Quality and cheese suitability of milk depending on the breed in the conditions of the Voronezh region

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Abstract. The article presents the analysis of the quality, technological properties of milk and its cheese suitability. The object of research was milk-raw materials obtained from the following breeds of cattle-red and white, Holstein and Simmental. The choice of cattle breeds is not accidental, as the animals of these breeds are mainly used for the production of raw milk in the Voronezh region. During the determination of the quality of milk organoleptic (taste, smell, color and consistency), physical (acidity, density) indicators and chemical (mass fraction of fat, protein, lactose, dry matter, skimmed milk solids), technological (thermal stability of the alcoholic sample, rennet coagulability) properties were determined.

1. Introduction

In the dairy industry, especially in the production of cheese, it is very important to obtain raw milk in a sufficient quantity and quality. To date, the main regulatory documents governing the quality of raw milk is GOST 31449-2013 “Raw cow's milk. Technical Conditions” and TR TS 033/2013 Technical Regulation of the Customs Union “On the Safety of Milk and Dairy Products” (as amended on December 20, 2017) (as amended since July 15, 2018). For raw milk used in the production of cheeses, the highest and specific requirements are imposed on the physicochemical properties of milk, its microbiological state and chemical composition. [3, 4, 5]

In accordance with GOST 31449-2013 “Raw cow's milk. Specifications” and TR TS 033/2013 “On the safety of milk and dairy products” in raw milk intended for the production of cheeses determine organoleptic (consistency, taste and smell, color), physico-chemical and microbiological parameters (mass fraction of fat, protein, dry skim milk substances, acidity, purity group, density, freezing point, somatic cell content, the number of mesophilic aerobic and facultative anaerobic microorganisms).

The properties of milk as a single physical and chemical system are determined by the properties of the components contained in it. Therefore, any changes in the content and condition of the components of milk must be accompanied by changes in its physical and chemical properties.

The components of milk differently affect the physical and chemical parameters of milk. Numerous studies have found that each breed has a specific, only her peculiar metabolism, which has a genetic determination. [6]
As an explanation of the breed differences of the individual components of milk, the authors give the idea of the dependence of the synthesis of its constituent components with the intensity of metabolism, which naturally differs in each of the breeds. [7, 8]

It is necessary to note that the quality indicators of milk vary even in cows of the same breed, the same age and physiological state, contained in the same conditions and on the same diet. All this is explained by the so-called individual characteristics of the animal. According to this specificity, the acidity of the milk of such cows can range from 14°T to 22°T, the percentage of fat from 2.5 % to 5 %, protein from 2% to 4 %. Corresponding differences are observed in the properties of proteins, fat, technological characteristics of milk [9, 10].

The main technological properties of milk include thermal stability and rennet coagulation.

Milk obtained from healthy animals has thermal stability (thermostability) - the ability to maintain its original properties at high temperatures. It is resistant to heating to 100 ° C for several tens of minutes. At higher temperatures and prolonged exposure, its proteins can coagulate. The duration of heating at 130 ° C until coagulation of proteins in various milk samples ranges from 2 to 60 minutes and above.

Rennet coagulability of milk is the ability of its proteins to coagulate under the influence of introduced rennet with the formation of a relatively dense clot. The duration of coagulation of milk is fluctuating widely. Thus, under standard conditions for rennet, the clotting time can be 10-35 minutes. Sometimes milk coagulates very slowly under the action of rennet or does not coagulate at all. Such milk is called rennet-lethargic. [7, 10]

The level of milk productivity and milk composition are determined by many factors that, by their influence, can be combined into two main groups: external and internal. External factors are determined by the influence of the environment, internal factors by genetic data and physical condition. [11, 12]

As of 01.01.2018, 112.27 thousand cattle were procured in all categories of farms in the Voronezh region. cattle, including 64.28 thousand cattle cows (table. 1).

