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Qualitative analysis of microbiological reports of Minas Frescal Cheese observed in a dairy from 2017 to 2020 in the municipality of Dourados-MS

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***Abstract*—** *Available to the consumer an innocuous product, without the presence of any type of pathogen, It has to be the goal of any type of industry that produces and markets, foodstuffs for human consumption. Throughout this study, dozens of authors, in their respective works, have alarming rates of contamination of Minas Frescal cheese. Conduct an analysis of the results of official reports, collected by the state inspection service, of routine microbiological examinations in a dairy in the municipality of Dourados MS, in the period from 2017 to 2020, was the objective of the present study, to quantify the results of CONFORM / NON CONFORM reports of thermotolerant coliforms, count of Staphylococcus spp., mold and yeast research, Salmonella spp. and L. monocytogenes. In the period studied were analyzed 212 reports results conducted by state inspection service, resulting in 11 reports (5.18%) reports NOT CONFORM. Although the index is very small, when compared to the works mentioned here, it's necessary for the industry in its production and storage processes of its products, to observe and put into practice by all its employees the Good Manufacturing Practices. In addition, with regard to the work performed by the official inspection service, it should be noted that the procedures for inspecting the production and marketing of any and all products intended for human consumption are of paramount importance.*

I. INTRODUCTION

For thousands of years, cheese of animal origin has been used for human consumption, several authors report on the use of this product, in the diet of man in the beginning of human civilization, a source of animal protein, which at that time was kept at temperature environment, enabling its storage for later consumption [1][2][3]

Already in the most read and commercialized book in the world, the Holy Bible, both in the Old Testament, as well as in the New Testament, we carry out the reading as for example, in the book of Genesis chapter 18 verse 8 account of the cheese being used for human food, the first report happened around 3,500 years before Christ.[4]

In the history of Brazil, especially with the advent of the arrival of the Portuguese royal family in the 17th century, there is even more news of the use of cheese by the entire Brazilian population, which over the years has become a product that is part of the diet of the Brazilian people, making this product a popular product in a country of continental extension.

Even though it is a product, popular and consumed all over the national territory, in Brazil, in the southeastern region, mainly in the states of Minas Gerais and the

interior of the state of São Paulo, they are states that produce more and sell cheeses.

Since the 17th century with the arrival of the Portuguese royal family, due to their habits of having daily cheese consumption in their food and in every meal, the history of cheese production in the southeast region has been registered, mainly in the states of Minas Gerais and São Paulo, in these states due to the environmental and geographical conditions for the implantation of the dairy industries in these regions, in Rio de Janeiro and Espírito Santo it was also suitable for this type of production.

Minas Frescal cheese, is the most popular cheese in Brazil, where the population has the habit of consuming at every meal, from the extreme north to the extreme south, there is a report of its consumption, however, it is a product that due to its production characteristics it has to be consumed immediately after manufacture because it has a short shelf life.[5]

When analyzing the Technical Regulation for Identity and Quality Fixing of Minas Frescal Cheese, by "Minas Frescal Cheese", you understand the fresh cheese obtained by coagulating milk enzymes with rennet and / or other appropriate coagulating enzymes, supplemented or not with action of specific lactic acid bacteria.[6]

In 1950, through the Regulation of Industrial Inspection, Sanitary of Products of Animal Origin, its annexes have an exclusive chapter regulating the production of cheese in Brazil, including Queijo Minas Frescal, a regulation that recommended the routine exams in order to inspect and to authorize dairy products that their products were in disagreement with the legislation.[7]

The official inspection service implanted in the industries that process milk and its products such as cheese, carry out official laboratory analyzes of monthly routine, where, the reports that present nonconformities, the industry is assessed, notified, fined and or even closed, due non-conformities. [7]

The dairy in which the object of this study was located is located in the state of Mato Grosso do Sul, in the Brazilian Midwest, which for more than 40 years is one of the 5 states that have the largest cattle herd in the country, and which in 2019 occupied the fifth position with more than 19,407,908 head of cattle [8]. The industry is located in Dourados - MS, a municipality with an estimated population of 225 thousand inhabitants, located in the southern center of the state of Mato Grosso do Sul, 220km away from the capital Campo Grande [8]. Livestock and agriculture are one of the main economic activities of the state having an important contribution to the municipal GDP, therefore the predominance of livestock in the state has a direct relationship with the production of dairy products, specifically cheese, the result of dairy farming activities.

Conducting an analysis of the results of the official reports, collected by the State Inspection Service (SIE), of routine microbiological examinations in a dairy in the municipality of Dourados MS, in the period from 2017 to 2020, was the objective of the present study, to quantify the results of CONFORMING / NON CONFORMING reports of thermotolerant coliforms, Staphylococcus spp. count, mold and yeast research, Salmonella spp. and L. Monocytogenes, will be the objective of the present work.

II. HISTORY OF CHEESE

Cheese is one of the most consumed dairy products in the world, containing a huge variety of both flavor and appearance. It is a food produced since before the Ancient Age, it is alleged that it arose in Iraq, 8 thousand years ago, between the Tigris and Euphrates rivers. In the period known as the agricultural revolution, the discovery of cheese was only possible when human beings began to domesticate plants and animals [9].

