EVALUATION OF THE QUALITY OF FRESH MILK SOLD IN THE MUNICIPALITY OF VALENÇA DO PIAUÍ

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ABSTRACT

Decree-Law No. 923/1969 provides for the prohibition of the sale of raw milk directly to the consumer. Since it is a very common practice for many municipalities to sell raw milk without the proper standards of production, hygiene and transport in Brazil, especially in the Northeast. The present study was conducted with the objective of evaluating the quality of fresh milk sold in the municipality of Valença do Piauí-PI, highlighting the physicochemical parameters of milk, the nutritional components of fresh milk and comparing the data obtained with the values established in MAPA Normative Instruction No. 76/2018. The contents of fat, protein, lactose, defatted dry extract, freezing point and pH were evaluated using the Ekomilk® ultrasonic analyzer. From the analyzes carried out, it was found that the samples of fresh milk did not reach the standards required by MAPA IN No. 76/2018 in at least one of the parameters studied.

Keywords: Legislation. Food. Hygiene.

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INTRODUCTION

The consumption of dairy products by humanity dates back more than 8,000 years, and is currently part of the nutritional diet of several countries, also because it is a food very rich in phosphorus, potassium, calcium and proteins (ROZENBERG et al., 2016).

The dairy chain in Brazil stands out for being one of the most economically productive activities, generating labor in almost all municipalities, employed by approximately one million rural producers directly in the field, as well as in other sectors of the chain (ROCHA; OAK; RESENDE, 2020).

Brazil is one of the five largest milk producers in the world with a production of 35 billion liters of milk in 2022, largely due to its diversified production system that covers almost the entire country (LEITE & STOCK, 2023). In the last twenty years, the activity has undergone significant changes with the increase in milk production due to the implementation of new technologies, which have provided an increase in productivity with the same amount of milked sows (ROCHA; OAK; RESENDE, 2020).

In terms of trade balance, in the past decade Brazil imported an average of 160 thousand tons of dairy products per year and exported just over 45 thousand tons per year, where dairy reached the second position of most exported products in the period (LEITE & STOCK, 2023).

Raw milk is conceptualized as a product originating from uninterrupted and complete milking, with ideal conditions of hygiene, healthy and well-managed sows in terms of food and well-being (BRASIL, 2011). It must also have a homogeneous opalescent white color and a characteristic smell, in addition to not showing substances that differ from its original composition, residues of veterinary drugs and other contaminants (BRASIL, 2018).

Cow's milk, on average, has approximately 87% water, 13% total dry extract or total solids, 4 to 5% lactose, 3% proteins, 3 to 4% lipids and 0.9% minerals in its composition (TRONCO, 2010).

Due to the high perishability of milk and also because it is a food of great nutritional importance, it is essential that the minimum standards of milk quality control from milking to the final consumer are preserved (SPADETTO et al, 2021).

The Staphylococcus aureus *bacterium* found in milk comes from tissues of the digestive tract and can cause mastitis due to infection in the cow's teat, and can proliferate in milk and its derivatives as a contaminant due to the lack of refrigeration (SALVADOR et al, 2012), indicating serious public health risks due to food poisoning generated by the production of enterotoxins (BORGES et al, 2008).

The commercialization of fresh milk commonly occurs in small cities directly to the consumer, where the production does not reach the dairy industries, and the origin of the management is not attested by the competent authorities, which can cause risks to the health of consumers (SILVA, 2021). The lack of care with the quality of milk, such as food management and cow welfare, hygiene, milking, storage and transportation are historically neglected aspects, often due to the lack of financial resources of milk producers in the municipality of Valença do Piauí.

Over the decades, several legislations have been created and applied to standardize the quality of milk from production, processing, and transportation, through strict quality control and inspection (MÜLLER et al, 2023). The Brazilian legislation for the control of the quality of fresh milk is regulated by the Ministry of Agriculture, Livestock and Supply (MAPA) through MAPA Normative Instruction No. 62, of December 29, 2011, which technically regulates the production, identity and quality of type A milk, refrigerated raw, pasteurized, collection and bulk transportation of raw milk (BRASIL, 2011); MAPA Normative Instruction No. 76, of November 26, 2018, which regulates the identity and characteristics of refrigerated, pasteurized and type A raw milk (BRASIL, 2018a); and MAPA Normative Instruction No. 77, of November 2018, which establishes criteria and procedures for the production, packaging, conservation, transportation, selection, and reception of raw milk in establishments registered with the inspection service (BRASIL, 2018b).

