by eggs, the Government of Republic of Moldova had approved Veterinary norm for eggs sale, by Decision no. 1208 of 27 October 2008.

It is necessary to conduct tests on eggs in order to avoid infection and transition of disease and to ensure the safety of the product for the consumer. The tests on eggs are proposed to prove their quality and microbiological indices.

In order to achieve the goal it is obvious to be performed and to be proved the regulatory conformity of the product with the documentation.

METHODES AND PROCEDURES

The research on microbiological parameters of eggs were performed in accredited microbiological laboratory of the Centre for Public Health, dis. Criuleni, accreditation certificate in the system of Ministry of Health Nr.2324 on 14/11/14.

As a biological material of the study served fresh hen eggs produced by six companies from the country. The eggs were purchased from market and were accompanied by veterinary certificates issued by the Authority of Food Safety. The eggs were stored at temperature of + 4 ° C. Microbiological tests were performed at 7 and 21 days of storage after laying. These terms have been established for the study of microbiological indices based on the marketing requirements of eggs according to the Instruction on marketing standards for consumption eggs.

For the research there have been analysed 30 eggs from each poultry enterprise. The indices of eggs' freshness were studied during storage. Albumen and yolk indices were determined with the purpose of analysing the state of freshness at 7 days and 21 days of storage.

Albumen and yolk indices were determined after breaking eggs and measuring the diameter and height. The indices had been calculated.

All microbiological tests were performed by applying the methods described in the following documents: method of determination of Content of mesophilic aerobic and facultative anaerobic microorganisms-QAAFAM/g/SM SR EN ISO 4833:2011, GOST 10444.15-94; Method of coliform bacteria group determination GOST 30518-97 and E. Coli determination GOST 30726-2001 MSR 16649-2:2011; The method of determination of microorganisms Salmonella gender SM EN ISO 6579: 2013, GOST 30519-97; determination of S. aureus GOST 10444.2-97, GOST 30364.2-96; determination of enterococci GOST 28566-90; Determination of mould, yeasts – GOST28805-95, GOST 30706-2000.

In the study were used normative acts on food safety of the Republic of Moldova.

RESULTS

During storage, some of the egg water evaporates. The content of the egg decreases and the volume of the air cell increases. The egg albumen becomes thinner, the yolk rises, chalazas are becoming weaken and are able to touch the shell, which adheres thereby facilitating the growth of microorganisms that penetrated through the pores if they are present on the shell. The freshness of the egg can be assessed by determining the size of the air cell, albumen and yolk indices. These indices are influenced by egg shelf life because of the changes in the consistency of its components.

During the storage the egg's freshness indices had changed, so the albumen index decreased from 7 days to 21 days of storage by 9.9%, and the yolk index decreased by 21.8%.

Size of the air cell has changed from the first to the second investigation, consequently the diameter increased by 40.2% and height increased by 35.4%. The experimental results have shown the interaction between quality indices and shelf life of egg.

Table 1. Indices of eggs freshness, (n = 3).

Index	Eggs at 7 days of storage		Eggs at 21 days of storage	
	X ± Sx	V,%	X ± Sx	V,%
Index, mm albumen	19,2 ± 1,4	12,8	17,3± 1,1	10,8
yolk	35,4 ± 1,4	6,9	27,7± 1,9	11,9
Size of air cell, mm diameter	15,3 ± 0,8	9,9	25,6 ± 1,1	7,9
height	5,3 ± 0,3	10,8	8,2 ± 0,4	11,8

Another objective of the study was the analysis of microbiological indicators of eggs with different length of shelf life.

Quantity of mesophilic aerobic and facultative anaerobic microorganisms in eggs at seven days of shelf life admissible under the stipulated rules in the normative documentation is 5×10^3 g CFU/g.

Following microbiological analysis of eggs produced by six producers was found that at seven days of storage both as in albumen and in yolk the quantity of mesophilic aerobic and facultative anaerobic microorganisms was 2×10^{-1} ; 2×10^{-2} g CFU/g and it was within the limits established for this product.

Table 2. Quantity of mesophilic aerobic and facultative anaerobic microorganisms, CFU/g.

Days of storage	Egg content	Poultry farm					
		SRL "Pasare Argintie"	SRL "DANI Agro"	SRL "Acoustic Tehnologic"	SA "Floreni"	SRL "Rediagro"	SRL "Intervet com"
		CFU/g					
7	albumen	2x10 ⁻¹	2x10 ⁻¹	2x10 ⁻¹	2x10 ⁻¹	2x10 ⁻¹	2x10 ⁻¹
		0,0	0,0	0,0	0,0	0,0	0,0
		2x10 ⁻²	2x10 ⁻²	2x10 ⁻²	2x10 ⁻²	2x10 ⁻²	2x10 ⁻²
	yolk	0,0	0,0	0,0	0,0	0,0	0,0
		2x10 ⁻²	2x10 ⁻²	2x10 ⁻²	2x10 ⁻²	2x10 ⁻²	2x10 ⁻²
		0,0	0,0	0,0	0,0	0,0	0,0
21	albumen	2x10 ⁻³	2x10 ⁻³	2x10 ⁻³	2x10 ⁻³	2x10 ⁻³	2x10 ⁻³
		0,0	0,0	1,1	0,0	1,2	2,2
		2x10 ⁻⁴	2x10 ⁻⁴	2x10 ⁻⁴	2x10 ⁻⁴	2x10 ⁻⁴	2x10 ⁻⁴
	yolk	0,0	0,0	0,0	0,0	0,0	0,0
		2x10 ⁻⁴	2x10 ⁻⁴	2x10 ⁻⁴	2x10 ⁻⁴	2x10 ⁻⁴	2x10 ⁻⁴
		0,0	0,0	0,0	0,0	0,0	0,0