There is evidence of consumption of solidified milk dating from 7 thousand years before a. C. and in materials found by archaeologists proving the existence of cheeses made with cow and goat milk 6 thousand a. C. In ancient Egypt there are records in Egyptian tombs that show scenes of cheese making and the Bible makes reference to cheese in various parts of the Old Testament [1].

Although several experts claim that the history of cheese is distant, there are those that delimit the Middle Ages as a reference for its manufacture [1]. Although it is one of the oldest foods of civilization, it is not known when it actually appeared, however it is very likely that it must have occurred concurrently with the domestication of goats, sheep and cows [2].

The production of "Queijo Minas" in Brazil dates back to the colonial period, it is no wonder that it is one of the most famous cheeses in Brazil and of the best quality. With a strong identity, it is an important ingredient for many cultural recipes from Minas Gerais and Brazilian cuisine and an important nutritional source [10]. The production of this cheese in Minas Gerais occurred simultaneously with the occupation of the captaincies and gold mining. Mining produced a rapid demographic explosion in the state, bringing a diversification of economic activities, including livestock [2].

Milk is one of the most versatile animal products in the world, about 30% of the world's milk production is used for the production of cheeses that add up to a variety of more than 1,000 types of this product. The great part of

these varieties happened due to some local circumstance, being factors as: composition of the milk, endogenous microbiology, species and animal race. In addition, the outstanding characteristic of the cheese may have occurred during the attempt to produce or stock the product with the growth of molds or the presence of other microorganisms [9].

In comparison with the production of cheese in the world, in Brazil, this reality is no different, 33% of the milk that is produced in the country is destined for the manufacture of cheese, which is one of the most consumed dairy products in the country. According to estimates made by the Brazilian Association of Cheese Industries (Abiq), in the Brazilian market there are more than 70 types of cheese available to consumers of national origin, with the inclusion of imported cheeses, this quantity exceeds 200 options. In 2017, Brazil produced 1 million tons of cheese, growing 2% over the previous year. The leading cheeses on the market are Muçarela with 30% of the market, followed by plate cheese with 20%, curd cheese 8% and Minas Frescal 6%. This group corresponds to almost 70% of the market.[11]

Cheese production has grown over the years, consequently the milk for the production of these dairy products has increased, the percentage went from 33% to 35% of the milk produced in Brazil for cheese production from 2018 to 2019 [11]. In the country there are about 2 thousand dairy products, 10% of which is responsible for 80% of cheese production, this activity moved 23 billion in 2019. Brazil is among the five largest cheese producers in the world, however the country it has a low consumption per inhabitant reaching only 5.5 kg / year, while countries like Argentina and Uruguay correspond to double 11 kg [12].

Contamination on the Minas Frescal cheese production line and Good Manufacturing Practices

Contamination of Minas Frescal cheese occurs due to poor hygiene along the chain. This contamination can happen since before the production process, happening during the milking of the milk, as well as during the production or even in the storage of the product until it is destined for the consumer. To guarantee the safety of the product, it is necessary to go through a strict quality control, adoption of Good Manufacturing Practices, and the qualification and training of specialized professionals [13][14]

Santos (2009) and Garcia (2016) state that the presence of chemical and physical contaminants in cheeses is associated with the poor quality of the raw material and the adoption of hygienic techniques in non-compliance with legal standards, evidently affecting the safety of the final product.[10][15]. However, the author points out that the adoption of GMP plus the appropriate techniques for personal, operational and behavioral activities in the production process are decisive strategies to ensure a quality product suitable for human consumption.

Brant, Fonseca and Silva (2007) and Rocha, Buriti and Saad (2006) agree that contamination can occur since before the start of the production process, due to the health conditions of the herds and the quality of the milk [16][17][18]. As well as in the production process due to the lack of hygienic sanitary conditions in manufacturing through contamination during the process. In addition, contamination can occur after processing, transportation, marketing and shelf life of cheeses during storage can result in contamination making consumption improper .[19].

Collegiate Board Resolution - RDC number 12, published on January 2, 2001 by the National Health Surveillance Agency (ANVISA) linked to the Ministry of Health, determines the Sanitary Microbiological Standards for food, establishing the criteria for the conclusion and interpretation of microbiological results of food. For foods with very high humidity above and 55% such as Minas Frescal cheese, the limits of the presence of microorganisms in the samples were determined, such as Coliforms at 45ºC, positive coagulase Staphylococcus, salmonella and L. monocytogenes. [20].

These pathogenic microorganisms, in addition to molds and yeasts, are contaminants of Minas Frescal cheese. Contamination of Minas Frescal cheese is very susceptible given its high moisture content, enabling the development of undesirable microorganisms [21]. Some of these microorganisms are pathogenic due to contamination in the production process without adequate quality control and the lack of Good Manufacturing Practices (GMP) [22]. Pathogenic bacteria are totally harmful to human health and can cause diseases due to the high power of multiplication and dissemination of tissues as well as the production of toxins. [13]

In this sense, microbiological analyzes, in addition to being a legal obligation to be made in the manufacture of dairy products, are essential to assess the risks that products such as cheese may present to the health of the consumer. Due to the large consumption of this type of cheese by the population, it is increasingly necessary to adopt practices that maintain the integrity and safety of the product. [23][24].

