

UDC: [636.2.09:618.19-002:577.115]:637.06

MILK LIPIDS AND SUBCLINICAL MASTITIS

DOI: <https://doi.org/10.15673/fst.v15i2.2103>

Article history

Received 16.01.2021

Reviewed 18.03.2021

Revised 25.04.2021

Approved 08.06.2021

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Cite as Vancouver style citation

Danchuk V, Ushkalov V, Midyk S, Vygovska L, Danchuk O, Korniyenko V. Milk lipids and subclinical mastitis. Food science and technology. 2021;15(2):26-41. DOI: <https://doi.org/10.15673/fst.v15i2.2103>

Цитування згідно ДСТУ 8302:2015

Milk lipids and subclinical mastitis/ Danchuk V. et al // Food science and technology. 2021. Vol. 15, Issue 2. P. 26-41 DOI: <https://doi.org/10.15673/fst.v15i2.2103>

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Introduction. Formulation of the problem

The impact of milk and dairy products on human health is as complex as it is diverse [1]. It is believed that the introduction of milk and cheese production in early European nations helped reduce infant mortality and helped stimulate population growth [2]. Despite the difference in the composition of the secretion of the breast in different species of mammals, the main components of milk are common to all lactating organisms. Functionally distinguish between food and biologically active components of milk. The latter are growth factors, immune defense and cells

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Abstract. This article deals with the process of obtaining quality raw milk by analyzing its lipid composition. The lipid composition of raw milk depends on many factors, among which, first of all, is the species, the composition of the diet and the physiological state of the mammary gland. In recent years, a large amount of data has accumulated on the fluctuations of certain lipid parameters of milk depending on the type, age, lactation, diet, time of year, exercise, animal husbandry technology, physiological state of the lactating organism in general and the mammary gland in particular. Factors of regulation of fatty acid composition of raw milk: genetically determined parameters of quality and safety; fatty acid composition of the diet; synthesis of fatty acids by microorganisms of the digestive tract; synthesis of fatty acids in the mammary gland; physiological state of the mammary gland. The milk of each species of productive animals has its own specific lipid profile and is used in the formulation of certain dairy products to obtain the planned technological and nutritional parameters. Diagnosis of productive animals for subclinical mastitis involves the use of auxiliary (thermometry, thermography, electrical conductivity) and laboratory research methods: counting the number of somatic cells; use of specialized tests; microbiological studies of milk; biochemical studies of milk. The biochemical component in the diagnosis of subclinical forms of mastitis is underestimated. An increase in body temperature implies an increase in the intensity of heat release during the oxidation of substrates, sometimes due to a decrease in the intensity of synthesis of energy-intensive compounds. There are simply no other sources of energy in the body. The situation is the same with certain parts of the metabolism, which are aimed at the development of protective reactions to the etiological factor aimed at the defeat of the mammary gland. That is why the biochemical composition of mammary gland secretion in the absence of clinical signs of mastitis undergoes biochemical changes and the task of scientists is to develop mechanisms for clear tracking of such changes, identification of animals with subclinical forms of mastitis and effective treatment.

Key words: milk, lipids, subclinical mastitis, fatty acid composition.

(leukocytes, epithelial and stem cells, potentially probiotic bacteria) [3].

According to recent studies on the priorities of the population in choosing from the range of drinking milk in retail chains for consumption, the main criteria are clarified, from the most significant to the least significant: price, fat content, shelf life, labeling of milk (regular, organic, local) [4]. However, all these factors do not in any way relate to the safety indicators of product consumption [5-9], which must be guaranteed by the state. Therefore, the procurement and use of quality raw milk is the main guarantee in obtaining safe dairy products of high quality. With the manifestations of various breast diseases, more or less

everything is clear, milk from cows with clinical manifestations of breast diseases is not allowed for further use.

Milk is the first life-giving fluid that a newborn consumes, and it depends on its physical and chemical composition, whether the body will be able to adapt to autonomous existence or not. Man has long used raw milk to obtain various dairy products, setting different quality and safety criteria for its evaluation, and in the first place, obtaining raw materials from a clinically healthy animal. However, in production there is a question of getting into the processing of milk from animals with subclinical form of mastitis (no symptoms).

The aim of this review article is an analysis of lipid th composition of raw milk farm animal, its physiological, biochemical and technological significance and possible prognostic value content of individual fatty acids in mammary gland secretions in detecting subclinical mastitis in lactating organisms.

Analysis of recent research and publications

Lipid composition of raw milk of productive animals and dairy products, their physiological significance

The main milk components that affect human health are lipids, proteins (whey and casein), mineral elements (calcium, magnesium, sodium, phosphorus, etc.) and membrane components – milk fat globules. Dairy products are heterogeneous in content of these components, as well as in their physical structure. Thus, goat's milk contains a large amount of short-chain fatty acids, which facilitates digestion. Sheep's milk is characterized by a higher total content of solids, fat, protein and caseins, but also more minerals and vitamins compared to cow's and sheep's milk. The structures of micelles in goat's and sheep's milk differ in average diameter, hydration and mineralization from the structures of cow's milk [10].

