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# STUDY OF NATURAL MILK ACCORDING TO THE VERTICAL ZONING OF GEORGIA AND ITS CHEMISM

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## ABSTRACT

The production of natural milk from cattle (cows) is traditional in Georgia. Milk is distinguished by biologically active substances. This is one of the most demanded food products. Milk has been produced in Georgia since time immemorial. The production of natural milk is currently declining globally, notwithstanding the fact that there are countries where the quality of milk naturalization is scrupulous (some regions of India, Austria, Switzerland, Latvia, Luxembourg, etc.). Natural pastures play crucial role in these countries. There are 12 landscapes in Georgia, and the country has natural meadows. Currently, recombined milk is widely represented in the Georgian market segment, having its own pros and cons. In Georgia, subspecies of cattle are mainly assimilated depending on the landscape (Mingrelian Red, Caucasian-brown, Swiss and Khevsur species). Considering the fact that indicators can change every year, the dairy products obtained from them are unique and correspond to both the modern international standard and the previous standard. The aim of this scientific research is total determination of indicators of mineral, biochemical microflora, microorganisms of natural milk obtained from cattle due to the result of the management (assimilation) of cattle genetics in Georgia and its identification with the limit of the range of the standard. Furthermore, selecting the desired technological mode. During the scientific study, which was held in an accredited laboratory, a laboratory analysis of milk obtained from all

subspecies (raw and boiled), as well as milk taken by us from the supermarket segment, was carried out, in which the main indicators were determined by quantitative method. The results are shown in the form of tables and diagrams. In the process of scientific research, we adopted the pasteurization method - immediate heating of milk to a temperature of 85-95°C without delay. The milk pasteurization method we use allows us to preserve the quality of milk naturalization, which includes the physiological value of milk and positive organoleptic indicators, which are very beneficial for human health. As a consequence of scientific research, it has been established that natural milk (raw and boiled) obtained from cattle in Georgia fully corresponds to the requirements for it and is preferable to milk taken from the marketing system.

**KEYWORDS:** Chemical indicators and composition of milk, assimilation of cattle, quantitative analysis of research, bacterial flora, milk quality.

## INTRODUCTION

The primary importance is awarded to food when it concerns to the material needs of society, therefore their production has been and will remain the core source of human existence. Milk occupies one of the main places among food products. Milk is used as a food product, either processed or unprocessed, or as a raw material in the industrial production of milk and food products. Milk has high nutritional and biological value. It is an invariable food product and contains a number of mineral and biochemical compounds.

Milk is a precious food product of biological origin, like other physiological fluids (blood, lymph, fluid cell). It is prone to constant changes under the influence of both internal (enzymes, etc.) and external factors. It is noteworthy that the microbiological processes ongoing in it, since milk and dairy products represents good soil for the reproduction and vital activity of microorganisms. The core indicators of milk as an object of technological processing are as follows: its composition, degree of purity, organoleptic, biochemical, physicochemical properties, along with the presence of toxic and neutralizing substances in it.

### Main body

Cow’s milk represents the main raw material for the production of dairy products in Georgia, as in many countries of the world. It contains more than 160 different components, including proteins, fats, carbohydrates, minerals, water, micro- and macro elements, vitamins, enzymes, hormones, amino acids, biologically active substances, gases and others. Their composition

depends on environmental factors, nutritional characteristics, nosology of the disease, and living conditions of the animals.

The average dry matter content in milk is 12.5%, water 87.5%. The individual components of milk are in strictly defined proportions. A violation of this ratio, resulting from animal diseases, microbiological processes in milk or other reasons, leads to protein coagulation, subsequently, milk loses many biological and technological traits.

Milk fat is of high quality in terms of biological and nutritional value. Among the known dietary fats, it stands out for its composition, with intense taste traits and good plasticity. This is a highly dispersed emulsion. This is a mixture of glycerides (esters of glycerol and fatty acids), in which triglycerides predominate, as well as mono- and diglycerides, free fatty acids, fat-soluble vitamins (A, D, E, carotenoids, cholesterol, etc.), it melts at low temperatures and is easily digestible. Fat in milk is exists in the form of fat globules (mature lipid droplets) with an average diameter of 2.5-3 microns, their size ranges from 0.5 to 10 microns. The density of milk fat is less than the density of water and other substances, so when milk is heated, fat globules rise upwards forming a creaming layer on top of the remaining skim milk.