The occurrence of contamination in Minas Frescal cheeses is a problem that lasts for many years, despite the evolution of legislation in order to ensure quality products to the consumer free from contamination, however, these

contaminations are something present in Brazil. This is evidenced by several studies carried out by researchers, this situation does not depend on the period studied and the origin of manufacture, as can be seen in the studies performed shown in Table 1.

Table 1 brings together several surveys carried out by several researchers over the years in order to analyze the microbiological condition of Minas Frescal cheese in Brazil. The table is composed of 5 columns that describe the author who carried out the research, as well as its objective that led him to carry it out, the type of inspection that the production of this cheese was subjected to, and lastly, the results obtained by each researcher. .

Table 1 - Analysis studies of the microbiological conditions of Minas Frescal cheese in Brazil.

Author	Objective	Type of inspection	Results
Loguercio and Aleixo, 2001	To evaluate the sanitary hygienic conditions of the Minas Frescal cheese produced by hand in Cuiabá - MT, a microbiological analysis of thirty samples obtained at two points of sale was carried out.	Not identified	In the determination of faecal coliforms, 28 samples (93.33%) had a more probable number (MPN)> 10^2 MPN / g and only two samples (6.67%) were within the required legal standards. In the count of S. aureus, in 29 samples (96.67%) values greater than 10^3ufc / g were obtained, with only 1 sample (3.33%) in compliance with the legal standard.
Salotti et al., 2006	To evaluate the microbiological quality of Minas Frescal cheese produced by hand and inspected by the State and Federal Inspection Service, through the quantification of fecal coliforms, positive coagulase Staphylococcus and researches of Salmonella spp., Listeria monocytogenes and Campylobacter spp.	With inspection (SIE and SIF)	Of the analyzed samples, regarding the presence of fecal coliforms 83.4% (25/30) and for industrial samples 66.7% (20/30) were not in accordance with what was established by ANVISA. For the values obtained in the count of positive coagulase Staphylococcus, 20% (6/30) of artisanal samples and 10% (3/30) of industrial samples exceeded the legal limit. Regarding the detection of Salmonella spp., Listeria monocytogenes and Campylobacter spp., Presented standards within the legal limits.
Brant, Fonseca e Silva, 2007	Evaluate the microbiological quality of artisanal Minas cheese from Serro and observe the variation of the microbiota of the newly manufactured cheese and on the last day of the shelf life.	With inspection	Thirty-seven samples (92.5%) were found to be unfit for human consumption, according to the parameters established by the resolution: RDC ANVISA nº 12/01, with the main cause of condemnation counting positive Staphylococcus coagulase 82.5% (33/40) and 60% (24/40) of coliforms at 45ºC above 5x10^3UFC / gram ..
Komatsu et al., 2010	Avaliar a presença de *Staphylococcus coagulase positiva* em queijos artesanais produzidos no município de Uberlândia-MG e determinar a incidência de amostras analisadas dentro e fora dos padrões permitidos pela legislação vigente.	Not identified	The results showed that 88% (44/50) of the samples presented revealed unacceptable levels of coagulase positive Staphylococcus.
Pinto et al., 2011	To evaluate the sanitary quality of Minas Frescal cheese with artisanal production and with production inspected by the State and Federal Inspection Service of the Municipality of Santa Helena, PR, through the quantification of thermotolerant coliforms, Staphylococcus spp. Counting,	With inspector (SIE e SIF)	Regarding the presence of thermotolerant coliforms, 90% (18/20) of artisanal samples and 55% (11/20) of those inspected were at odds with what was established by ANVISA according to Resolution No. 12 of January 2, 2001 . Regarding the enumeration of Staphylococcus spp., 100% (20) of the artisanal samples and 25% (5/20) of the inspected samples were in disagreement with what was established by the legislation. Salmonella spp. and Listeria

	mold and yeast research, Salmonella spp.		monocytogene were within the standards. Of the total samples analyzed, only 15% (6/40) were within the limits established by ANVISA, while 100% (20) of artisanal samples and 70% (14/20) of those inspected were above the limits established by legislation.
Wolupeck et al., 2012	Evaluate and compare the microbiological quality of Minas Frescal cheese marketed in the city of Curitiba (PR) in the years 1999 and 2009, verifying the evolution in the hygienic-sanitary quality of this product in the period of 10 years.	With inspector (SIE e SIF)	Of the 55 cheese samples, 41.82% and 78.18% (43/50) had an E. coli and total coliform count above the permitted limit, respectively. Only one sample (1.82%) of the total evaluated was found to disagree with the standards for positive S. coagulase and one for Salmonella spp. Both samples were acquired in 2009. Comparatively, the cheeses evaluated in 1999 showed microbiological quality superior to the cheeses evaluated in 2009 ($p < 0.05$). Of these, 100% presented at least one microbiological parameter in disagreement with the current legislation, indicating that the quality of the Minas Frescal cheeses evaluated in 2009 was lower than that of the cheeses evaluated in 1999.
Lombardi and Rezende, 2014	To evaluate the microbiological quality of Minas Frescal cheese produced under Municipal Inspection in Uberlândia - MG from August 2012 to October 2013	With inspector (SIM)	Dairy factories “A” and “B” presented 100% and 50% of the raw milk samples satisfactory, respectively, for total bacterial count. Of the cheese samples analyzed, regarding the presence of thermotolerant coliforms, 12% (2/17) were at odds with the standards established by ANVISA and, as for the survey of coagulase positive Staphylococcus and Salmonella sp. 100% of the samples were within the legal standards required.
Apolinário, Santos and Lavorato, 2014	To evaluate the microbiological quality of Minas Frescal cheese, produced and commercialized by dairy products in the state of Minas Gerais, by analyzing the presence of total coliforms, thermotolerant coliforms, Salmonella spp., Listeria monocytogenes and coagulase positive staphylococci.	With inspector (SIE e SIF)	77.4% (24/31) of the samples were found with counts higher than that recommended by the legislation for total coliforms, 54.8% (17/31) for thermotolerant coliforms, 16.12% (5/31) for coagulase positive staphylococci and 9.6% (3/31) for Listeria monocytogenes. There were no samples with contamination by Salmonella spp. Thus, 80.6% (25/31) of the analyzed samples were unfit for consumption.
Feitosa et al., 2016	Identify and describe possible contaminants in cheese; investigate people's knowledge about the origin of the food they consume and correlate the data obtained with others described in the literature.	Not identified	The level of contamination obtained in the water period was 100% (37) for Total Coliform; 78.38% (29/37) for Fecal Coliform; 35.14% (13/37) of Staphylococcus aureus and 5.41% (2/37) of Staphylococcus sp. In the dry season, 86.49% (32/37) was found for Total Coliform; 62.16% (23/37) for Fecal Coliform; 27.03% (10/37) for Staphylococcus aureus and 2.7% (1/37) for Staphylococcus sp.