Milk lipids are an extremely important component that provides the development of membrane ultrastructures of cells of growing organisms, the synthesis of biologically active substances and the production of large amounts of metabolic energy. In fact, due to its properties in milk, there are more than 400 different fatty acids [11]. They are present in milk: with an even and odd number of carbon atoms; cis - and trans - isomers; short -, medium - and long - chain; with a straight and branched chain; saturated, monounsaturated and polyunsaturated [12].

Lipids in mammary gland milk provide most of the energy for newborn and are important components in the development of growing cells. More than 200 fatty acids are found in mammary gland milk; however, many of them are present in very low concentrations, with others dominating, for example, oleic acid is 30-40 g / 100 g of fat in mammary gland milk. The synthesis of fatty acids de novo is approximately 17% of the total fat in mammary gland

milk [13]. Fatty acids are integral parts of cell membranes, can act as signaling molecules, modulators of the immune response and create a favorable microenvironment for the gastrointestinal microbiota [14]. Most research is to multiply polyunsaturated fatty acids (LCPUFA) and their metabolites, signaling pathways that regulate pain, light ting, thrombosis and vasoconstriction [15].

It is established that the milk of each species of productive animals has its own specific profile of fatty acid composition of milk, in particular, camel milk contains the lowest levels of C4:0–C12:0 and the highest levels of unsaturated fatty acids. Goat's milk is characterized by the highest level of C8:0–C14:0 fatty acids. Characteristic differences were also observed for yak and buffalo milk, which differed from cow's milk by a higher level of saturated fatty acids and a lower content of polyunsaturated fatty acids [16]. There are quite a number of factors that affect the fatty acid composition of raw milk (diet; seasonal fluctuations; technology of keeping animals; individual, breed and species characteristics; lactation; milk yield; exercise; physiological condition, etc.) [17, 18].

Nutritional guidelines generally encourage low intake of saturated fats, suggest consumption of ω -3 polyunsaturated fatty acids and avoid trans fats and partially hydrated fat (but not from ruminants) to strengthen the cardiovascular system [19].

Some researchers believe that the focus on the milk matrix (the product as a whole), rather than on individual nutrients contained in the dairy product, allows a more complete study of their impact on health and prevent some negative effects on milk and dairy products [20].

The behavior of lactating organisms, exercise, intensity and time of grazing, can also affect the quality of breast secretions [21]. Thus, a 6-kilometer walk (1.5 hours) of dairy cattle helps to reduce milk yield by 1 kg/milking, while their short-term transportation (10.5 km, 1 hour) does not significantly affect the amount of milk yield, although the fat content in milk in both cases underwent changes [22]. Despite the number of different manipulations with the diet of dairy animals to correct the fatty acid composition of milk and increase its biological value, lactating organisms always have a biological mechanism that ensures complete milk production regardless of most dietary manipulations, although the melting point of milk fat can vary [23]. At the same time, there is the concept of milk obtained from cows that were not fed silage - "Haymilk". This milk is most suitable for making cheese and is the result of seasonal feeding of animals with hay in winter and mainly green mass (summer) and its quality is regulated [24,25]. Feeding hay and fresh grass and green mass promotes an increase in the concentration of long-chain polyunsaturated fatty acids and a decrease in short- and medium-chain fatty acids in the milk of dairy cows [26,27].

Significantly different content of fatty acids with odd chains (C15:0, C17:0, C17:1) was reported in samples of milk and cheese from pastures of different botanical composition, which contributed to the development of protection mechanisms for the production of typical dairy products [28]. Lipids present in food can be oxidized or hydrolyzed, however, the oxidation of lipids in cheese is not significant, possibly due to its low redox potential (-250 mV) [29, 30].

Available lipolytic enzymes in cheese come from various sources: milk; rennet enzymes; microorganisms of different origin; exogenous lipase preparations. Cow's milk contains 10–20 nmol lipase / l, but yeast bacteria are a major factor in lipolysis, which occurs during maturation in most types of cheese made from pasteurized milk [30]. In the process of cheese production, microorganisms change the fatty acid composition of polar lipids, which has a positive effect on the prevention of thrombosis in humans [31]. It has been found that lipids from aged cheeses are better absorbed in the digestive tract than soft cheeses, and there is even some difference depending on the species origin of raw milk. Thus, lipids from fresh goat and aged cheeses were better absorbed than from fresh cow and soft cheeses [32]. The fatty acid composition of cheeses may change during storage. Thus, after 21 days of storage of smoked cheeses, there was a significant and constant decrease (up to the 69th day) in the proportion of fatty acids with an odd number of carbon atoms in the chain, with a branched chain and polyunsaturated fatty acids. The content of conjugated linoleic acids and the ratio of fatty acids n6 to n3 decreased (by 47% on the 69th day of storage) [33].

Galactomyces geotrichum is a natural microflora of dairy products and can be used to enrich food / cheese with omega-3 deficient lipids [34].