In terms of their amino acid composition, milk proteins are among the main protein substances that are of vital importance in human nutrition; they contain all the essential amino acids and are relatively easily absorbed by the body.

There are three types of proteins in milk: casein, albumin, and globulin. In addition, some protein compounds are confronted, namely in the form of fat pad shell proteins and enzyme proteins. The total amount of protein is about 3.3%, including casein 2.7%, albumin 0.4% and globulin 0.1%. Albumin and globulin are soluble whey proteins and are therefore called whey proteins.

Milk sugar, that is, lactose, is occurring only in milk and is not found in any other product. It occurs in α and β forms. Cow's milk contains α-lactose. Form α is less soluble. In the intestine, lactose hydrolysis occurs slowly and does not cause intense fermentation. Milk intolerance, which occurs in some people, is reportedly caused by a deficiency in the body of the enzyme that decomposes galactose.

The sweet taste of milk depends on the lactose sugar essence in the milk, which, as a result of milk coagulation, partially remains in the whey, from which it is separated in various ways.

Milk is rich in minerals. It contains all the minerals that are necessary for the growth and development of the newborn's body. Calcium and phosphorus are of particular importance in the mineral composition of milk. Milk contains a significant content of citric acid. It is 0.2% in cow's milk. Most often it is found in the form of potassium and calcium salts, and some of it is in free form.

Milk contains water- and fat-soluble vitamins, the presence of which increases its biological and nutritional value. From the fat-soluble vitamins, A, D, E, K and others should be noted, as for the water-soluble vitamins - C, P, H, B vitamins are noteworthy. The content of vitamins in milk varies significantly depending on the time of year, characteristic of feeding, the breed of cattle and the period lactation. The content of vitamins in milk and dairy products is strongly influenced by its heat treatment.

Among the components of milk, enzymes that accelerate physiological processes in the animal's body should be noted. The classification of enzymes is based on the principle of their action. Enzymes that act upon proteins are called proteins, those that influence on sugars are called amylases, and those that act on fats are called lipases. The most important enzymes in milk are: lipase, catalase, phosphatase, reductase.

Density, viscosity, osmotic pressure, thermal properties and acidity are among the main indicators of the physicochemical properties of milk.

The viscosity of milk is mainly due to its protein component. The viscosity of milk is influenced by the following factors: duration of storage, temperature, acidity of milk, heat and mechanical treatment before taking a sample to determine viscosity, etc.

The acidity of milk is due to the presence of proteins, soluble salts and citric acid in it. The acidity of milk is expressed either by total acidity (titrate) or active acidity (concentration of hydrogen ions). The acidity of milk is one of the most important indicators of its quality. Acidity indicates the freshness of milk and should be taken into account when processing it.

The overall acidity of milk depends on the content of amphoteric proteins, acid salts and gases. The acidity of milk is expressed in Turner degrees (°T), which shows the amount of

0.1 N amount of alkali in milliliters spent on neutralizing 100 ml of milk with phenolphthalein.

The bactericidal nature of milk is due to the presence of protective substances in it, such as lactenins, lysociums, immune bodies, etc. Until such time as milk retains bactericidal properties, microbes almost do not develop in it and it does not spoil. This period is called the bactericidal stage.

Freshly milked and unrefrigerated milk retains these properties for 2-3 hours, and the fresher the milk and the lower its storage temperature, the longer the bactericidal phase.

Drinking milk is divided into pasteurized, boiled and sterilized milk based on temperature treatment. Another sign of the classification of drinking milk is its fat content. Normal, low-fat, low-fat and skimmed milk are known. When the normal fat content of drinking milk is 3.2%, it is called healthy milk. High fat content is 4.6%, low fat content is 2.5-1.5%. Sometimes drinking milk of certain types is divided according to the type of packaging and container: milk packaged in small containers and milk packaged in large containers. An essential feature of the classification of healthy milk is its division into normalized and recombined milk. The technological process for the production of drinking milk consists of the following operations: receiving and sorting milk, filtration, normalization, homogenization, pasteurization, cooling, bottling, capping, storage and transportation in the distribution network.