Souza et al., 2017	To evaluate the microbiological quality of Minas Frescal cheese as to the Most Probable Number of coliforms at 30ºC and 45ºC, positive coagulasse staphylococcus count and the presence of Staphylococcus aureus, Escherichia coli, Listeria monocytogenes and Salmonella sp., In order to assess their compliance current legislation.	With inspector (SIF ou SIM)	All samples, regardless of origin, presented coliforms at 35 ºC, with values ranging from 1.5 x 101 to 1.1 x 106 NMP / g. The presence of E. coli was confirmed in 16 samples (32%). Coagulase positive staphylococcal counts were also above the accepted limit in 16 (32%) samples and 10 (20%) contained S. aureus. There was no presence of L. monocytogenes, however, Salmonella sp. was confirmed in 20 samples (40%). It was found that only 11 samples (22%) were in compliance with Brazilian legislation.
Pinto et al., 2020	To evaluate the presence of microorganisms harmful to human health, contaminants of Minas Frescal cheeses, sold in commercial establishments in the municipality of Rolim de Moura - RO.	With inspector	Of the 30 cheese samples evaluated, there were three positive samples (9%) for coliforms at 45 ° C, 13 positive samples (43.3%) for Escherichia coli, and all 30 samples (100%) positive for Staphylococcus sp.
Amaral et al., 2020	Assess the quality of cheeses produced and marketed informally in open markets in the Federal District. Thirty cheese samples were collected without a health inspection certificate, marketed at ten fairs in the Federal District, in which the moisture content, the presence of Salmonella spp., Psychrotrophic microorganisms and the development of limosity and apparent mold were evaluated.	Not identified	The results obtained demonstrated the absence of Salmonella spp., And high counts for psychrotrophic microorganisms. The moisture content varied between 43% (13/30) and 61% (18/30), indicating a lack of standard in this product, concomitant with the appearance of limosity on the surface of 40% (12/30) of the samples and development of molds in 33% (10/30). Regarding the presence of Salmonella spp. was not detected in the analyzed samples.

Source: Prepared by the author (2021).

GMP is a set of practices that aims to guarantee the quality standards of products / services in the production area, which are included in the entire production process [10]. In addition, the GMP compliments improve the quality of the cheeses produced, preventing contamination and, consequently, the involvement of diseases related to bacteria resulting from bad manufacturing practices, in addition to reducing economic losses guaranteeing the continuity of the business.[21][25].

Food security is of utmost importance, considering that it refers to the health of the population, and not only the quality of the products. In addition, Foodborne Diseases

(DTA's) are affected by the ingestion of contaminated food, to ensure that this factor does not occur it is essential that the industry has assiduous quality management by developing control and prevention programs in GMP.[26]

Therefore, it is essential that hygienic practices be adopted throughout the cheese chain, and above all that the GMP of Minas Frescal cheese is followed, taking into account the serious dangers that microbiological contamination poses to the consumer, in addition to the great financial losses [1]. Therefore, it is extremely important to ensure the integrity and quality of the cheeses produced for human consumption.[23]

III. PROBLEM FORMULATION

What are the main pathogens found in routine examinations, carried out by the Official Sanitary Inspection Agency, of Minas Frescal cheese in a dairy in the municipality of Dourados MS in the period from 2017 to 2020?

IV. HYPOTHESIS

Hygienic-sanitary handling in Minas Frescal cheese processing tend to cause bacterial contamination.

V. OBJECT

Conduct a survey in the routine microbiological analysis of Minas Frescal cheese in a dairy in the municipality of Dourados/MS in the period from 2017 to 2020.