Until the beginning of the 1950s, there was no defined legislation on the production of fresh milk and its derivatives. However, a few years later, Decree No. 30,691, of March 29, 1952, was published, which approved the new Technical Regulation for Industrial and Sanitary Inspection of Products of Animal Origin (BRASIL, 1952) and more than a decade later, Decree-Law No. 923, of October 10, 1969, which provides for the commercialization, prohibiting the sale of raw milk directly to the consumer (BRASIL, 1969). Since it is a very common practice for many Brazilian municipalities, especially in the Northeast, to sell raw milk without the proper production, hygiene and transportation standards. And in the local context, what is the quality of fresh milk sold in the municipality of Valença do Piauí-PI?

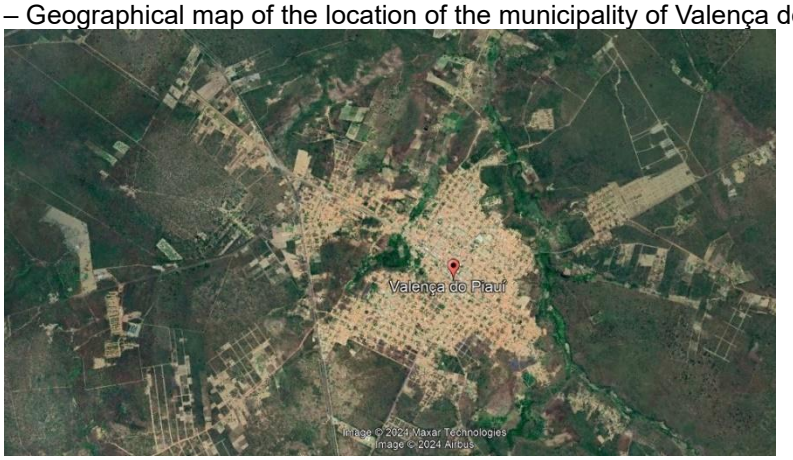
The present study was conducted with the general objective of evaluating the quality of fresh milk sold in the municipality of Valença do Piauí-PI, highlighting the physicochemical parameters of the milk; the nutritional components of fresh milk; comparing the data obtained with the values established in MAPA Normative Instruction No. 76/2018. Since there are still producers who do not carry out basic hygiene and health controls from milking to the transport of raw milk.

METHODOLOGY

FIELD OF STUDY

The municipality of Valença do Piauí is located in the Center-North mesoregion of Piauí and the Valença do Piauí microregion (IBGE, 2022, Figure 1). It is geographically characterized by having an area of 1,333.752 km²; density of 15.23 inhabitants/km². It is located at latitude 06º24'02" south and longitude 41º44'55" west. Its estimated population in 2021 is 20,940 inhabitants; semi-arid climate; UTC – 3 time zone (IBGE, 2022).

Figure 1 – Geographical map of the location of the municipality of Valença do Piauí.



Fonte: Google Earth (2023).

METHODOLOGICAL PROCEDURES

In the municipality of Valença do Piauí, 3 of the 4 main producers of fresh milk were chosen, due to the difficulty of access in the collection of samples for analysis of the latter. The producers were previously visited to organize the procedures for the collections. Producer A had 11 lactating animals at the time of collection, the animals of the herd are Gir/Holstein crossbreds and received concentrated feeding consisting of soybean meal and corn in the trough, not knowing the quantity, before milking and graze an area of brachiaria grass pasture. Property B also works with crossbred Gir/Holstein animals, at the time it had 10 lactating animals, where it supplied concentrate daily in the early morning and late afternoon a quantity of 4 kilos per animal; The animals grazed an area composed of pastures of Mombasa grass, canarana grass and native pasture. Producer C had only 3 lactating cows, cows with predominantly Zebu Gir/Nellore blood, and at the moment he did not supply concentrate and moved the animals on the banks of Avenida Joaquim Manoel/PI-120, so that they could feed on the available native pasture, composed mostly of androphogon grass.

