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VETERINARY AND SANITARY EVALUATION OF HOLSTEIN MILK

ANNOTATION

Livestock in Kazakhstan occupies about 43% of the total gross agricultural output, is the main source of employment, nutrition and income of the rural population and its development is one of the main strategic economic objectives of the Republic. The dairy industry has always been and remains the leading sector of the Republic's agro-industrial complex, accounting for about 20% of the volume of food produced in Kazakhstan. The provision of the population with quality products is closely connected with the development of cattle breeding; in turn, the provision of dairy products largely depends on the efficiency of dairy cattle breeding and the fullest use of its potential. To date, the main task in dairy cattle breeding is to increase cow productivity, as well as to improve milk quality: to increase the amount of fat, protein and dry matter. The development of the dairy industry in the Republic of Kazakhstan has a positive trend. The range of dairy products is wide and is approaching European standards in terms of quality. New brands using high-tech production lines have emerged in Kazakhstan's domestic market, which creates a special demand from consumers for competitive advantages in terms of product quality.

Key words: *milk, veterinary and sanitary assessment, cattle, selection, productivity.*

Introduction. Recently, in the Republic of Kazakhstan, there have been high rates agricultural growth, including through an increase in production capacities of enterprises for the production of milk [5]. Quantities of bovine production milk increases by 2-4% every year, but the bulk of raw milk, i.e. 90% of all milk production is produced in-house farms of the population [6].

The quality characteristics of milk, namely grade, protein content and fat content, are the main criteria for determining the price and competitiveness of products all over the world. The quality characteristics of milk, namely grade, protein content and fat content, are the most important criteria in determining the price and competitiveness of products worldwide [7]. Agricultural producers are competing fiercely producers in their struggle for survival on the world food market the stiff competition between agricultural producers to survive in the global food market forces them to seek innovative zootechnical and veterinary approaches to the development of dairy cattle breeding, the

dairy industry is in a dire need to find innovative zootechnical and veterinary approaches for the development of the dairy sector of raw milk for the dairy industry [8].

Milk is a well-balanced and highly nutritious product that provides the daily requirement of an adult in animal fat, calcium, potassium, phosphorus; 53% in animal protein; 35% in biologically active essential fatty acids and in vitamins A, C, thiamine; 12.6% in phospholipids and 26% in energy. Cow's milk consists of 87.8% water and 12.9% dry matter and contains vitamins, immune bodies and enzymes. The dry matter contains 3.7%-protein, 3.9%-fat, 4.6%-milk sugar, 1%-mineral matter [9]. Milk fat is 95-96% absorbed by the human body and contains about 20 fatty acids (both substitutable and essential). The greatest fluctuations in its chemical composition occur due to changes in the water and fat content of milk, while the content of lactose, minerals and milk proteins is almost constant. Therefore, it is possible to judge the naturalness of milk by its COMO content [10].

The main constituents directly affecting the palatability and processing properties of milk are milk fat and proteins. Milk fat is one of the most valuable dietary fats. It is a complex mixture of triglycerides: triatomic alcohol - glycerol and fatty acids. The composition of the fatty acids determines the quality of the milk oil. It is not only the concentration of the individual fatty acids which is important, but also the ratio of saturated to unsaturated fatty acids. Of the saturated fatty acids, palmitic, myristic and stearic acids have the highest specific volume [11]. They mainly determine the strength of the oil grain and are least susceptible to oxidation during storage of the product. Oleic acid makes up to 65-70 % of unsaturated fatty acids; it is the least stable during storage and oxidises quickly, giving the oil an unpleasant taste and smell. Milk proteins mainly consist of casein, albumin and globulin. Casein accounts for up to 80 % and more of the total proteins. The quality of the casein in milk determines its coagulation by enzymes, the production of curds and especially of hard cheeses [12].