VI. MATERIALS AND METHODS

a) Types of Study to be carried out

In the official microbiological analysis reports, a survey of the compliant and non-compliant results was carried out in the period from 2017 to 2020. The study will be descriptive and quantitative. Descriptive studies are carried out through observed, registered, analyzed, classified and interpreted facts, without explorer interference made with standardized data collection techniques using a questionnaire and systemic observation [27]. Quantitative research seeks results that can be quantified through data collection in a structural and intuitive way.[28].

b) Research Ethical Considerations

This research will be carried out with the collection of secondary data, analyzed and used only for what refers to the objectives of the study, without any prejudice for the people involved in the analysis process, and without mentioning the names of the company and also of the inspection professionals.

With written authorization by the business owner.

c) Research location

The research was carried out in a dairy located in the region of Dourados / MS, under inspection (SIE) of the State Agency IAGRO (State Agency for Animal and Plant Health).

d) Minas Frescal Cheese Making Procedure

In Brazil, there are legal provisions that classify cheeses in terms of moisture and fat content, such as Portaria nº 146, of March 7, 1996 and Portaria nº 352, of September 4, 1997 (SANTOS, 2009). These ordinances discriminate characteristics such as moisture defining very hard, hard, semi-hard and fresh cheeses, and regarding the content of lipids as fatty, semi-fatty, lean and skimmed. In addition, the 1996 document addresses the types of additives and adjuvants in technology or preparation that may be used in production, contamination factors, hygiene, determines the general technical regulation for setting the microbiological requirements of cheeses, among other aspects (BRAZIL) , 1996; BRASIL, 1997b).

In the production of Minas Frescal cheese according to Santos (2009, p.1) “The technology for producing this cheese occurs through the enzymatic coagulation of milk with rennet and / or other appropriate coagulating enzymes, complemented or not by the action of specific lactic acid bacteria. ”It is usually sold in 0.5 kg to 3 kg forms (SILVA, 2005). Given the high humidity of Minas Frescal cheese, this factor increases the possibility of contamination of microorganisms, some of which are highly pathogenic (DUARTE, 2019).

As shown in the flowchart in figure 1, the manufacture of Minas Frescal cheese goes through a rigorous manufacturing process from the arrival of the raw material to storage. The milk arrives at the dairy in the truck with a temperature that should reach a maximum of 7ºC. Upon arrival, a sample is collected from each of the tanks to be analyzed. While the milk is being analyzed, the tank truck goes through a washing and sanitization process to avoid the contact of the truck dirt with the milk at the time of unloading on the platform. Front desk.

The milk goes through several analyzes before unloading to check if it is among the standards for production. In this way, analyzes are made: of acidity (14 to 18); alizarol (stable); fat (minimum 3.0); density (1.028 to 1.034); total dry extract (minimum 11.8); defatted dry extract (minimum 8.4); percentage of water in milk; antibiotic residue (absent); acidity neutralizer (absent); and density replenisher (absent). The better the microbiological quality the better the cheese [9]. After the analysis of the milk, if it conforms to the standards, it is authorized to discharge it, on the other hand, if it does not meet the criteria, the milk is discarded.

The unloading of the milk is done in refrigeration tanks where the milk will be stored, staying at a maximum temperature of 3ºC. After this stage, the acidity of the milk is measured for quality control, and then the pasteurization process begins. The pasteurization used is fast, in which the milk is subjected to a temperature of 72ºC to 75ºC for 12 to 15 seconds.[9]