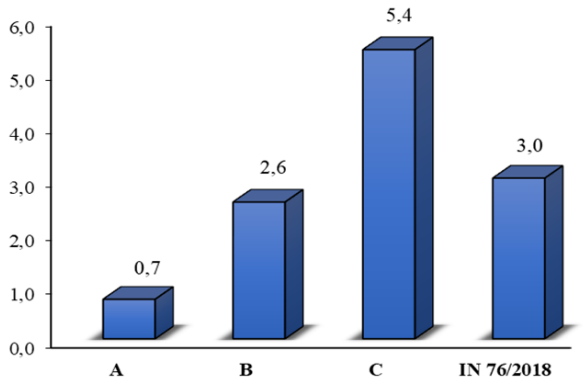
Samples were collected from all lactating animals in each farm. Milk samples were collected from May to June 2023, from lactating cows at the time of collection. They were

then cooled and sent to the Center for Studies, Research and Food Procedures of the Federal University of Piauí (NUEPPA - UFPI), where they underwent analysis in the Ekomilk® equipment (Ultrasonic Milk Analyzer) to measure the physicochemical contents of Fat, Protein, Lactose, Defatted Dry Extract (ESD), Freezing Point and pH. From the results obtained, the data were tabulated in the Microsoft Office Excel 2019® application with the preparation of the graphs and compared with the quality parameters of refrigerated raw milk established by MAPA Normative Instruction No. 76, of November 26, 2018.

RESULTS AND DISCUSSION

The physicochemical analyses carried out on the milk samples collected in the municipality of Valença do Piauí aim to demonstrate whether the milk sold is suitable, according to MAPA IN No. 76/2018, to be consumed by the population, where changes in the levels of the elements, may or may not, characterize possible adulteration in the physicochemical composition of raw milk.

Figure 2 – Comparative analyses of Fat (%) of fresh milk sold in the municipality of Valença do Piauí in 2023.



Source: Study data, elaborated by the author (2023).

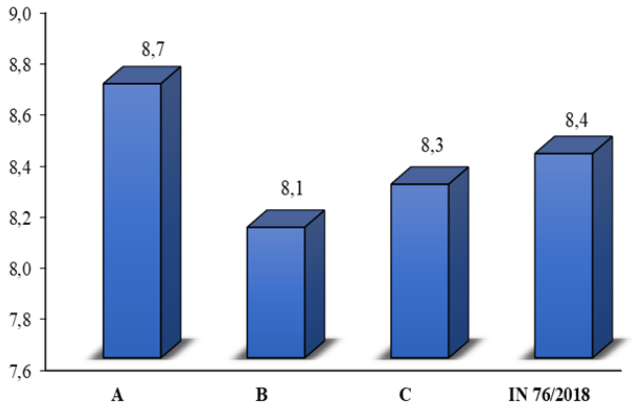
In the samples analyzed for fat content, only sample C showed a favorable average with 5.4% fat (Figure 2), higher than the minimum parameter of 3.0g/100g of fat required by MAPA IN No. 76/2018 (BRASIL, 2018). Samples A and B had average levels well below the official parameters with 0.7% and 2.6% fat, as well as Souza (2020) who also obtained average levels below the minimum with 2.2% fat in milk samples collected in the municipality of Areia – PB.

The diet and the genetic variability among ruminant species significantly interfere in the composition and quantity of triglycerides that form milk fat, as some fatty acids produced in the digestive system and from the diet are transported and incorporated into

the mammary glands, causing differences in the composition of milk fat (GONZÁLEZ, 2001).

The Defatted Dry Extract (ESD) parameter revealed that sample A reached a value of 8.7%, within the minimum content of 8.4% indicated by the IN of MAPA No. 76/2018 (BRASIL, 2018), while samples B and C presented lower values, with 8.1% and 8.3%, respectively (Figure 3).

