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Влияние типа потребительской упаковки на качество творога в течение срока годности

The influence of the type of consumer packaging on the quality of cottage cheese during the shelf life

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Аннотация. *В статье обобщены сведения по использованию полимерных материалов и бумаги для потребительской упаковки творога, а также по экспертизе потребительских свойств творога, реализуемого на потребительских рынках городов РФ. Приведены экспериментальные данные по влиянию типа потребительской упаковки творога на его качество и безопасность в течение срока годности. Показана степень влияния материала упаковки – пергамент, кашированная фольга и контейнер из поливинилхлорида на сохранность творога жирностью 5 %.*

Ключевые слова: творог, потребительская упаковка, качество, срок годности

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Abstract. *The article summarizes information on the use of polymer materials and paper for consumer packaging of cottage cheese, as well as on the examination of consumer properties of cottage cheese sold in consumer markets of cities of the Russian Federation. Experimental data on the effect of the type of consumer packaging of cottage cheese on its quality and safety during the shelf life are presented. The degree of influence of the packaging material – parchment, laminated foil and a container made of polyvinyl chloride on the safety of cottage cheese with a fat content of 5% is shown.*

Keywords: cottage cheese, consumer packaging, quality, shelf life

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Introduction. The problem of maintaining the quality of food products has always been acute. The development of technological processes in food production and the preservation, both quantitatively and qualitatively, of finished products cannot be fully carried out without the use of modern packaging materials. And in modern realities, consumer packaging, along with ensuring the safety and unchanged properties of the food product during the shelf life, must attract the attention of buyers, be environmentally friendly and inexpensive. Therefore, the choice of packaging material is very important.

According to statistics, the share of polymer materials in food packaging is about 38% [1]. Polymers attract manufacturers with their low cost, excellent technological and mechanical characteristics, low weight and long service life. Over the past 50 years, the global production of plastics has increased from 30 to 367 million tons. However, there is practically no recycling of plastic containers, and the result is its distribution in soil, water, and even in the biomass of animals and humans [2].

In this regard, the question arises about the relevance of the development and use of biodegradable packaging for various food products, including cottage cheese.

In the work of Myalenko D.M. It is shown that when studying biodegradable materials, scientists paid great attention to their properties and structure, while the specifics of using such materials as food packaging have not been well studied. It should be noted that many polyesters, due to the peculiarities of their properties, cannot be used as full-fledged packaging for dairy and food products. They are used in the form of coatings on biodegradable polymer materials, thereby imparting additional resistance to fat and moisture, allowing them to be used as packaging for any products, including products with a moisture content of more than 15.0% [2].

Agarkov A.A. studied the possibility of using packaging based on environmentally friendly degradable materials - 25-micron thick film bags made of a polymer composition based on polylactic acid and polybutylene adipate co-terephthalate, which made it possible to assess the potential influence of the product composition - cottage cheese of varying degrees of fat content (0, 9.0 and 18.0%) for this package during storage. It was found that in all studied samples of cottage cheese there is an increase in titratable acidity and a decrease in active acidity, a slight increase in anisidine and peroxide numbers, which is characteristic of this product. As for the packaging material, after 35 days. storage of all samples of cottage cheese, the film is not deformed or destroyed, which provides good prerequisites for its use as an alternative to traditionally used polymeric materials [3]

In the study by Asyakina L.K. it has been shown that the use of developed biodegradable containers based on gelatin and natural polysaccharides for packaging cottage cheese is advisable, since it allows increasing the shelf life of the product by 40–50% compared to traditional polymer packaging (in particular, a container made of polyethylene terephthalate) [4].

There is currently no cottage cheese in biodegradable packaging, and the ratio of different types of packaging for cottage cheese and cottage cheese products is as follows [5]: glasses sealed with foil or a plastic lid - polymer 10.1%, cardboard - 14, 6%, containers and flow-pack bags made of polymer materials – 27.8% and 35.1%, respectively, packs made of foil, parchment and laminated paper – 12.4%. As can be seen from the data presented, the share of polymer materials accounts for 73% [6].