Milk is rich in elements, but mainly calcium and phosphorous. Milk contains proteins in an ash form, due to its alkaline and alkaline-earth metals. Minerals in milk are present in ionic and molecularly dispersed states, and are combined with vitamins, proteins, enzymes and hormones. The mineral content of milk is 0.6-0.85%. Minerals are divided into macronutrients and trace elements, depending on their content. Macronutrients are found in the ash: both cations (calcium, potassium, iron, sodium, magnesium, etc.) and anions (phosphorus, sulphur, chlorine, etc.). In milk they are found in the form of organic and inorganic salts, and some in a free state. In milk, there are medium and acid salts. Acidic salts and other factors determine the acidity of freshly milked milk. Phosphorus and other salts form colloidal solutions. Most of the salts are present in milk in ionic and molecular states. More than half of the macronutrients are calcium, phosphorus and potassium. Minerals characterize the nutritional value and stabilize the colloidal state of proteins. Milk contains all elements that ensure mineral metabolism, growth and development of the body[13].

Milk contains enzymes in its composition. These substances act like catalysts. A temperature of 70-80°C is considered critical for enzymes. Milk contains enzymes such as peroxidase, catalase, alkaline phosphatase, lipase, reductase, lysozyme etc. Peroxidase is synthesized by mammary gland cells and partially liberated from leukocytes. The enzyme is inactivated at about 80°C and is used in the dairy industry to control the effectiveness of pasteurisation of milk. Catalase catalyses the breakdown of hydrogen peroxide into water and molecular oxygen [14]. This enzyme is transferred to milk from mammary gland tissue and is also produced by the microflora of milk and by leucocytes. It is present in milk in small amounts. In mastitis, the content of catalase in milk increases. Alkaline phosphatase in an alkaline environment catalyses the hydrolysis reactions of orthophosphorus esters. This enzyme is sensitive to high temperatures. Heating of the milk at 63°C for 30 minutes and pasteurisation at 75-85°C completely destroyed alkaline phosphatase. High enzyme activity in an animal can indicate bone and liver disease, and in milk it indicates low sanitary quality (microbial origin of alkaline phosphatase). Lipase in milk is in native and bacterial form. It is involved in the reaction of fat hydrolysis to glycerol and fatty acids. This enzyme is relatively resistant to high temperatures. At the end of lactation lipase activity increases, this affects the quality of milk, it becomes rancid. Reductase is a by-product of a bacterium that can only enter the milk during its processing or extraction. It has the ability to bleach methylene blue. The more bacteria in the milk, the quicker the blue becomes discoloured. This is the method used to determine the degree of bacterial contamination of milk [15].

Milk contains a large amount of vitamins, they get into it from the feed eaten by animals or are synthesized by the microflora of the rumen. During heat treatment and storage of milk, the content of some vitamins changes. Of the fat-soluble vitamins, 100 g of milk contains vitamins (mg): A - 0.02-0.2; E - 0.06; D - 0.002; K - 0, 032, etc. The main source of vitamin A is the plant pigment carotene, so the content of vitamin A can be judged by the yellow color of milk. The more carotene and vitamin A it contains, the more intense the color of the milk will be. The amount of vitamin E is higher in the milk of cows fed green fodder than in the milk of cows fed dry fodder. This vitamin is stable and is not destroyed when milk is heated to 170°C for three hours. The main function of this vitamin is to protect polyunsaturated fatty acids, which are part of milk fat globules, from oxidation. In the body of animals and humans, vitamin D is formed from ergosterol, with ultraviolet irradiation. Milk obtained in summer contains 5-8 times more calciferol than milk obtained in winter. During the processing of milk, the destruction of the vitamin does not occur; with milk fat, it passes into dairy products. Vitamin K is essential for blood clotting and bone mineralization [16].

Materials and research methods. Dairy farming and milk production is one of the leading directions in the structure of the entire agro-industrial complex of Kazakhstan. Highly productive cows are the basis of profitable and competitive dairy farming. Domestic cattle breeding has a wide variety of breeds of dairy productivity, the genetic potential of which in terms of milk productivity exceeds 6000-8000 kg of milk, and taking into account their use in crossing with high-intensity breeds - up to 10000 kg [17]. In many areas of our country, the milk yield of breeding animals is kept at the level of 7000-9000 kg of milk.

In recent decades, to improve the breeding and productive qualities of domestic dairy breeds of cattle, frozen sperm of bulls-producers of the Holstein breed of highly developed countries - the USA, Canada, Germany, Denmark, Holland - has been used [18]. The work carried out, of course, increased the level of productivity of domestic herds. Taking into account the selection, all cows were divided into the following groups of cows: the first group of Kazakhstan - 25 heads, the second group of the USA - 25 heads and the third group of Holland - 25 heads. Based on this, the purpose of the research was to assess the qualitative composition of milk and its nutritional value obtained from cows of different selections.