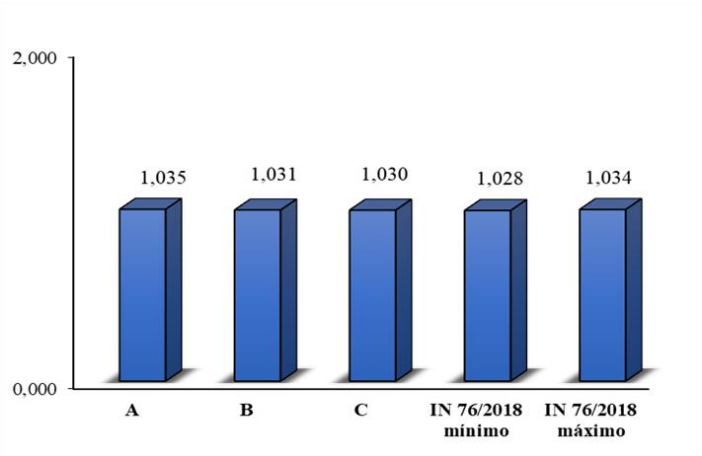
Figure 3 – Comparative analyses of Defatted dry extract (%) of fresh milk sold in the municipality of Valença do Piauí in 2023.



Source: Study data, elaborated by the author (2023).

The samples analyzed by Martins et al. (2015) in the state of Sergipe met the legal requirements with averages of 9g/100g of milk. Silva (2021) analyzed raw milk samples in the municipality of Sumé - PB and observed three samples below the recommended content of 8.4% with 7.18%, 7.21% and 8.28%, also indicating that two of these samples were adulterated by water and that they may have influenced the nutrient content. As well as the addition of water, the differentiated nutrition of the herd can interfere with the levels of solids.

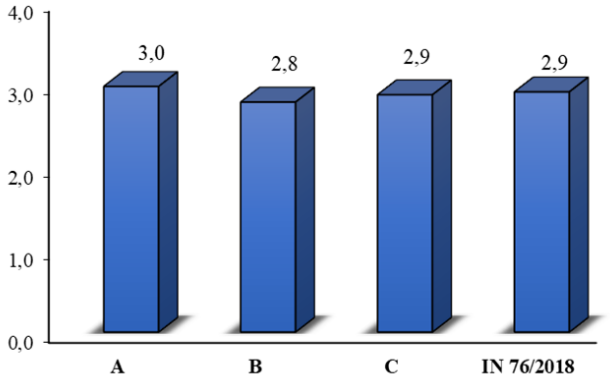
Figure 4 – Comparative analysis of Density (mg/l) of fresh milk sold in the municipality of Valença do Piauí in 2023.



Source: Study data, elaborated by the author (2023)

The density of milk samples B and C with values of 1.031 g/mL and 1.030 g/mL, respectively, met the minimum parameter established by MAPA IN No. 76/2018 (BRASIL, 2018), but sample A presented a value of 1.035 g/mL, above the official reference value. Souza (2020) observed that only two samples with values of 1.027 g/mL were lower than the reference parameter, characterizing possible water adulteration, skimming or imbalance of dairy elements, where it can be proven by analyzing simultaneously with Cryoscopic index.

Figure 5 – Comparative analyses of Protein (%) of fresh milk sold in the municipality of Valença do Piauí in 2023.



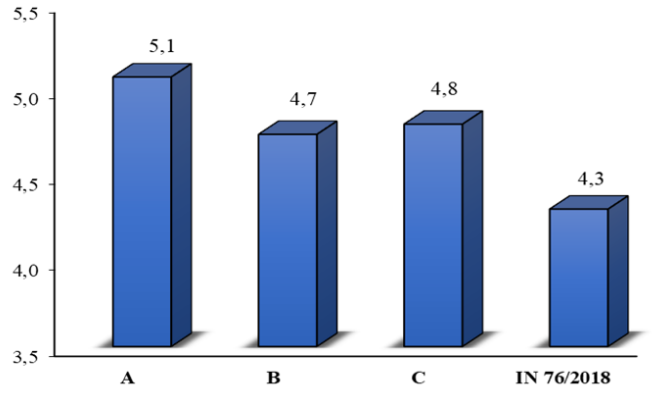
Source: Study data, elaborated by the author (2023).

The analyses of the milk protein content identified that samples A and C remained within the minimum value of 2.9% of the IN of MAPA No. 76/2018 (BRASIL, 2018). Only sample B reached a value of 2.8% (Figure 5), which was lower than the normative standard. Brum (2014) found 3.2% of protein with a temperature of 15ºC and Silva (2017) also found a sample with an average below the standard norm of 2.6%, in a study applied in the

municipality of Areia – PB. Like fat, protein content is also influenced by the variation of species, but in a smaller proportion related to fat, as well as at the time of milk milking.