Lipids in milk have a concentration of 99 g/l in sheep's milk to 33 g/l in cow's milk [35]. The lipid composition of raw milk is not really homogeneous [36]. Researchers have identified about 514 substances of lipid nature, belonging to 15 classes, including: more than 60 varieties for the classes of phosphatidylcholine, phosphatidylinositol, phosphatidylserine and sphingomyelin; from 20 to 45 varieties for phosphatidylethanolamine, phosphatidic acid and lactosylceramide and 20 varieties for phosphatidylglycerol, lyso-phosphatidylcholine, lyso-phosphatidylethanolamine, glucosylceramide, plasmalogen and ganglioside [37].

The lipid part of cow's milk consists mainly of triglycerols (98%), diacylglycerols (2%), non-esterified and esterified cholesterol (<0.5%), phospholipids (1%) and free fatty acids (0.1%) [38]. In cattle milk, triacylglycerols also make up the largest proportion of milk lipids, including large amounts of esterified fatty acids. The five fatty acids (C10:0, C14:0, C16:0, C18:0

and C18:1) account for > 75% of the total in goat's and sheep's milk. Levels of short-chain and medium-chain fatty acids, kapron (C6:0) (2.9%, 2.4%, 1.6%), caprylic (C8:0) (2.6%, 2.7%, 1.3 %), capric (C10:0) (7.8%, 10.0%, 3.0%) and lauric (C12:0) (4.4%, 5.0%, 3.1%) are significantly higher in sheep and goats than in cow's milk, respectively [39, 10]. This actually explains the difference in the fatty acid composition of cheeses made from the milk of different species of productive animals [40].

The possibility of using the results of the study of the fatty acid composition of milk to create a prognostic model is quite problematic due to the influence of several significant factors: 1) the inability to adequately characterize the components of the diet by fatty acid composition; 2) low level of detection of certain fatty acids in milk; 3) the formation of different fatty acids of one peak on the chromatogram; 4) selective characterization of the fatty acid composition of milk only by the content of those acids that are present in milk fat in significant quantities [41]. The biological significance of milk fatty acids is presented in Fig. 1.

It is known that there are 2 main ways of synthesis of fatty acids of milk with an even number of carbon atoms in the chain. The first is saturated fatty acids from C4:0 to C 14:0 and about half of C16:0 is synthesized de novo in the mammary gland from short-chain acids. Acetate and butyric acid, in turn, are formed in the pancreas of ruminants and monogastric intestines by bacterial fermentation of dietary components. Secondly, the rest of C16: 0 and almost all long-chain fatty acids are extracted from dietary lipids, absorbed in the small intestine by lipolysis of triacylglycerols of adipose tissue [46]. The microsomal fraction of ruminant mammary gland tissue is able to convert stearate (C18:0) to oleic (C18:1) and palmitic (C16:0) to palmitoleic in (C16:1), but does not affect C14:0 or C12:0 acid.

Unlike monogastric mammals, rumen microorganisms are the largest microbial group in the digestive tract of ruminants, their biological activity provides the formation of a large number of short-chain fatty acids (acetate, butyrate, propionate) [47].

Of the five short-chain fatty acids (formic, acetic, propionic, butyric, valeric) in samples of human milk were detected only formic, acetic, butyric, whereas propionate and valerate were not detected in any and the samples [48].

Today, there are two main sources of medium-chain fatty acids in the diet - milk and coconut oil. The presence of these acids in the diets of animals has a positive effect on health, productivity, digestibility of dietary components, growth of muscle and adipose tissue, and they also have antibacterial, anticoccidial and antiviral effects [49,50].