Monitoring of milk quality indicators is carried out on the basis of the interstate standard GOST 31449-2013 “Raw cow's milk. Specifications” and the technical regulations of the customs union “On the safety of milk and dairy products” (TR TS 033/2013) [19]. In milk, the fat content (%) was determined by the Gerber acid method according to GOST R ISO 2446-2011 and protein (%) by the Kjeldahl method according to GOST 23327-98 and the formol titration method according to GOST 25179-90. The amount of milk fat, protein per lactation, and the milk yield index were calculated according to generally accepted formulas [19].

The results of the milk productivity of cows of the Holstein breed of domestic and foreign selection, obtained for the first three lactations, are shown in table 1.

Table 1 – Milk productivity and live weight of Holstein cows of different selection bred in the Kostanay region, % ***(X ± m x)***

Index	Selection		
	Kazakhstan	USA	Holland
1	2	3	4
1st lactation			
Number of cows	25	25	25
Milk yield, kg	7524±180	8568±179	7945±170
Fat content in milk, %	3.76±0.02	3.69±0.03	3.80±0.02
Yield of milk fat, kg	289.1±6.8	318.8±6.7	302.0±6.3
Protein content in milk, %	3.30±0.02	3.19±0.03	3.38±0.02
Milk protein yield, kg	255.0±6.0	287.0±5.8	278.5±5.4
Live weight, kg	553±2.4	582±3.0	560±2.7
Milk coefficient, kg	13.6±0.3	14.9±0.3	14.4±0.3
2nd lactation			

1	2	3	4
Number of cows	25	22	24
Milk yield, kg	7753±193	8904±202	3258±176
Fat content in milk, %	3.87±0.03	3.78±0.04	3.94±0.03
Yield of milk fat, kg	286.2±7.2	319.0±7.6	335.3±6.9
Protein content in milk, %	3.38±0.03	3.25±0.03	3.44±0.02
Milk protein yield, kg	268.7±6.3	292.9±6.5	284.1±5.8
Live weight, kg	569±1.6	581±2.2	573±1.8
Milk coefficient, kg	13.4±0.3	15.0±0.3	14.4±0.3
3rd lactation			
Number of cows	23	19	-
Milk yield, kg	7876±204	8817±215	-
Fat content in milk, %	4.00±0.02	3.88±0.03	-
Yield of milk fat, kg	321.0±7.8	356.0±8.3	-
Protein content in milk, %	3.36±0.02	3.22±0.03	-
Milk protein yield, kg	271.3±6.8	297.1±6.9	-
Live weight, kg	612±1.9	629±2.4	-
Milk coefficient, kg	12.7±0.3	14.2±0.3	-

According to the first lactation, the superiority in milk yield of daughters of Holstein bulls of the American selection was established, which amounted to 1044 kg (P> 1) in comparison with domestic Holsteins , and 623 kg (P < 9). Differences in milk yield between the heifers of the Dutch and domestic selections amounted to 421 kg in favor of foreign animals (P>10). In the second lactation, the differences in this indicator between the experimental groups of cows remained with the advantage of American Holsteins , which amounted to 1151 kg (P> 9) relative to domestic Holsteins and 4459 kg compared to their peers from Holland (P < 0.95). Comparing the data on milk yield of cows for the 3rd lactation, revealed a significant superiority of US Holsteins, which amounted to 941 kg (P> 0.999).

A complex indicator of milk productivity, characterizing the quantitative and qualitative aspects, is the yield of milk fat and protein per lactation. According to these parameters, no significant differences were found between cows of foreign selections, and only a tendency was observed for the superiority of US Holsteins in terms of the amount of milk fat, while in terms of protein yield, Dutch Holsteins . Ceteris paribus, both of them excelled over domestic Holsteins : in absolute fat yield - by 22.9-29.7 kg in the first lactation (P> 0.95-0.99), by 29.1-32, 8 kg in the second lactation (P>0.99); by the amount of milk protein - by 22.0-23.5 (P> 0.95-0.99) and 24.2-25.4 kg (P> 0.99).