As for lactose, samples A, B and C with values of 5.1%, 4.7% and 4.8% (Figure 6), respectively, fit the minimum levels of 4.3% of the IN of MAPA No. 76/2018 (Brasil, 2018). Souza (2020) observed that all samples were higher than the required technical standard, with values between 4.91% and 9.72% of lactose in milk. Lactose does not vary so much between breeds, remaining constant, and may decrease the content during the lactation period and increase again according to the consumption of colostrum by the calf or milking (GONZÁLEZ, 2001).

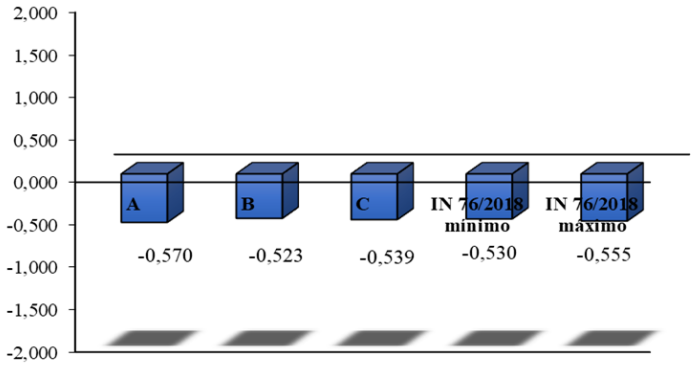
Figure 6 – Comparative analyses of Lactose (%) of fresh milk sold in the municipality of Valença do Piauí in 2023.



Source: Study data, elaborated by the author (2023).

The analysis of the refrigerated fresh milk samples showed that only sample C, with a value of -0.540ºH, corresponded to the temperature range between -0.530ºH and -0.555ºH (Figure 7) required by the IN of MAPA No. 76/2018 (BRASIL, 2018), while samples A and B, with values -0.570ºH and -0.520ºH, remained below the reference interval of the technical standard. Silva (2021) identified samples with a freezing point between -0.450ºH and -0.650ºH, where small fractions of water added to milk can cause increased cryoscopy.

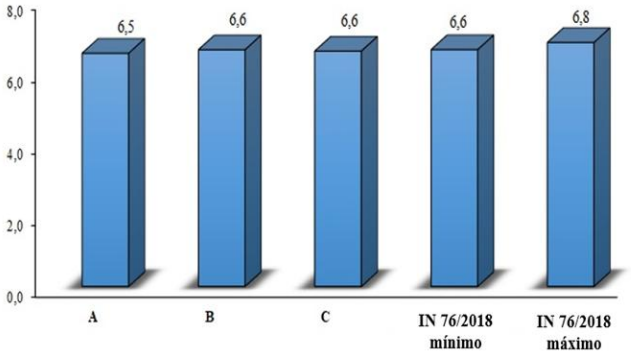
Figure 7 – Comparative analyses of the cryoscopic point (°H) of fresh milk sold in the municipality of Valença do Piauí in 2023.



Source: Study data, elaborated by the author (2023).

Regarding pH, samples B and C showed significant values of 6.6 each, within the acceptable standards by MAPA IN No. 76/2018, which are between 6.6 and 6.8 (BRASIL, 2018), on the other hand, sample A with a value of 6.5 was lower than the others, not reaching the ideal value (Figure 8).

Figure 8 – Comparative pH analyses of fresh milk sold in the municipality of Valença do Piauí in 2023.



Source: Study data, elaborated by the author (2023).

The pH of fresh milk is ideal for processing and consumption when it is on a scale between 6.6 and 6.8, being classified with light acidity and can be measured directly with a pH meter. Therefore, pH imbalance can cause lactose degradation due to high acidity levels due to lactic acid production (DIAS & ANTES, 2014).

CONCLUSION

From the analyzes carried out, it was found that the samples of fresh milk did not reach the standards required by MAPA IN No. 76/2018 in at least one of the parameters studied. The search for improvement of milk production conditions in the municipality can take place through the cooperativism of producers, who, once organized, can establish

partnerships with government agencies and banks that would facilitate the transfer of technologies for rational and sustainable production, investments for the acquisition of equipment and infrastructure and costing aimed at maintaining the activity, in addition to opening a market for the flow of production. In view of this, the theme needs more research in order to reach other milk producers in order to obtain more accurate results that portray the quality of milk in the municipality of Valença do Piauí.

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