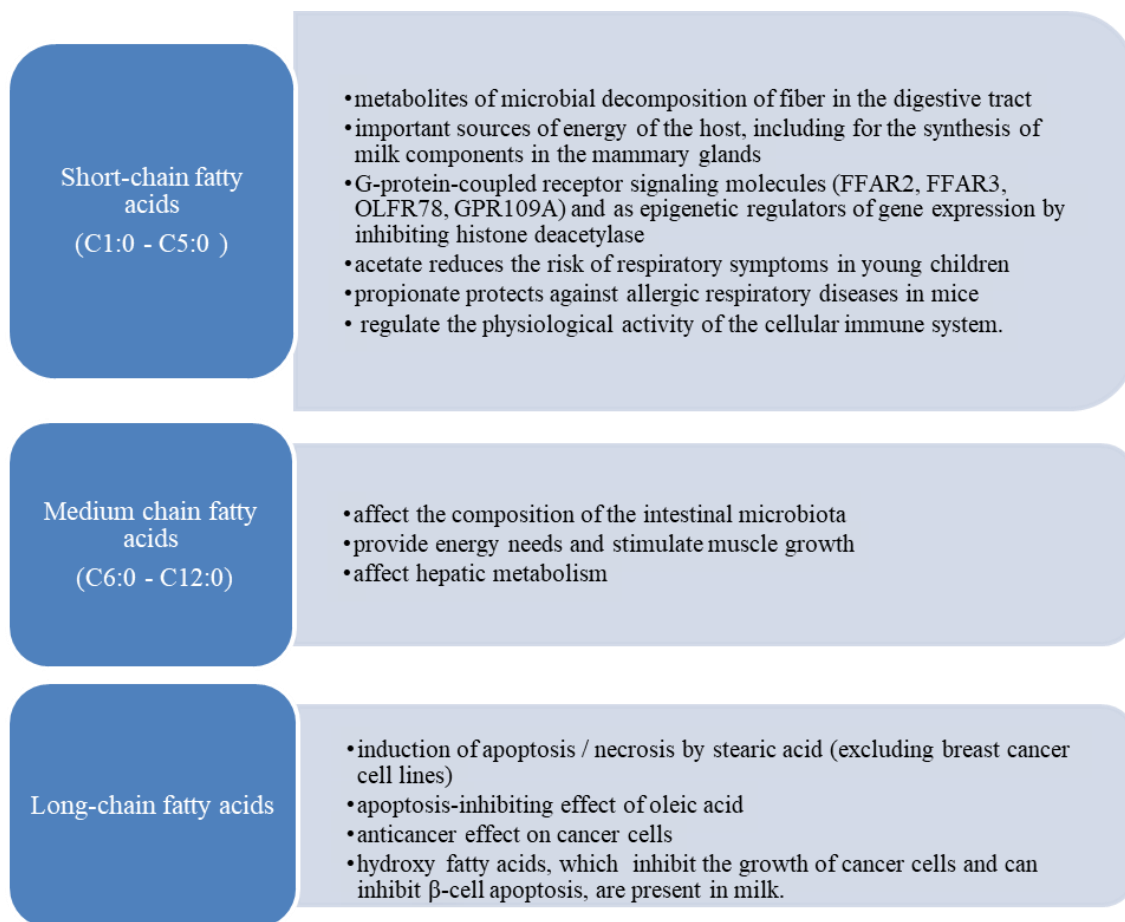


Fig. 1. Biological significance of milk fatty acids [42-45].

Medium- chain fatty acids of milk fat (caproic, C6:0; caprylic, C8:0; capric C10:0; lauric, C12:0), due to their relatively low molecular weight and size are more soluble in water and biological fluids than long-chain fatty acids, so they are better transported and able to regulate energy metabolism in humans and stimulate the growth of muscle tissue [51]. They can also improve intestinal development after the end of the suckling period of mammalian development [52]. Since the cells of the intestinal epithelium are the main place of absorption of nutrients, providing a sufficient level of medium- chain fatty acids significantly improves the growth and development of the body [42,53,54].

It is interesting to note that the addition of monoacylglycerols (C6 - C18) to the milk substitute in the diet has a beneficial effect on the health of calves and scar function, which reduces the need for antibiotic treatment [55]. A similar pattern is observed in meeting the needs of premature infants in short-chain and medium- chain fatty acids. Detected in the milk of their mothers, the content of these acids is much lower [56]. That is why medium-chain triacylglycerols are widely used in infant formulas to meet the needs of medium-chain fatty acids for infants with special requirements for fat absorption [57].

With a static model of digestion *in vitro* for newborn, consisting of the stomach and duodenum, studied and analyzed the release of some free fatty acids in human milk consumption as well and children's village in Misha. In the gastric phase of digestion, 4–11% of lipolysis occurred, and mainly short-chain fatty acids and medium -chain fatty acids were released. In the duodenal phase, lipolysis proceeded with the release of C4:0, but was characterized by rapid release of long-chain fatty acids [58].

Fatty acids with an odd number of carbon atoms and a branched chain in milk fat are largely of bacterial origin. In the milk of dairy cows, isomers of tetradecanoic (iso C14: 0), pentadecanoic (C15:0, iso C15:0 and anteiso C15:0), hexadecanoic acid (iso C16: 0) and heptadecanoic acid (C17:0, iso C17:0 and anteiso C17:0) are detected.

Thus, in camel's milk, eleven fatty acids with branched chains have been identified, which mainly belong to C15:0, anteiso -C15:0, anteiso -C17:0 and C17:0 [60].

The presence of the families of oxostearic acids (OSA) and oxopalmitic acids (OPA) in the milk of ruminants was revealed. 8OSA, 9OSA, 7OSA, 10OSA and 10OPA have been found to be the most common

SOFAs in cow's and goat's milk. Higher SOFAs were found in cow's milk compared to goat's milk [61].

About 70% of the lactic acid fatty acids in Swedish milk from dairy cows are saturated, of which about 11% consist of short-chain fatty acids, almost half of which are butyric acid. Approximately 25% of fatty acids in milk are monounsaturated and 2,3% are polyunsaturated with an omega-6 / omega-3 ratio of about 2,3. Approximately 2,7% are trans fatty acids [11]. Some fatty acids present in milk fat, such as butyric acid (C4:0), oleic acid, n-3 and n-6 polyunsaturated fatty acids, trans-vaccine acid (trans11 C18:1) and conjugated linoleic acid cis 9-trans 11 C18:2 potentially have a positive effect on human health [62]. Cis-9, trans-11 isomer is the main among the open isomers of conjugated linoleic acids of ruminant milk (80-90%). By changing the components of the diet, the ratio of isomers can be adjusted, for example, by increasing the percentage of trans-10, cis-12 acid [63].