After receiving and weighing, the milk is passed through a milk purifier or filter to remove mechanical and other impurities. Dairy processing factories producing drinking milk generally normalize fat content.

In order to improve the consistency and taste of milk, milk is homogenized at a temperature of 12.5 ± 2.5 MPa. under pressure. Milk homogenization is a necessary operation in the production of drinking milk. Homogenization promotes uniformity in drinking dairy products and prevents fat loss.

The milk pasteurization regime should ensure the destruction of non-spore forms of microorganisms in milk by 99.5-99.9%. Among them there is a carrier of the disease. Depending on the temperature and heat treatment, there are three methods of milk pasteurization: 1. instant - heating milk to a temperature of 85-95°C without heat treatment.

2. Short-term – heating to 71–76°C with a delay of 20–30 seconds. 3. Long-term heating to 63-65°C with a heat treatment of 30 minutes.

After pasteurization, the milk is immediately cooled to a temperature of 4–6°C. Storage of pasteurized milk before packaging is allowed for no more than 6 hours. Finished products are stored in a special storage tanks, where the temperature is from 0 to 8°C, relative humidity is 85-90%.

Boiled milk is prepared in accordance with the general technological scheme of pasteurized drinking milk, in which only the heat treatment mode of the normalized mixture changes. Boiled milk has a fat content of 4% and 6%. During the fermentation process, part of the water evaporates from the normalized mixture and, accordingly, the dry matter content, including fat, increases. Therefore, when preparing the mixture, this feature is taken into account, and the mass fraction of fat should be 3.9 and 5.8%. After fermentation, the fat content in the mixture increases from 4.05% to 6.05%, which ensures to obtain standard product. After filtration, homogenization and pasteurization of the normalized mixture (at a temperature of 95-99°C), the milk is placed in a closed vessel. The milk is stirred periodically to avoid forming a layer of fat and protein membrane on the surface of the milk. After the heat treatment, the milk is cooled in the same vessel up to 40°C, then to 4-6°C. After this, the product is packaged in small containers.

There are 12 landscapes established in Georgia. It is broadly known that, milk and dairy products are produced in all over the place. Vertical zones are presented in our country as follows: humid subtropical, subtropical, continental, subcontinental. Cattle breeds are assimilated in these vertical zones and are presented in the form of subspecies (three subspecies - Mingrelian Red, brown Caucasian, Swiss and Khevsur species).

## MATERIAL AND METHODS

The purpose of this scientific study is total determination of indicators such as minerals, biochemical microflora, microorganisms of natural milk obtained from cattle due to the result of the management (assimilation) of cattle genetics in Georgia and its identification with the limit of the range of the standard. Furthermore, selecting the desired technological mode.

In the process of research work under the supervision of a veterinarian, ten heads of cattle (cows) of each subspecies were selected in different regions of Georgia: Mingrelian Red

(Guria, Samegrelo), brown Caucasian (Samtskhe-Javakheti), Swiss (Imeretian plateau), Khevsur species (upper and lower Khevsureti - Barisakho). Milk samples from the listed subspecies of cattle were taken in spring and late autumn for the purpose of laboratory analysis and selection of the desired technological regime.

During the research work in an accredited laboratory, a quantitative analysis of milk obtained from all subspecies (raw and boiled), as well as milk taken by us from the supermarket segment, was carried out, the results of which are presented in the form of tables and diagrams.

In the process of scientific research, we selected the pasteurization method – instant heating of milk to a temperature of 85-95°C without heat treatment.

## 3. RESULTS AND ITS DISCUSSION

**Table 1: Raw milk.**

| Cattle species | Counting of microorganisms 30°C | | |
|---|---|---|---|
| | Result | Dimensions | Method |
| Mingrelian Red | 1,2×10*6 | pfu/mL | GS ISO 4833-1:2013/2015 |
| Brown Caucasian | 3,6×10*6 | pfu/mL | GS ISO 4833-1:2013/2015 |
| Swiss | 2,2×10*5 | pfu/mL | GS ISO 4833-1:2013/2015 |
| Khevsur | 2×10*5 | pfu/mL | GS ISO 4833-1:2013/2015 |