The purpose of the work is to study the influence of three types of consumer packaging of cottage cheese on its quality and safety during its shelf life. The choice of cottage cheese as an object of study is due to the fact that its consumer packaging is quite diverse both in material - paper, foil, polymer materials, and in type - pack, glass, bag, which makes it possible to conduct a comparative assessment of changes in the quality of cottage cheese during storage and analyze the degree of influence of packaging on the preservation of the quality and safety of samples.

There are known studies on the examination of the consumer properties of cottage cheese sold in the consumer markets of the cities of Khabarovsk, Yekaterinburg, Irkutsk, Anapa, during which full or partial compliance with the requirements of GOST 31453 Cottage cheese was established. Technical conditions and TR CU 033/2011 On the safety of milk and dairy products [7-10]. A number of studies have been carried out on the influence of the type of dairy raw material, including breed, on the quality of cottage cheese [11-13]. At the same time, no data have been found on the influence of the type and material of consumer packaging on the quality of cottage cheese during its shelf life.

Materials and research methods. Cottage cheese of three trade names with a fat content of 5%, packed in a pack of parchment (sample No. 1, weight 180 g, shelf life 7 days), in a transparent colorless “drop” container made of polyvinyl chloride (PVC), sealed with a film lid (sample No. 2, weight 220 g, shelf life 30 days) and a pack of laminated foil (sample No. 3, weight 180 g, shelf life 7 days).

The quality of the samples was assessed for compliance with the requirements of GOST 31453 according to: organoleptic indicators: undamaged packaging, appearance and color, consistency, smell and taste - visual inspection, rubbing, testing according to [14], physico-chemical: net weight

of samples in consumer packaging; mass fraction of moisture, acidity - using standard methods according to GOST 3624, GOST 3626. Evaluation of packaging and cottage cheese was carried out on fresh samples and at the end of the storage period of packaged cottage cheese in the refrigerator at a temperature of +4±2 °C.

The assessment of the organoleptic properties of cottage cheese samples was carried out taking into account the recommendations of V.P. Shidlovskaya. on a 30-point scale, according to which 2 points are allocated to evaluate packaging [15]. However, the packaging scoring criteria are not given. In this regard, a 2-point scale was developed (Table 1).

Table 1 – Criteria for evaluating consumer packaging of cottage cheese

Name of the indicator and requirements for it	Grade			
	"Great" 2 points	"Fine" 1.5 points	"Satisfactorily" 1 point	"Unsatisfactory" 0.5 points
Appearance (shape, attractiveness)	Correct shape, bright multi-color printing	Correct shape, multi-color printing is not very bright	The shape of the briquette is somewhat broken, the printing is not bright and not attractive	Irregular shape, unattractive appearance, faded printing
Reliability (tightness, strength, integrity)	Without visible external damage or loss of integrity, sealed, dry, retains the properties of cottage cheese for a given time	Without visible external damage or loss of integrity, sealed, slightly damp to the touch, retains the properties of cottage cheese for a given time	There are non-critical violations of the integrity of the packaging (tears, chips), wet to the touch	There are violations of the integrity of the packaging, it is wet to the touch, the seal is broken

Among the microbiological indicators, the content of the number of coliform bacteria (coliform bacteria) according to GOST 31747, yeast and molds - according to GOST 10444.12 were studied using standard methods.

Research results and their discussion. The organoleptic assessment of cottage cheese began with an assessment of the condition of the packaging: all samples have attractive, colorful consumer packaging - multi-color printing is applied to the parchment, foil and film lid; intact, clean, without mold, not slippery to the touch, the integrity of the packaging is not damaged, for samples No. 1 and 3 the edges of parchment and foil are placed one on top of the other, the container of sample No. 2 is hermetically sealed with a heat-sealable lid.

