

# Research Journal of Pharmaceutical, Biological and Chemical Sciences

## Optimization of Technological Properties of Milk as A Raw Material and Produce Due to Lactating Cows' Injecting with An Antioxidant Preparation.

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### ABSTRACT

The article contains the information of the expediency of injecting cows of the milk and meat production field with the antioxidant preparation "Kartok" proved experimentally, which positively influences the state of metabolic processes in their organism. This is manifested in improving the technological parameters of their milk and products of its processing. These changes are more expressed in cows of the milk production field.

**Keywords:** "Kartok" antioxidant preparation, milk productivity, protein, fat, SOMO, density, acidity, technological suitability, cream, butter.

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## BACKGROUND

The biochemical and technological properties of milk, as a raw material for the production of dairy products, depend on a multitude of factors, the main ones are the level, the full value of feeding and meeting the needs of cows, not only in the total amount of carotene, but also in its most active  $\beta$ -fraction [1,2, 3.4]. Along with this, under conditions of the industrial milk production technology, feed additives or injecting new generation preparations that possess anti-stress action and promote activation of the antioxidant protection system are used in the cows' diets. The reasonable use of recommended additives makes it possible to increase the coefficient of efficiency of cow diets and, as a result, to improve the composition and technological properties of milk and products of its processing [5]. One of such preparations is "Kartok", whose active substances (beta carotene and vitamin E) are important factors in activating the antioxidant system in the body, improving metabolic processes, and therefore quantitative and qualitative indicators of animal productivity [6]. Despite the obvious theoretical and practical validity and expediency of using the preparation "Kartok" the effectiveness of its application in the technology of feeding cows has not been studied.

### The purpose of the study

The effect of the use of "Kartok" as an activator of the antioxidant system on the technological properties of milk and products of its processing was studied in the experiment. The preparation consists of a mixture of 2 g / kg  $\beta$ -carotene and 2.25% vitamin E ( $\alpha$ -tocopherol) in an oily solution.

## METHODOLOGY

The studies were conducted according to the experiment design (Table 1) at the dairy complex of the LLC "Agro-Neptune" in the Novospassky District of the Ulyanovsk Region on cows of milk and meat (the Bestuzhevskaya breed) and milk (red-and-white Holstein) breeds. For each breed, two groups of cows were selected according to the principle of analogues -control (I) and experimental (II). The feeding of the experimental cows was carried out with the diets equal in its composition made up according to the detailed standards [7]. The difference in the feeding of animals of the compared groups was only in the fact that the cows of the experimental group were injected intramuscularly twice a month with the antioxidant preparation "Kartok", 15 ml.

## EXPERIMENT DESIGN

Cows of the Bestuzhevskaya breed (milk and meat production)		Cows of the red and white Holstein breed (milk production)	
Group			
I – C (n=21)	II – E (n=21)	I – C (n=22)	II – E (n=22)
Basic diet (BD) according to the norms of All Union Institute of Livestock breeding	BD+"Kartok" injected (15 ml 1 time in 15 days)	Basic diet (BD) according to the norms of All Union Institute of Livestock breeding	BD+"Kartok" injected ( 15 ml 1 time in 15 days)

C – control group, E – experimental group, BD – basic diet.

The effectiveness of the preparation injected into cows was taken into account and studied according to the commonly accepted methods in zootechny. The numerical material was processed with the use of standard programs of variation statistics - the MS Office-2003 software package. The difference in the mean values was considered reliable by the Student criterion depending on the number of degrees of freedom.

## RESULTS

The industry produces carotene preparations that improve their bioavailability (bioabsorption). So, while using pure preparations in the form of oil solutions or suspensions with a particle size of 2-3 microns, a higher degree of their assimilation can be achieved. The consumption, digestion and use of nutrients of diets by animals of different breeds and production systems unequally and ambiguously influenced the efficiency of

processing milk and its products. The change in the constituent components and properties of milk affects its technological parameters.

One of the factors determining the suitability of milk as a raw material for the dairy industry is a breed of cattle. Milk, obtained from cows of different breeds, with different chemical composition, unequal nutritional content, should be used for the production of protein-containing, fat-containing products by the processing industry in accordance with technological requirements and parameters of the chemical composition. Thus, butter in its nutritional value is inferior to milk, cheeses and sour milk products due to less balanced basic nutrients - with a high amount of fat it contains few proteins, carbohydrates, minerals and water-soluble vitamins.

At the same time, butter is the carrier and supplier of very important polyunsaturated fatty acids, fat-soluble vitamins, phospholipids. The importance of fat-soluble vitamins is especially high: vitamin A is necessary for the formation of visual purple, the growth of cells of a young organism; vitamin D is necessary to provide the transport of calcium and phosphorus through biological membranes, prevention of rachitis; vitamin E, like vitamin A, serves as a biological antioxidant. In the process of making butter, the content of vitamins A and D practically does not change. The values of the dry matter and MSNF (milk solids non-fat) determine the nutritional value of milk, its consumption in the production of dairy products (cream, butter, etc.). Due to the content of fat, dairy products have an expressed flavor, aroma, texture and consistency. Milk fat is considered as a real source of vitamin A intake into the human body [8, 9].