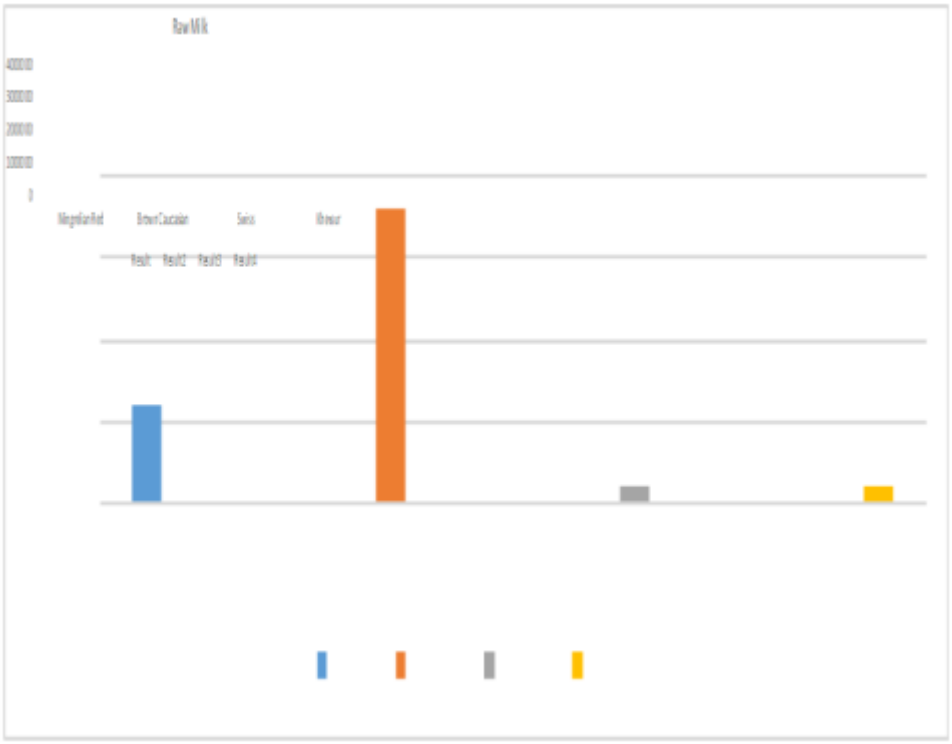


**Diagram 1: Raw milk.**

**Table 2: Boiled milk.**

| Cattle Species | Counting of microorganisms 30°C | | |
|---|---|---|---|
| | Result | Dimensions | Method |
| Mingrelian Red | 1,9×10*2 | pfu/mL | GS ISO 4833-1:2013/2015 |
| Brown Caucasian | 1,1×10*3 | pfu/mL | GS ISO 4833-1:2013/2015 |
| Swiss | 3×10*3 | pfu/mL | GS ISO 4833-1:2013/2015 |
| Khevsur | 7,5×10*2 | pfu/mL | GS ISO 4833-1:2013/2015 |