In the case of dairy products (cheeses or fermented beverages) the level of conjugated linoleic acid is significantly affected not only by the composition of the diet of animals, the activity of the scar ecosystem and the physiological state of the mammary gland but also the conditions arising during transportation and manufacture of dairy products. features of production, activity of added yeasts, etc.) [64-66].

The stability of quality and safety of raw milk is of paramount importance for the dairy industry. Free fatty acids are mainly formed in dairy products by enzymatic cleavage of glycerols due to the action of lipases of various origins. The content of free fatty acids in milk is low, but may be significant in some dairy products. Free fatty acids, especially short-chain, have low taste thresholds and provide a characteristic taste of fermented dairy products, especially cheese [67,35]. Free fatty acids also affect the technological suitability of raw milk for processing, as they affect its surface tension and foaming ability [68].

However, elevated levels of C4:0 are also a cause of rancidity in milk and other dairy products. The bitter taste, as a rule, becomes unacceptable for the consumer [69]. It is also shown that the intensity of lipolysis in cheeses made from raw sheep's milk is influenced by both its lipid composition and the time of year (winter, spring and summer) [67].

As can be seen from Figure 2, genetically determined parameters of quality and safety of raw milk are key in its suitability for consumption and processing. Their characteristics significantly affect both the profitability of dairy production and the number of animals involved in ensuring its stability. Another key position in the regulation of the fatty acid composition of dairy cows is the fatty acid composition of feed and the intensity of synthesis [70-73].

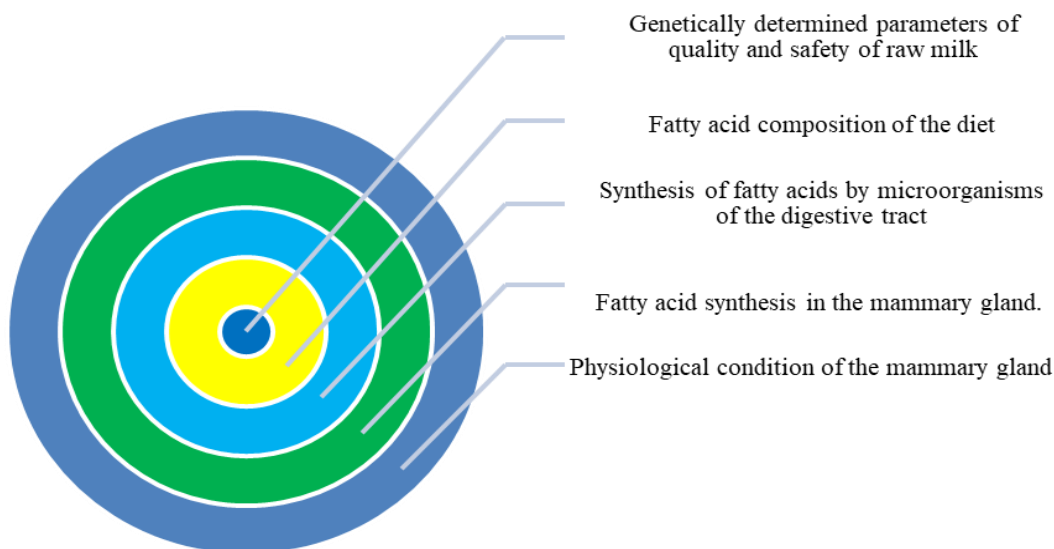


Fig. 2. Factors of regulation of fatty acid composition of raw milk

It should be noted that the high level of heredity of indicators is more characteristic of the content of lactose and protein in the milk of dairy cows, while moderate values were obtained for milk fat, saturated fatty acids and palmitic acid. Of course, these indicators also depend on the number of lactations, the day of lactation and the level of productivity of the animal [74]. On the other hand, at least for sheep of the Ukrainian mountain Carpathian breed, the fatty acid

composition of the obtained milk significantly depended on the zone of their grazing (lowland and foothill zones of the Transcarpathian region of Ukraine) [75]. Sheep respond more effectively than goats to grazing and changing the diet to correct the content of cis-9, trans-11 conjugated linoleic and α -linolenic acids in their milk [76].

The consumption of milk fat has recently been criticized for its high concentration of saturated fatty

acids, low content of monounsaturated and polyunsaturated fatty acids. Therefore, despite the relatively low level of genetic influence, some researchers are working to improve using breeding methods [77].

As for the presence of fatty acids from C6 to C12, it was found that they have a higher metabolic availability compared to long-chain fatty acids. In particular, C8:0 in hepatocytes is relatively rapidly oxidized to acetyl- CoA and assimilated into ketone bodies, intermediates of the citrate cycle [78].