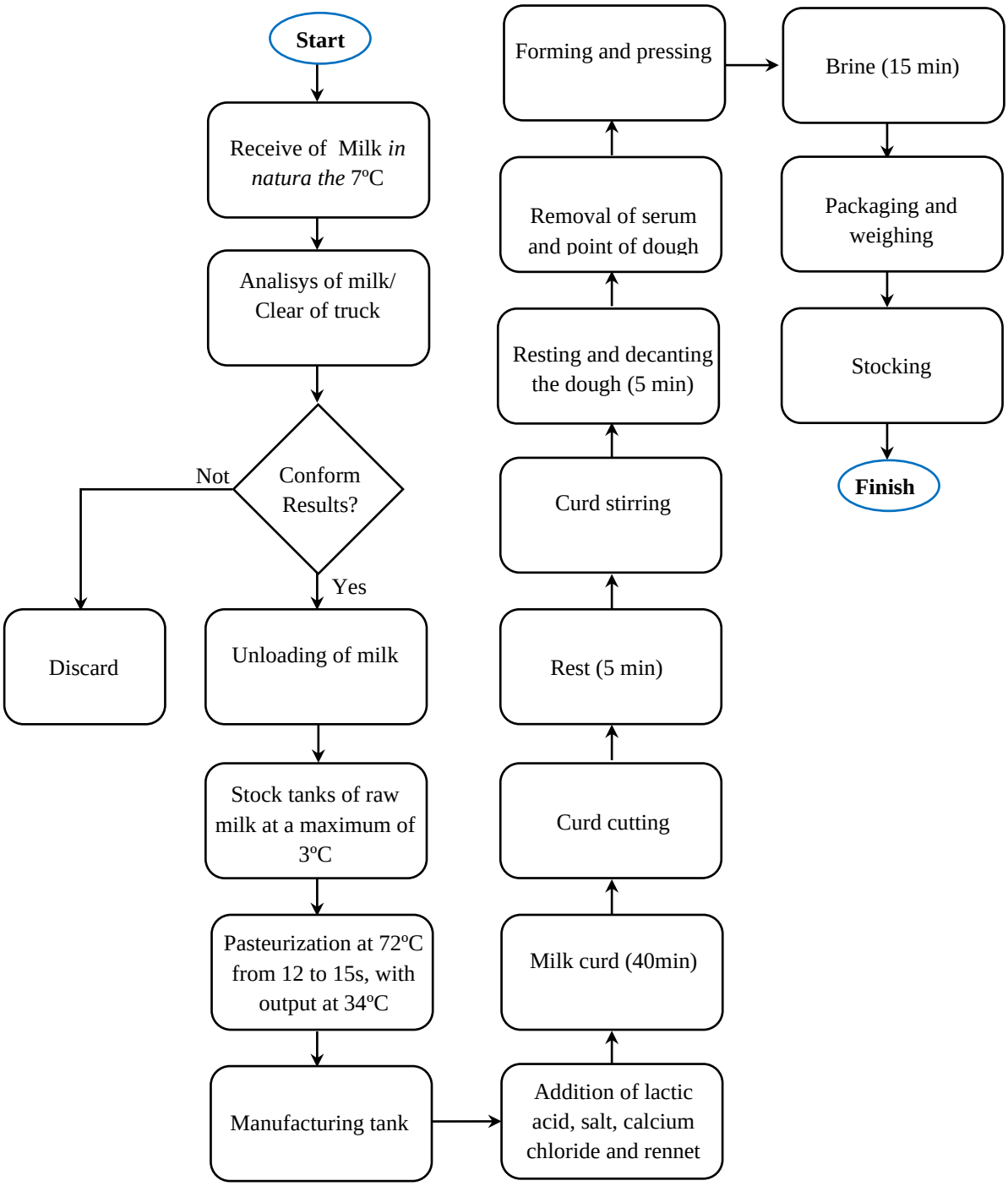


Fig.1: Flowchart of the manufacture of Minas Frescal cheeses in the Dourados dairy - MS.

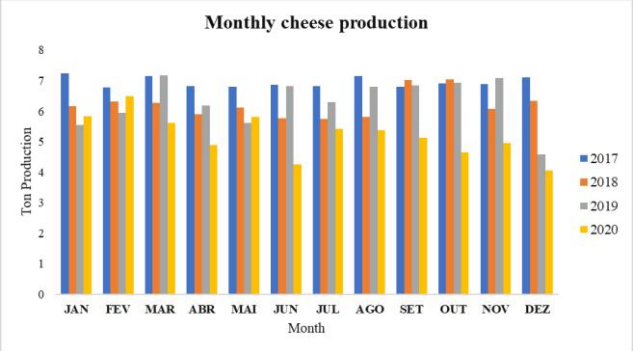
Pasteurization is a mandatory thermal process that aims to destroy pathogens and mitigate the maximum number of microorganisms in general, since the microbiological quality for the production of fresh cheeses is essential [1][32]. Vinha (2016) warns that pasteurization is the main activity of the production process to reduce contamination of matter and eliminate pathogens. This elimination of pathogens is extremely important for products suitable for consumption that are free of thermostable enterotoxins associated with gastroenteritis. Pasteurization is the means of ensuring that the cheese is free of contaminating microorganisms harmful to human health, such as bacteria and fungi.[25][31]

After this process, the milk is transferred to the receiving tank to cool. Then, lactic acid, salt, calcium chloride and rennet are added. It is expected 40 minutes for the milk curd, with the curdled milk the curd is cut. After cutting the dough there is a 5-minute rest. After these

steps, with the help of a stainless steel lyre, mixing occurs, which constitutes the agitation of the dough after coagulation, remaining at rest for settling for 5 minutes [33]. Subsequently, the serum is removed, separating it from the mass. With the dough separated and the defined point of moisture, the baking and pressing of the dough begins. Soon after the previous process is finished, the brine is made for 15 minutes, and with the ready cheese it is packed, weighed and stored.

e) Production of Minas Frescal Cheese

In the industry where this study was carried out, the main product in its manufacturing line is the Minas Frescal cheese, among several factors for this production choice, it is the acceptance in the market and also because it is a product that does not have any difficulty in its graph 1 shows the production of Minas Frescal cheese over the period studied.



Graph 1: Production of Minas Frescal cheese from 2017 to 2020.

Source: Build by authors (2021).

f) Sample Characterization and Recruitment

The participants of this research will comprise the professionals of the IAGRO organ responsible for the sanitary inspection of the dairy, providing analysis data with the owner of the enterprise obtained in the period from 2017 to 2020.

g) Research Procedures and Instruments

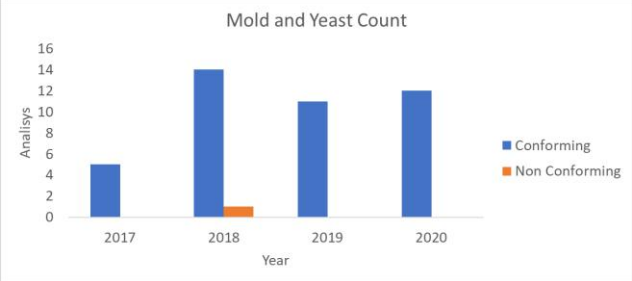
The method consists of a study of the results of official routine examinations, observing the results, relating them to production activities (Good Manufacturing Practices), routine microbiological analyzes of the industry's water. With participant observation in the field and with a monographic report. The steps in these processes are; what is the objective to be investigated, the location and the expected length of stay for data collection.[34]