According to the criteria, table. 1, the packaging of samples No. 2 and No. 3 was assigned a qualitative gradation of “excellent” (2 points), “good” (1.5 points) - sample No. 1, whose design is not bright and not as colorful as the other samples, apparently, when offset printing on parchment, not the best inks were used. Marking of samples complies with the requirements of GOST 31453.

The curd samples have an attractive appearance, the surface is clean, without signs of mold or slime, without voids in the mass, white, uniform in color, which made it possible to assign all samples without discounts 4 points for appearance. Consistency was determined by appearance and tasting, taste and smell by testing (Table 2).

Table 2 – Organoleptic characteristics of fresh cottage cheese

Sample	Consistency		Taste and smell		Sum of points	Sum of points with packaging
	Characteristics (descriptive)	Point	Characteristics (descriptive)	Point		
No. 1	Homogeneous, crumbly	8	Clean, fermented, slightly fresh	15	27	28.5
No. 2	Homogeneous, tender, slightly coarse	9	Pure, fermented milk, but a slightly sour taste is noticeable	15	28	30

No. 3	Homogeneous, slightly coarse	9	Pure, fermented milk	15	28	30

The crumbly consistency of sample No. 1, for which it received a discount of 1 point, is allowed for low-fat and low-fat cottage cheese. But apparently, this is due to the low humidity of this sample (Table 3).

Table 3 – Physico-chemical indicators of cottage cheese

Index	Standard according to GOST 31453	Samples					
		No. 1		No. 2		No. 3	
		Fresh	Storage 7 days.	Fresh	Storage 30 days.	Fresh	Storage 7 days.
Moisture content, %	No more than 75	64.2±1.8	50.1±1.8	66.1±1.8	63.1±1.8	65.5±1.8	57.8±1.8
Acidity, °T	No more than 230	210.0±4.0	212.0±4.0	215.0±4.0	229.0±4.0	212.0±4.0	217.0±4.0

The dynamics of microbiological parameters of cottage cheese samples are shown in Table 4.

Table 4 – Microbiological indicators of cottage cheese

Index	Standard according to GOST TR TS 033 /2013	Samples					
		No. 1		No. 2		No. 3	
		Fresh	Storage 7 days.	Fresh	Storage 30 days.	Fresh	Storage 7 days.
Coliform*	0.01	0.005	0.007	0.001	0.002	0.002	0.003
Yeast, CFU/g	No more than 100	2.5	20.0	2.0	17.5	2.0	20.0
Mold, CFU/g	No more than 50	2.0	17.5	2.0	15.0	2.0	15.0
* – mass (g) in which it is not allowed (for cottage cheese with a shelf life of more than 72 hours)							

Thus, fresh samples of cottage cheese meet the requirements of regulatory documents for all selected quality indicators.

After the storage period of the samples, it was established that some changes had occurred in their packaging: No. 1 (7 days) – the parchment became slightly damp to the touch, but without signs of slipping, as a result of which grains of cottage cheese stick to the edges of the packaging, the pack has somewhat lost its shape, the color of steel even more faded, which corresponds to the quality gradation “satisfactory” (1 point). The packaging of samples No. 2 (30 days) and No. 3 (7 days) did not change (2 points each).

When opening the consumer packaging after the expiration of the shelf life, it was found that the appearance indicators did not change: the samples retained an attractive appearance with a clean surface, no signs of mold or sliming were detected, the color was white, uniform, which made it possible to evaluate the appearance of the samples according to the maximum rating - 4 points. It is known that the moisture content of products has a significant impact on the consistency of products. As can be seen from table. 3, the mass fraction of moisture decreases more sharply in sample No. 1, packaged in parchment; by the end of storage, it decreased by 14.1%, which caused the feeling of moisture in the parchment package to the touch, and, as a result, the consistency became dry and crumbly. Parchment paper, due to its certain porosity, contributes to the drying of the cottage cheese [16]; while in other samples by: 3.0% - in No. 2 (PVC container), which was reflected in the consistency - it remained homogeneous, tender with a slight graininess), 7.7% - in No. 3 - a pack of laminated foil, which is essentially a laminate of grease- and moisture-resistant paper with aluminum foil, which made it possible to maintain a uniform consistency with a slight graininess for this sample. Such packaging is superior to parchment in one of its barrier properties – moisture resistance.