Council Regulation (EC) No 1234/2007 of 1994 and Commission Regulation (EC) № 445/2007 establish standards for fatty oils, including functional fats and spreads. They determine fat by different categories: butter, margarine and blends. Greases that can be lubricated are standardized and classified by fat content and origin (dairy / non-dairy, vegetable / animal). Non-greasy fats are products with a fat content of at least 10% but less than 90% by weight, which remain solid at room temperature.

In order to determine the probable negative / positive impact of milk fat components on the

physiological state and human health, about 12 different indices have been developed and proposed for use, only there are four desaturation indices [17, 79-88].

Subclinical mastitis and lipid composition

Acute problem is mastitis in lactating animals, in particular cattle. In the development of these drugs, staphylococcus is one of the leading etiological factors, along with *Escherichia coli*, *Salmonella*, *Yersinia*, *Klebsiella*, *Proteus*, etc. [89]. Microorganisms that cause the development of the breast can be involved in lactating responsibility with food / food and, subsequently, come into contact with milk, among others - and antibiotic-resistant microorganisms [90, 91]. In production, there is a very high risk of costs in the total capacity of milk from animals with subclinical form of mastitis, which does not threaten the spread of dangerous microorganisms (Fig. 3). After all, neither the operator of the public hall, nor a specialist in veterinary medicine for external signs that can not determine the presence of this pathology. This can be done using various auxiliary methods [92].

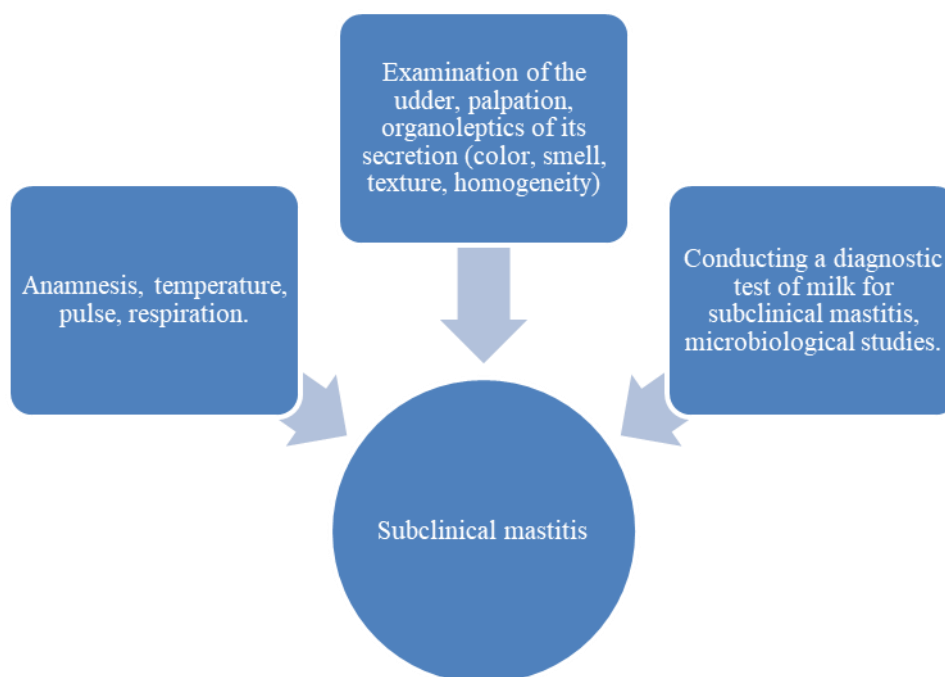


Fig. 3. Diagnosing subclinical mastitis

The Fig. 3 shows the main means of differential diagnosis of subclinical forms of mastitis. Moreover, for the final diagnosis of subclinical mastitis in a lactating organism, only laboratory diagnostic approaches with the use of specialized equipment and diagnostic tests can be used. Therefore, monitoring the possible emergence of farm animals subclinical mastitis is a form of claim ershocherhovyh tasks manufacturer [93].

There are several explanations for this. First, the detection of mastitis at an early stage significantly reduces the cost of treatment and prevention measures and allows to ensure a stable process of dairy

production. Therefore, studies of productive animals for subclinical mastitis should be performed at regular intervals. The situation is developing differently in different countries of the world. In this way, if in Finland there is an improvement, in India - vice versa. According to some authors, in recent years the incidence of mastitis in India has increased from 20% to 50% with a high prevalence in winter (36%), compared to other periods of the year (10-28%) [94]. In developed countries, systems for monitoring the health and accounting of milk from dairy herds have been developed [95].