The organoleptic characteristics of milk were evaluated, namely color, texture, taste and smell. According to GOST, the color of milk should be from white to light cream, the consistency is assessed by uniformity and the absence of sediment, the taste and smell should be clean, without impurities. The next stage of the milk examination was the assessment of physicochemical and microbiological parameters, the specified regulatory document regulates the following indicators: mass fraction of fat, protein and dry fat-free substances of milk, titratable acidity, density, freezing point, purity group, somatic cell content, as well as bacterial contamination of milk.

Table 2 – Organoleptic examination of milk samples

Name of indicator	GOST standard	Sample No. 1	Sample No. 2	Sample No. 3
1	2	3	4	5
Appearance and consistency	Homogeneous liquid, without any flakes or sediment	The consistency is liquid, homogeneous, without flakes, sludge or lumps of fat	The consistency is liquid, homogeneous, without flakes, sludge or lumps of fat	The consistency is liquid, homogeneous, without flakes, sludge or lumps of fat

1	2	3	4	5
Taste	Pure, with no no foreign flavours	Milk-like, with no without off-taste	Milk-like, with no without off-taste	Milk-like, with no without off-taste
Colour	White to light cream cream	White	White	White
Smell	Characteristic of milk, pleasant	The smell is characteristic of milk	The smell is characteristic of milk	The smell is characteristic of milk

Organoleptic characteristics of milk were studied in accordance with GOST 28283-2015 "Cow's milk. Method for organoleptic evaluation of taste and smell" and GOST R ISO 22935-2- 2011 "Milk and dairy products. Organoleptic analysis. part 2. Recommended methods for organoleptic evaluation" (table 2).

By analysing Table 1, it can be concluded that the appearance and consistency, taste, colour and smell of milk samples No. 1, 2, 3 were in accordance with GOST.

Table 3 – Physical and chemical properties and chemical compound milk

Name	No. samples	Casein, %	lactose, %	water, %	Dry thing, %	SOMO, %	pH
Holstein breed	1	2.57	4.46	87 .956	14.044 _ _	8.850	6, 71
	2	2.61	4.44	87 .966	14.034 _ _	8.840	6, 67
	3	2.59	4.45	87 .961	14.039 _ _	8.835	6, 69

When examining milk samples for the content of casein, lactose, water and dry substances, the following results were obtained: all these substances present in milk were within the normal range. Based on this, it is possible to make a reasonable conclusion about good quality milk.

In samples milk also studied microbiological indicators QMAFAnM, the presence of pathogenic microorganisms (Salmonella), also somatic cells [20]. It was found that the studied milk samples fully comply with the Uniform sanitary and epidemiological And hygienic requirements (tab. 4).

Table 4 – Microbiological indicators and the number of somatic cells in milk

Name	No. samples	QMAFAnM, CFU/g	Pathogenic microorganisms, incl. Salmonella	Somatic cells, thousand / cm^3	Bacteria of the Escherichia coli group
Holstein breed	1	$3, 9 \times 10^2$	Not discovered	115	Not discovered
	2	$3, 8 \times 10^3$	Not discovered	120	Not discovered
	3	$3, 85 \times 10^4$	Not discovered	125	Not discovered

The number of somatic cells in milk samples averaged 115, which complies with the maximum permissible standards and gives grounds for concluding that the the state of the mammary gland and the health of the cow in general. In 1 cm^3 milk received from healthy cows contained up to 5×10^5 somatic cells, and in milk with an admixture abnormal or received from milk yield sick animals – more 5×10^5.

In our time, many farms use antibiotics to stimulate the growth of animals and as therapeutic and prophylactic agents. Studies have been conducted to determine the residual amounts of antibiotics in milk, in particular, the tetracycline group, streptomycin, penicillin and chloramphenicol. Residual amounts of antibiotics were not found, which indicates that all animals treated with antibiotics undergo a course of rehabilitation and maturation after receiving drugs so that antibiotic residues do not get into the milk, since they affect the quality of the resulting milk raw materials (Table 5).