Table 1. Number of breeds of cattle bred in the territory of the Voronezh region

| Breed                  | total number of cattle | thousands of cattle | percents | thousands of cows | percents |
|------------------------|------------------------|---------------------|----------|------------------|----------|
| Brown shvitskaya       | 2.62                   | 2.33                | 2        | 3.02             |
| Holstein               | 27.33                  | 24.34               | 18.25    | 27.53            |
| Jersey                 | 5.62                   | 5.01                | 3.41     | 5.14             |
| Red-motley             | 53.88                  | 47.99               | 29.79    | 44.95            |
| Montbeliard            | 6.12                   | 5.45                | 4.05     | 6.11             |
| Simmental              | 10.64                  | 9.48                | 6.2      | 9.35             |
| Black and White        | 6.06                   | 5.40                | 2.58     | 3.89             |
| Total                  | 112.27                 | 100                 | 66.28    | 100              |

The cattle of the following breeds are predominantly bred in the farms of the region - Brown Schwyz, Holstein, Jersey, Red-motley, Montbeliard, Simmental, black-motley. In terms of numbers the leading cattle breeds are Red-motley - total cattle 53.88 thousand cattle, including 29.79 thousand cattle cows, Holstein - 27.33 thousand cattle total cattle, including the number of cows 18.25 thousand animals and Simmental total cattle 10.64 thousand animals, including cows 6.20 thousand animals [13].
2. Problem statement
To assess the quality, to study the technological properties of milk and its cheese suitability of Red-mottley, Holstein and Simmental breeds of cattle. On the basis of the received data on quality of milk and its technological properties are used to prove efficiency of use of milk-raw materials in production of cheeses.

3. Materials and methods
On the basis of the above mentioned aspects in the work in determining the quality of raw milk were determined not only the indicators regulated by GOST 31449-2013 “Raw cow's milk. Technical Conditions” and TR CU 033/2013 “On the Safety of Milk and Dairy Products”, but indicators characterizing the suitability of milk were investigated.

Raw milk of Holstein, red-mottley and Simmental breeds of cattle bred in the Voronezh region was used for evaluation. Studies of milk quality indicators and technological properties were carried out in the laboratory of the “Voronezh State Agricultural University after Emperor Peter the Great”

4. Results and discussion
The analysis of the quality and technological properties of milk of cows depending on the breed are presented respectively in tables 2, 3 and figures 1.

## Table 2. Organoleptic and physical parameters of milk

| Name of the indicator                  | Cattle Breed       |
|---------------------------------------|--------------------|
|                                       | Red-mottled | Holstein | Simmental |
| Consistency                           | homogeneous liquid without sediment and flakes |
| The smell and taste                   | are clean, without extraneous odors and tastes not characteristic of fresh milk |
| Color                                 | white       | white    | white with a light yellow tint |
| Density, kg / cm³                     | 1029.5      | 1029.4   | 1029.7     |
| Acidity, °T                           | 17.7        | 17.4     | 17.1       |

![Figure 1. Diagram of chemical parameters of milk](image-url)
The analysis of the results showed that the cows of Simmental breed in terms of the chemical composition of milk prevail over animals of the red-motley and Holstein cattle breeds in: mass fraction of fat by 0.01-0.02% mass fraction of protein by 0.03% SOMO, by 0.05-0.08% CB, by 0.08-0.17%.

It is also worth noting that if we compare the chemical composition of milk of animals of red-motley and Holstein breeds then we see the dominance of the first over the second in terms of: mass fraction of fat by 0.01% SOMO, by 0.05% CB, by 0.09%

According to organoleptic indicators milk does not have significant differences.

### Table 3. Technological properties of milk

| Name of the indicator                | Cattle Breed          |
|--------------------------------------|-----------------------|
|                                      | Red-mottled | Holstein | Simmental |
| Heat resistance, not lower (by alcoholic test) | II          | II       | II        |
| Rennet coagulation, min              | 25          | 28       | 26        |

As a result of determining the technological properties of milk the following was revealed: thermal stability is not lower than group II. i.e. milk has the ability at high temperatures to maintain the initial properties in animals of all the above listed cattle breeds; rennet coagulability of milk in animals by duration in minutes is 25 in cows of red-motley breed. 28 in animals of Holstein breed and 26 in animals of Simmental breed. Thus we can single out the animals of the red-motley breed in the first place followed by the animals of the Simmental breed and in the third place the Holstein cattle. It is worth noting that this process is most important in the manufacture of cheese. The consistency pattern appearance and other indicators of cheese depend on the speed of formation structural-mechanical and synergistic properties of rennet clot.

### 5. Conclusion

Our studies of the cheese suitability of milk of the main dairy breeds of cows bred in the Voronezh region argued the production necessity of using Simmental and red-motley cattle breeds since the raw milk obtained from these cattle breeds is more suitable for the production of cheeses.

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