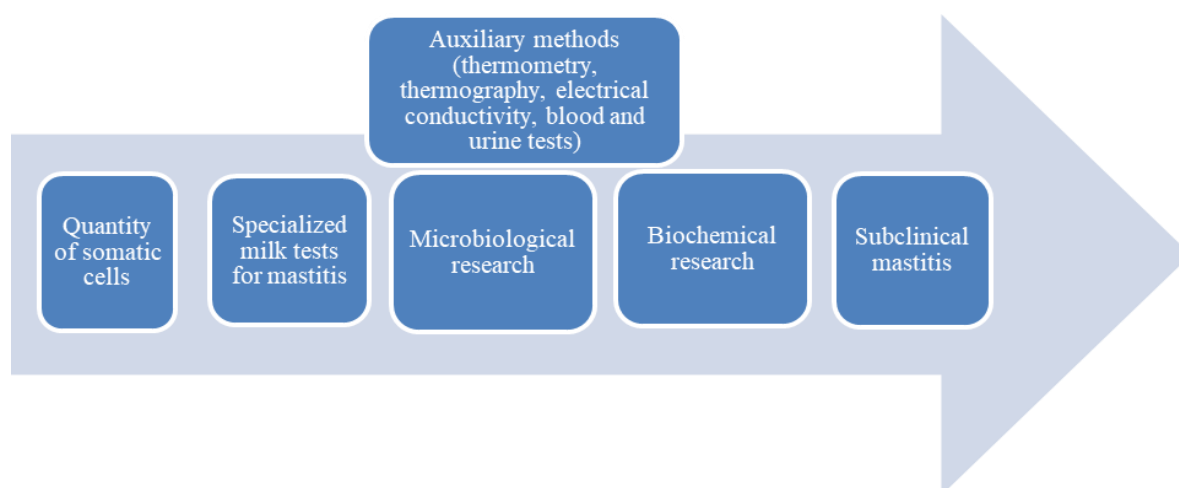


Fig. 4. Main and auxiliary factors of diagnosis of subclinical mastitis [99]

The prevalence of subclinical forms of mastitis in women of developed countries in the first month of lactation can reach 35.4% [96]. Moreover, this pathology may precede the manifestations of the classic symptoms of mastitis. However, the low incidence of clinical mastitis indicates that in most cases the immune response can reduce the likelihood of pathology in women [97]. Clinical forms of mastitis can lead to partial or complete loss of secretory activity with possible subsequent atrophy of the mammary gland.

There are several approaches to the principles of diagnosis of subclinical mastitis (Fig. 4). Some involve monitoring the number of somatic cells in milk [98], determining the conductivity and use specialized tests for mastitis, and others - rumen temperature measurement in real time using a swallowed biosensor [100] or infrared udder thermography [101]. There are also publications on the diagnosis of mastitis by urinary metabolites in lactating organisms [102], although in our opinion, with productive animals, this approach is somewhat more methodologically complex.

There are two main approaches to the study of mammary gland secretion for suitability for consumption. The first is, of course, microbiological, radiological and chemical studies, which close the question of the safety of product consumption [103].

The second is biochemical, which indicates potential changes in milk parameters during lactation with the mammary gland affected by the subclinical form of mastitis. In our opinion, the biochemical component in the diagnosis of subclinical forms of mastitis is somewhat underestimated. The fact is that inflammation of the mammary gland (except for the acute form) never occurs immediately. The clinical signs of the disease are preceded by gradual changes in the metabolic activity of the cells. Thus, an increase in temperature implies an increase in the intensity of heat release during the oxidation of substrates, sometimes

due to a decrease in the intensity of synthesis of energy-intensive compounds. There are simply no other sources of energy in the body. The situation is the same with certain parts of the metabolism, which are aimed at the development of protective reactions to the etiological factor aimed at the defeat of the mammary gland. In any case, it is the cost of energy and metabolites to trigger compensatory reactions and maintain homeostasis parameters. It is a cut is the secret of mammary gland cancer in the absence of cells. In such signs of mastitis course undergo biochemical changes. The aim of the scientists is to develop mechanisms for clear monitoring of such changes, identification of animals with subclinical forms of mastitis and effective treatment.

There are a large number of studies on changes in the composition of milk in subclinical mastitis (changes in protein composition; concentration of biologically active substances, cytokines, interleukins, lactose, fatty acids, calcium, phosphorus, potassium and others) [104-106].

The microbiological ecosystem in the udder of dairy cows directly affects the taste and quality of milk, however, in conditions of subclinical mastitis, it undergoes significant changes, which are also accompanied by some changes in the chemical composition of milk. Several typical metabolites were highly correlated with the quantitative content of specific bacteria in ruminants, such as *Streptococcaceae*, *Lachnospiraceae*, *Lactobacillaceae*, and *Corynebacteriaceae*, demonstrating functional correlations between the milk microbiome and related metabolites [107].

It has also been shown that antibiotic treatment of mastitis in cows can affect the chemical composition of milk [108]. As early as the 1980s, it was found that the fatty acid composition of milk from cows with mastitis can differ significantly from that in healthy animals [109].

Some researchers emphasize that mastitis in milk may increase the content of polyunsaturated fatty acids, mainly linoleic acid, and a change in the intensity of oxylipid synthesis in the direction of activation of the lipoxygenase pathway and cytochrome P450 [110].