Table 5 – Presence of antibiotics in milk

Name	No. samples	antibiotics , mg / kg			
		Levomycetin	Tetracycline group	Streptomycin	Penicillin
Holstein breed	1	Not discovered	Not discovered	Not discovered	Not discovered
	2	Not discovered	Not discovered	Not discovered	Not discovered
	3	Not discovered	Not discovered	Not discovered	Not discovered

Neutralising agents such as soda and ammonia were identified in the raw milk (Table 6). In order to reduce the acidity in milk, baking soda, a lactic acid neutraliser, is added, which stops the development of putrefactive micro-organisms and promotes the destruction of vitamin C. Since such milk is not suitable for food, ammonia is added to kill the aflotoxins.

Table 6 – Neutralising substances in milk

Name	Sample number	Soda	Ammonia
Holstein breed	1	Not detected	Not detected
	2	Not detected	Not detected
	3	Not detected	Not detected

No neutralising agents (soda, ammonia) were detected in raw milk samples from all three groups according to laboratory tests.

Conclusion. An analysis of studies has shown that the quality of milk depends on a number of conditions, the most important of which is the genetic potential of animals. The breed affiliation of cows has a direct impact on the metabolic processes occurring in the body [4]. When examining milk samples for the content of casein, lactose, water and solids, the following results were obtained: all these substances present in milk were within the normal range.

The study of favorable and unfavorable environmental factors affecting the biosynthesis of milk components, as well as the development and implementation of zootechnical and veterinary measures will improve the quality of milk in industrial technology.

The introduction into force of the updated rules for the veterinary sanitary examination of milk and dairy products will strengthen the control of incoming dairy products on the shelves of stores and food markets, which means protecting people from the inevitable consequences of harm to health.

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ТҮЙІН

Қазақстанда мал шаруашылығы жалпы ауыл шаруашылығы өнімінің 43%-ға жуығын алады, ауыл тұрғындарын жұмыспен қамтудың, азық-түлік пен табыстың негізгі көзі болып, оны дамыту республиканың басты стратегиялық экономикалық міндеттерінің бірі болып табылады. Қазақстанда өндірілетін азық-түлік көлемінің шамамен 20%-ын құрайтын республиканың агроөнеркәсіп кешенінің жетекші саласы сүт өнеркәсібі болды және болып қала береді [1]. Халықты сапалы өніммен қамтамасыз ету мал шаруашылығын дамытумен тығыз байланысты, өз кезегінде сүт өнімдерімен қамтамасыз ету көп жағдайда сүтті мал шаруашылығының тиімділігіне, оның мүмкіндіктерін барынша толық пайдалануға байланысты. Бүгінгі таңда сүтті мал шаруашылығында басты міндет сиырдың өнімділігін арттыру, сонымен қатар сүттің сапасын жақсарту: майдың, ақуыздың және құрғақ заттың мөлшерін арттыру болып табылады [2]. Қазақстан Республикасында сүт өнеркәсібінің дамуы оң үрдіске ие болып отыр. Сүт өнімдерінің ассортименті кең ауқымда дамып, сапасы жағынан еуропалық стандарттарға жақын [3]. Қазақстанның ішкі нарығында жоғары технологиялық өндіріс желілерін пайдаланатын жаңа брендтер пайда болды, бұл тұтынушылар арасында өнім сапасы бойынша бәсекелестік артықшылықтарға ерекше сұраныстыдырады [4].

РЕЗЮМЕ

Животноводство Казахстана занимает около 43% от всей валовой продукции сельского хозяйства, является основным источником занятости, питания и доходов сельского населения и его развитие является одной из основных стратегических экономических задач республики. Ведущей отраслью агропромышленного комплекса республики, на долю которой приходится около 20% объема производимых в Казахстане продуктов питания всегда была и остается молочная отрасль [1]. Обеспечение населения качественными продуктами тесно связано с развитием животноводства, в свою очередь, обеспечение молочными продуктами в значительной степени зависит от эффективности ведения молочного скотоводства, наиболее полного использования его потенциала. На сегодняшний день главной задачей в молочном скотоводстве является повышение продуктивности коров, а также улучшение качества молока: увеличение количества жира, белка и сухих веществ [2]. Развитие молочной промышленности в Республике Казахстан имеет положительную тенденцию. Ассортимент молочной продукции широк и по качеству приближается к европейским стандартам [3]. На внутреннем рынке Казахстана появились новые бренды, использующие высокотехнологичные производственные линии, что вызывает у потребителей особый спрос на конкурентные преимущества по качеству продукции [4].

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