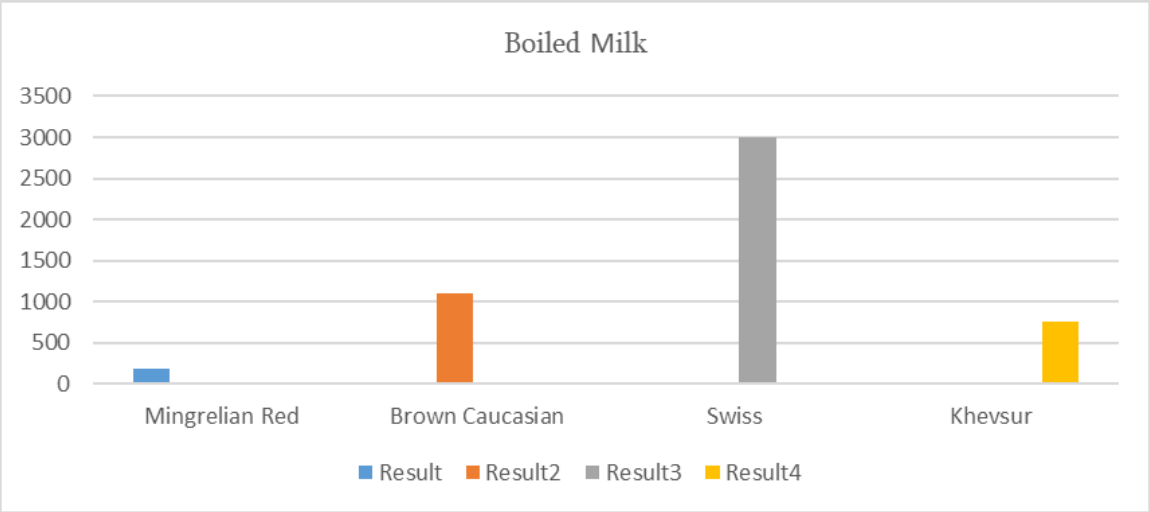


**Diagram 2: Boiled milk.**

**Table 3: Pasteurized milk.**

| Milk | Counting of microorganisms 30°C | | |
|---|---|---|---|
| | Result | Result | Result |
| Pasteurized supermarket milk N 5 | 9,5×10*4 | pfu/mL | GS ISO 4833-1:2013/2015 |
| Ultra-pasteurized supermarket milk N 6 | It was not revealed | pfu/mL | GS ISO 4833-1:2013/2015 |
| Pasteurized supermarket milk N7 | 1,1×10*5 | pfu/mL | GS ISO 4833-1:2013/2015 |
| Pasteurized supermarket milk N 8 | 1,3×10*5 | pfu/mL | GS ISO 4833-1:2013/2015 |

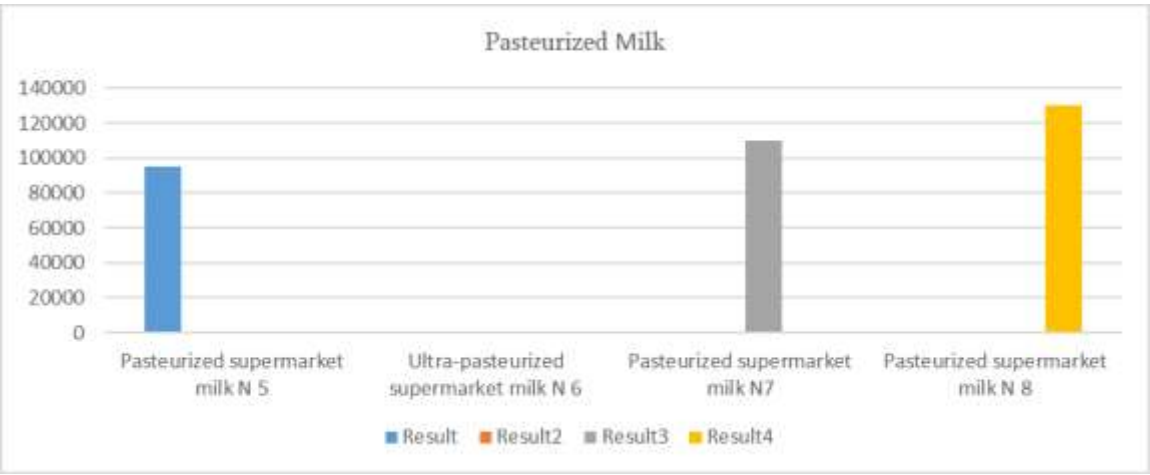


**Diagram 3: Pasteurized milk.**

During the research process, milk obtained from assimilated cattle (three subspecies, one breed), together with milk samples taken by us from the marketing system, were tested by research laboratory analysis, as a result of the study it was established that the examined Natural raw milk belongs to mainly to second quality milk, which is satisfactory. As regards boiled natural milk, it refers mainly to milk of the first and second quality.

The milk pasteurization method we use allows us to preserve the quality of milk naturalization, which includes the physiological value of milk and positive organoleptic indicators, the aforesaid are very beneficial for human health.

## 4. CONCLUSION

As a consequence of scientific research, it has been confirmed that natural raw and boiled milk obtained from cattle in Georgia fully complies with established requirements and is preferable in comparison to milk taken from the marketing system.

After processing, natural milk is better from the perspective of mineral, biochemical and organoleptic indicators, since its natural properties are less disrupted as a result of technological processing.

According to the vertical zonation, the chemical composition of milk in spring and winter changes slightly, and this fact depends on natural conditions.

The selected pasteurization method preserves the quality of naturalization of milk, which has a positive effect on the quality of milk and dairy products.

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