Thus, in cows with mastitis caused by *Escherichia coli*, the lipid composition of milk changed only 48–72 hours after induction of mastitis. Concentrations of short-chain fatty acids began to change in the direction of increase after +6 days after induction of mastitis against the background of relatively stable values of C16: 0 and C18: 0 and a decrease in the content of long-chain unsaturated fatty acids [111].

It is the latent form of mastitis that causes huge economic losses to farmers. Subclinical mastitis is an asymptomatic, inflammatory condition of the lactating breast, it is characteristic of all mammalian species. Moreover, under conditions of subclinical mastitis, a decrease in the total content of fatty acids in milk (saturated, monounsaturated and polyunsaturated fatty acids) was found. However, the percentage of saturated fatty acids and monounsaturated fatty acids in the mammary gland secretion of sick animals was higher than in regular milk [112]. Due to the fact that the presence of subclinical mastitis in productive animals can be detected only with the use of special research methods, there is a risk that such milk can often be processed. Scientists have long set themselves the goal of developing integrated indicators of quality and safety of raw milk, which with a high probability can confirm or deny the probable course of the disease.

In recent years, the literature describes research on the development of prognostic models of mastitis [113–116].

Different systems are evaluated differently based on the number of somatic cells, features of amino acid metabolism [117], urinary metabolites (acylcarnitines,

phosphatidylcholines, amino acids and biogenic amines) [118], lactose concentrations in milk [119].

The use of fatty acid composition of raw milk for diagnostic purposes is quite promising, because the exclusion of the use of raw materials with altered fatty acid composition will not only potentially preserve the health of consumers, but also allow to obtain dairy products with predicted high quality.

Conclusion

The fatty acid composition of raw milk depends on many factors, among which are the following: genetically determined parameters of quality and safety of raw milk; fatty acid composition of the diet; synthesis of fatty acids by microorganisms of the digestive tract; synthesis of fatty acids in the breast; physiological condition of the animal in general, and the breast in particular. Therefore, if you comply with certain requirements for feeding, keeping and breeding lactating cows, you can ensure a stable supply of quality raw milk. However, subclinical mastitis in dairy animals, in addition to the fact that they are difficult to diagnose (only routine diagnostic activities), due to the defeat of the breast can change the composition of milk, including fatty acids. In order to prevent milk from animals with subclinical mastitis for further processing, it is proposed to determine its fatty acid composition, because the change in metabolic rate in mastitis affects the secretory activity of the gland and its secretion.

Thus, the lipid composition of raw milk and, in particular, the concentration of certain fatty acids is one of the determining factors indicating the dietary value of dairy products and may serve as one of the additional criteria for establishing the subclinical form of mastitis in productive animals.

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ЛІПІДИ МОЛОКА ТА СУБКЛІНІЧНИЙ МАСТИТ

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Анотація. Дана стаття стосується процесу одержання якісної молочної сировини за рахунок аналізування її ліпідного складу. Ліпідний склад молока-сировини залежить від багатьох факторів серед яких, в першу чергу, це видова приналежність, склад раціону та фізіологічний стан молочної залози. За останні роки накопичилася велика кількість даних стосовно коливання тих чи інших ліпідних показників молока залежно від виду, віку, періоду лактації, раціону, доби року, моціону, технології утримання тварин, фізіологічного стану лактуючого організму в цілому та стану молочної залози зокрема. Фактори регуляції жирнокислотного складу молока-сировини: генетично обумовлені параметри якості і безпеки; жирнокислотний склад раціону; синтез жирних кислот мікроорганізмами травного тракту; синтез жирних кислот у молочної залозі; фізіологічний стан молочної залози. Молоко кожного виду продуктивних тварин має свій специфічний ліпідний профіль та використовується в рецептурі визначених молочних продуктів для одержання запланованих технологічних та харчових параметрів. Постановка діагнозу у продуктивних тварин на субклінічний мастит передбачає використання допоміжних (термометрія, термографія, електропровідність) та лабораторних методів досліджень: підрахунок кількості соматичних клітин; використання спеціалізованих тестів; мікробіологічні дослідження молока; біохімічні дослідження молока. Біохімічна складова у діагностиці субклінічної форми маститу є недооцінена. Підвищення температури органу передбачає зростання інтенсивності виділення тепла під час окиснення субстратів, іноді за рахунок зниження інтенсивності синтезу енергоємних сполук. Інших джерел енергії в організмі просто не існує. Така сама ситуація і з окремими ланками метаболізму, які спрямовані на розвиток захисних реакцій на етіологічний фактор, що спрямований на ураження молочної залози. Саме через це біохімічний склад секрету молочної залози за умов відсутності клінічних ознак перебігу маститу зазнає біохімічних змін і завданням учених є розробити механізми чіткого відслідковування таких змін, ідентифікації тварин з субклінічною формою маститу та проведення ефективного лікування.

Ключові слова: молоко, ліпіди, субклінічний мастит, жирнокислотний склад.

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