Simple frequency calculations and percentage calculations were performed regarding the data collected, analyzed and provided by the dairy. As this is a qualitative study (nominal variables – COMNFORM/NON CONFORMING), with independent samples from each other, year by year, the statistical test to be applied in the results of the reports in the period from 2017 to 2020 will be the chi-square (X^2). The groups will be divided by etiological agent (Count of Molds and Yeasts; Count of Thermotolerant Coliforms at 45ºC; Research of Salmonella spp; Count of Total Coliforms and Count of coagulase positive Sthaphylococcus) and year, according to the release of the reports by the dairy.

VII. RESULTS AND DISCUSSION

Throughout the study period (2017-2020) official collections of samples produced from Minas Frescal cheese were carried out, due to the variation in production related to the availability of milk for production, there was variation in the production of Minas Frescal cheese in the studied period.

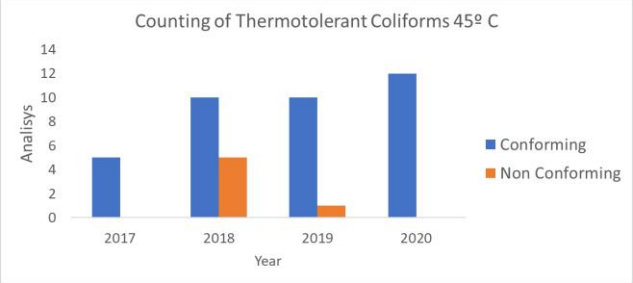
212 collections were carried out in the period, resulting in the official reports studied here according to the graphs represented.



Graph 1.1 - Result of the analysis of the Count of Molds and Yeasts in the period 2017 to 2020

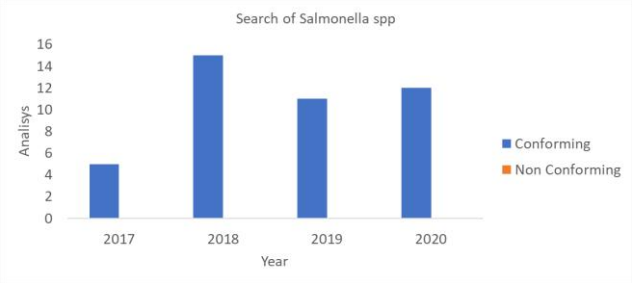
Source: Build by authors (2021).

During the study period, 43 reports referring to the count of Molds and Yeasts were analyzed, resulting in 1 report (2.63%) NOT CONFORMING, in the same study carried out by Pinto et al., (2011) detected contamination in samples of Minas Frescal cheeses corresponding to 65% (13/20) and 40% (8/20) of artisanal and inspected samples, respectively. This demonstrates that in the question of the studied microorganisms related to Molds and Yeasts in the dairy in which the present study was carried out, the index of this contamination is well below the study referenced here and according to the statistical test X^2 (chi-square and p-value 0.944), in this item of molds and yeasts, found a significant difference between the number of CONFORMING analyzes in relation to the number of NON CONFORMING analyzes.



Graph 2 - Result of the analysis of Thermotolerant Coliforms 45º C in the period 2017 to 2020

Source: Build by authors (2021).



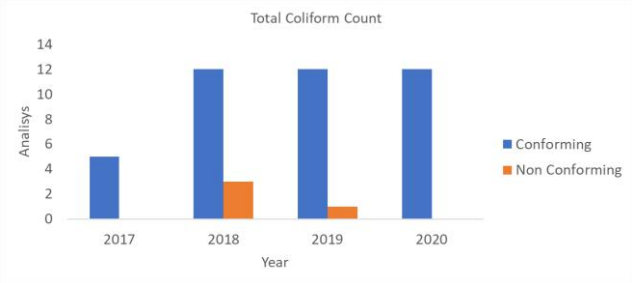
Graph 3 - Result of the analysis of the Salmonella spp survey in the period 2017 to 2020

Source: Build by authors (2021).

During the study period, 43 reports were analyzed regarding the Count of Thermotolerant Coliforms at 45ºC, resulting in 6 reports (13.95%) NON-CONFORMING, featuring 5 reports (11.63%) in the year 2018 and 1 (2.32%)) report in 2019. In 2018, 15 reports were made and 11 reports were made in 2019. In the same study by Dias et al., (2016) where 5 samples of industrialized cheeses and 5 of artisanal cheeses were analyzed, contamination was detected in all samples (100%) of industrial cheeses and two (40%) in samples handcrafted. Of the 10 samples analyzed, 7 (70%) were contaminated. The high contamination by this type of bacteria outside the established standards is an indication of the presence of microorganisms such as Escherichia coli (VINHA, 2016)

Visotto (2011) reports that several studies demonstrate the occurrence of pathogenic bacteria in Minas Frescal cheeses, with high counts of Thermotolerant Coliforms being frequent. A research carried out by Apolinário, Santos and Lavorato (2014) identified the presence of contamination of 54.8% (17/31) by Thermotolerant Coliforms of the analyzed samples. The research carried out by Feitosa (2016), on the other hand, identified the contamination of 12% (2/17). This demonstrates that in terms of the studied microorganisms related to Thermotolerant Coliforms 45º C in the dairy in which the present study was carried out, the index of this contamination is well below the studies referenced here, emphasizing that in the years 2017 and 2020 there were no, Non-Conformities in the samples officially collected by the supervisory body (IAGRO). And according to the statistical test X2 (chi-square and p-value 0.264) applied in this item of Counting of Thermotolerant Coliforms 45ºC, found a significant difference between the number of CONFORMING analyzes in relation to the number of NON CONFORMING analyzes.