During storage, some changes occurred in the organoleptic properties of the cottage cheese samples, without the appearance of foreign tastes and odors (Table 5).

Table 5 – Organoleptic characteristics of cottage cheese after expiration date

Sample	Consistency		Taste and smell		Sum of points	Sum of points with packaging
	Characteristics (descriptive)	Point	Characteristics (descriptive)	Point		
No. 1 (7 days)	Homogeneous, dry, crumbly	7	Clean, fermented, slightly fresh	15	26	27
No. 2 (30 days)	Homogeneous, tender, slightly coarse	9	Sour milk, but sour tones predominate	eleven	24	26
No. 3 (7 days)	Homogeneous, slightly coarse	9	Fermented milk, pure, slightly sour	14	27	29

Changes in the taste and smell of the samples are due to an increase in their acidity, which at the end of storage was, °T: No. 1 - 212, No. 2 - 229, No. 3 - 217 (Table 3). At the same time, the minimum change in acidity in the cottage cheese, which was stored in a parchment pack - by 1.0%, significant - in sample No. 2, by 6.5%, which was stored in PVC packaging, a decrease in the quality of the cottage cheese is obvious, and, possibly, the development of lactic acid fermentation, that the taste of the cottage cheese has changed so significantly, and the intermediate position is occupied by the laminated foil packaging of sample No. 3 - the acidity gradually increases by 2.4%.

Thus, the sum of points was: sample No. 1 – 27, No. 2 – 26, No. 3 – 29: samples No. 1 (due to deterioration in consistency) and No. 3 decreased by one point (a slightly sour tone appeared in the taste); the worst quality is for sample No. 2 (decrease by 4 points), in the taste of which pronounced sour tones developed during storage, because Initially, the taste of this sample was sour, which may have been a manufacturing defect - the sour taste arises as a result of over-fermentation of the curd or prolonged self-pressing.

Based on the data obtained, it is possible to assess the degree of influence of packaging materials on the preservation of cottage cheese during the period regulated by the manufacturer (Table 6).

Table 6 – Assessment of the degree of influence of packaging material on the safety of cottage cheese with a fat content of 5%

Material manufacturing	Impact on quality indicators	Degree of influence
Parchment	The pack does not hold its shape in the best way, it perfectly retains optimal acidity levels, but does not retain the moisture of the product well, which contributes to a change in consistency	Minor
PVC	High water-holding capacity, but acidity increases, causing an overly sour taste	Significant
Laminated foil	The pack holds its shape well and is characterized by greater resistance to changes in the acidity and moisture content of the curd	Virtually no effect

Conclusion. Thus, the influence of the primary (consumer) packaging material on the change in the quality of cottage cheese during storage is obvious. Based on the results of the research, we can say that the best material is paper, in particular, packaging materials based on it, such as parchment and laminated foil.

In conclusion, the characteristics of packaging materials in relation to cottage cheese are given:

– parchment perfectly retains optimal acidity levels, is economically feasible, environmentally friendly, easy to recycle, but does not retain product moisture well;

– laminated foil is characterized by greater resistance to changes in the acidity of the cottage cheese, humidity, superior to parchment in terms of protective characteristics, but is less economically effective.

– polyvinyl chloride. The tightness of the closure protects against drying out, a high degree of isolation of the product from the environment, and facilitates the application of color printing and labeling text. It contributes to the greatest extent to changing the initial characteristics of the cottage cheese, specific, uncharacteristic taste and smell appear, changes the acidity to the greatest extent, is the most expensive type of packaging, and is difficult to recycle.

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