There is determined in the normative documentation that the quantity of mesophilic aerobic and facultative anaerobic microorganisms in eggs stored for 21 days must not exceed 5x10⁵g CFU/g. In the microbiological control carried out at 21 days of storage was found that this index in albumen and yolk of eggs produced by different poultry farmers was 2x10⁻³; 2x10⁻⁴g CFU/g. In the experiments the quantity of mesophilic aerobic and facultative anaerobic microorganisms was within acceptable limits.

During the study there have been analysed other microbiological indicators, comparing them with admissible norm: Coliform bacteria (absent in 0.1g); Pathogenic microflora including Salmonella (absent in 5x 25g); Microorganisms as Proteus (absent in 0.1 g); Microorganisms as Candida (absent in 1.0g.); S. aureus (absent in 1.0g); E. coli (absent in 1.0g); Enterococci spp (absent in 0.1g). All indices were completely free of development, except coliform content.

Table 3. Quantity of Coliform bacteria in hen eggs.

Days of storage	Egg content	Poultry farm					
		SRL "Pasare Argintie"	SRL "DANI Agro"	SRL "Acoustic Tehnologic"	SA "Floreni"	SRL "Redi agro"	SRL "Intervet com"
		Coliform bacteria					
7	albumen	nd	nd	nd	nd	nd	nd
	yolk	nd	nd	nd	nd	nd	nd
21	albumen	10 ⁻² mr	10 ⁻² mr	10 ⁻² mr	10 ⁻² mr	10 ⁻² mr	10 ⁻² mr
	yolk	nd	10 ⁻² mr	10 ⁻² mr	10 ⁻² mr	10 ⁻² mr	10 ⁻² mr

The study results showed that coliform bacteria were not detected in eggs stored for up to 7 days after laying. It should be mentioned that at 21 days of storage in the albumen of eggs produced by SRL "Pasare Argintie" the concentration of coliform bacteria was 10^2 , in the albumen and the yolk of eggs produced by SRL "DANI Agro", SRL "Acustic Tehnologic", SA "Floreni", SRL Rediagro "and SRL" Intervetcom "concentration was 10^2 . Regardless of whether the content of coliform

bacteria was detected in eggs the contamination meets the requirements of the standards.

In the study there had been investigated the microbial load of eggs shell, that were sold on the market, the presence of pathogens, including Salmonella, samples with positive results were not recorded. That fact indicates that the eggs were not contaminated.

Table 4.Total quantity of mesophilic aerobic and facultative anaerobic microorganisms in eggs at 7 days of storage, CFU/g.

Nr.	Poultry farm	Dilution		Admissible norm
		2×10^{-1}	2×10^{-2}	5×10^{-3}
1	SRL,,Pasare Argintie"	nd	nd	mr
2	SRL,, DANI-Agro"	nd	nd	mr
3	SRL,,Acustic Tehnologic"	nd	nd	mr
4	SA ,,Floreni"	nd	nd	mr
5	SRL,, Rediagro"	nd	nd	mr
6	SRL,, Intervetcom"	nd	nd	mr

Note: nd- not detected
mr-meet requirements

Table 5.Total quantity of mesophilic aerobic and facultative anaerobic microorganisms in eggs at 21 days of storage, CFU/g.

Nr.	Poultry farm	Dilution		Admissible norm
		2×10^{-3}	2×10^{-4}	5×10^{-5}
1	SRL,,Pasare Argintie"	0,0	nd	mr
2	SRL,, DANI-Agro"	0,0	nd	mr
3	SRL,,Acustic Tehnologic"	1,1	nd	mr
4	SA ,,Floreni"	0,0	nd	mr
5	SRL,, Rediagro"	1,2	nd	mr
6	SRL,, Intervetcom"	2,2	nd	mr

Note: nd- not detected
mr-meet requirements

All the results showed that sanitary veterinary regime at poultry factories and in trading system are respected under the current rules and the sold eggs on the local market are safe for human consumption.

CONCLUSIONS

Studies on microbiological indices of sold eggs in the commercial places need to be carried out regularly to ensure about harmlessness and safety of this product for the consumer's health and life as the egg is perishable and easy to be contaminated.

The microbiology of eggs produced by different poultry enterprises and sold on the market showed that content of CMAFAM in albumen and yolk of eggs stored 7 days met regulatory requirements and at 21 days of storage did not exceed standards set in the reference documents.

In tests conducted on eggs were not detected bacteria and fungi, except coliform bacteria, found in eggs that had been stored for 21 days after laying but their content was admissible under the existing documentation.

The results of microbiological study confirm that producers offer safe eggs for human consumption.

The safety of product is covered by veterinary certificates issued by the District Department for Food Safety.

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