During the study period, 43 reports referring to Salmonella spp Research were analyzed, resulting in none (0%) of NON-CONFORMING reports. In a study by Morais and Rezende (2013); Valiatti et al., (2015); Salotti et al., (2006) something similar was detected and no contamination was found in the analyzed samples. On the other hand, in the studies by Pinto et al., (2011) 25% (5/20) of the inspected samples showed contamination by Samonela ssp. This demonstrates that, regarding the studied microorganisms related to Salmonella ssp Research, in the dairy where the present study was carried out, no index of this pathogen was detected in the official routine analyzes over the 4 years studied here. In this item it was impossible to perform the statistical test X^2 (chi-square), since all the reports presented results in CONFORMING



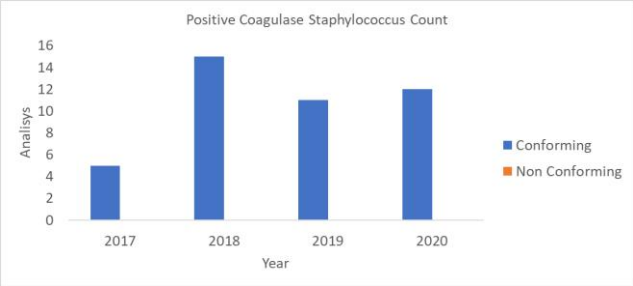
Graph 4 - Result of the Total Coliform Count analysis in the period from 2017 to 2020.

Source: Build by authors (2021).

Over the period studied, 45 reports on Total Coliform Counting were analyzed, resulting in 4 reports (8.88%) of NON-CONFORMING reports, with 3 (6.66%) reports in 2018, and in 2019 1 report (2.22%). In the same study carried out by Wolupeck et al., (2012) 78.18% (43/50) of the analyzed samples presented Total Coliforms above the allowed. Similar indices were found in studies Apolinário, Santos and Lavorato, (2014) and Dias et al., (2016), with respectively 77.4% (24/31) and 100% (10/10). Garcia et al.

(2016), on the other hand, found the contamination of 89% (17/18) with the presence of Total Coliforms from the analyzes performed.

Valiatti (2015) states that the presence or absence of Total Coliforms denotes the sanitary hygienic quality, so that the higher the quantity detected, the more inept is the hygienic sanitary condition of the cheese. This demonstrates that in the question of the microorganisms studied, the Total Coliform Count in the dairy where the present study was carried out, the index of this contamination is well below the studies referenced here. Furthermore, it is worth mentioning that in the years 2017 and 2020, the years when the greatest production of Minas Frescal Cheese occurred, as shown in Graph 1 of this study, with no Non-Conforming report, with respect to the Fecal Coliform Count. And, according to the statistical test X2 (chi-square and p-value 0.681) applied to this item of Total Coliform Count, it found a significant difference between the number of CONFORMING analyzes in relation to the number of NONCONFORMING analyzes.



Graph 5 - Result of the analysis of Staphylococcus Coagulase Positive Count in the period from 2017 to 2020.

Source: Build by authors (2021).

During the studied period, 43 reports referring to the Count of Staphylococcus Coagulase Positive were analyzed, resulting in none (0%) of NON-CONFORMING reports. In the same study by Pinto et al., (2020) they detected contamination in samples of Minas Frescal cheeses, corresponding to 100% in the 30 samples analyzed. In the study by Morais and Rezende (2011), samples contaminated by Staphylococcus Coagulase Positive were not identified. Unlike what occurred in the research results of Valliatti et al, (2015) that there was 100% contamination of the samples and Brant, Fonseca and Silva (2007) that the contamination of 92.5% (37/40) of the samples was detected samples. This demonstrates that, regarding the studied microorganisms related to the Survey of Positive Coagulase Staphylococcus in the dairy in which the present study was carried out, there was no index of this type of contamination in the four years referred to in this study. In this item, it was impossible to perform the X2 statistical test (chi-square), since all reports presented CONFORMING results.

VIII. CONCLUSION

Making a harmless product available to the consumer, without the presence of any type of pathogenic agent, has to be the goal of any type of industry that produces and sells products for human consumption. Throughout this study, dozens of authors, in their respective works, have alarming rates of contamination of Minas Frescal cheese. In the industry where the present work was carried out, in the official routine analyzes, collected by the official body responsible for the state inspection service, (11/212) reports, that is, 5.19% of Non-Conforming reports, a very small index when analyzing the studies referenced here, but it is necessary to have an even stricter control of good manufacturing practices by the present company, that this work be sent to the official inspection body and that a quality control project be carried out in which the annual targets that, each year, there will be a result even lower than the one presented here, that is, zeroing in the official reports of Non-Conforming results.

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