The milk separation was carried out on a household separator under the conditions of an educational milk laboratory. The weight fraction of fat in the milk of the cows of the experimental groups was 3.82% (in the Bestuzhevskaya breed) and 3.91% (in the Holstein breed), which is significantly higher ( $P < 0.001$ , table 2) than in similar peers of the control group (3, 70% and 3.72%). This gives the ground to assume that injecting cows with the antioxidant preparation "Kartok" increases the effectiveness of use of blood-derived lipids of food by the mammary gland and acetic acid formed in the rumen. These changes were more expressed in the cows of the red and white Holstein breed.

The milk of the cows of the experimental groups of the breeds compared has a distinct advantage over the content of MSNF in relation to cows of the control group. The parenteral use of "Kartok" increased the amount of vitamin A in milk of cows ( $P < 0.01$ ) of the Bestuzhevskaya breed in 1.62 times, while in the red and white Holstein breed it was 1.65 times higher than in cows of the control groups. Due to the influence of the preparation "Kartok", the differences in the level of the milk fat synthesis by cows of different breeds have also changed the technological properties of milk and products of its processing. For instance, in cows of the Bestuzhevskaya breed, the thermal stability of milk increased by  $6.5\text{ A}^\circ$  ( $P < 0.05$ ), and ethanol was required to coagulate milk of red and white Holstein cows with strength of  $8.4\text{ A}^\circ$  ( $P < 0.001$ ). Thus, the parenteral administration of the preparation in cows improves the composition and technological properties of their milk. In this case, the cows of the red and white Holstein breed produced the most technologically suitable milk for processing.

**Table 2: Influence of the preparation «Kartok» on the processing efficiency of 10 kg of milk**

Indicator	The breed and group of cows			
	Bestuzhevskaya		Red and white Holstein	
	I-C	II-E	I-C	II-E
Fat content in milk, %	3,70±0,006	3,82±0,006**	3,72±0,019	3,91±0,022**
Weight fraction of MSNF, %	8,66±0,011	8,73±0,009*	8,66±0,005	8,75±0,014**
Vitamin A, mg %	0,287±0,015	0,464±0,023*	0,275±0,005	0,453±0,025*
Thermal stability, A°	71,30±0,98	77,80±1,43*	70,80±1,14	79,20±1,14**
Obtained, kg:	1,014±0,009	1,037±0,011	1,010±0,006	1,056±0,011*
- cream, -skimmed milk	8,986±0,077	8,963±0,050	8,990±0,122	8,944±0,040
Fat content of cream, %	36,47±1,333	36,80±0,383	36,67±0,452	36,83±0,162
Extent of extracting fat from milk:- to cream, %	99,95±0,053	99,99±0,192	99,56±0,033	99,47±0,027

\* $P < 0,05$  и \*\*  $P < 0,001$

Because of this, while separating an equal amount of raw milk, from the milk of the experimental group of cows, more cream was obtained by 2.27 and 4.55%, with more economical consumption of more than 1 kg of cream. At the same time, their fat content (36.80 and 36.83%), as well as the indicator of the extent of extracting fat from milk (99.99 and 99.47%) varied insignificantly compared to the control group of animals (36.47 and 36.67% , 99.95 and 99.56%).

The efficiency of cream processing, while producing butter, was assessed with the help of quantitative and qualitative indicators (Table 3). Using the churning method, butter was obtained. At the same time, of this cream it was produced by 2.82 and 5.91% more than from the cream obtained from cows of the control group ( $P < 0.01 \dots 0.001$ ), and the milk consumption per 1 kg of butter was more economical by 2.82 and 5, 39%. The butter, produced from cream of injected cows, contained more fat: in Bestuzhevskaya - by 0.133% and in red and white Holstein rock by 0.4%. It is more suitable for storage, since its lower acidity predetermined a significant reduction in the peroxide number ( $P < 0.05$ ), and the antioxidant properties of the preparation protect fats from oxidation. In the coefficient of thermal stability (Km), the butter's ability to keep its shape at a temperature of 28-30 ° C, the butter obtained from the milk of the experimental group of cows and especially from the milk of the red and white Holstein breed was the best by 3.4 ... 4.50%, where  $K_m = 1$ .

**Table 3: Influence of the preparation «Kartok» on the efficiency of processing cream and butter yield**

Indicator	The breed and group of cows			
	Bestuzhevskaya		Red and white Holstein	
	I-C	II-E	I-C	II-E
Butter obtained from cream, kg	0,496±0,002	0,510±0,006*	0,491±0,003	0,520±0,006**
Fat content, %	72,100±0,200	72,233±0,153	72,033±0,100	72,433±0,058
Butter acidity, °T	17,953±0,050	17,000±0,017**	17,367±0,208	17,078±0,104
Peroxide number, mg	0,072±0,003	0,060±0,001	0,068±0,001	0,059±0,001*
Thermal stability, units	0,880±0,010	0,910±0,010	0,957±0,058	1,000±0,064
Milk consumption, kg:				
for 1 kg of cream	9,86±0,087	9,64±0,106	9,90±0,077	9,46±0,011*
for 1 kg of butter	20,18±0,443	19,61±1,050	20,39±0,655	19,29±1,056

\*  $P < 0,05$  и \*\*  $P < 0,001$

### CONCLUSIONS

Thus, injecting cows of milk, meat and milk production systems with an antioxidant preparation resulted in activation of metabolic processes in their organism, including in the mammary gland, through the enzyme-humoral system, increased bioavailability of vitamins and synthesis of milk components, which was manifested in improving technological properties milk and products of its processing, reduced its consumption for the production of cream and butter. The specified changes are more pronounced in the cows of the red-and-white Holstein breed.

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