Implications for the quality of artisanal cheeses offered at street markets in the northern and southern regions of Dourados/MS

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ABSTRACT

The objective of this work was to analyze the quality of artisanal cheeses offered in open markets in the north and south of Dourados / MS 3 samples of fresh cheeses sold in the fairs were acquired, whose samples were named A, B and C, the D sample (industrial production control cheese) each sample weighed approximately 800 to 1000g. The physical and chemical analyses were: visual analysis of packaging, pH, acidity, % moisture, ash and water activity, texture and instrumental color. Microbiological analyses: Thermotolerant coliforms, Escgerichia coli and Total coliforms. According to the results obtained, the samples of fresh cheeses defined as A, B and C did not present any type of identification on the label of the packages, did not contain official identification, and therefore were not in accordance with Resolution No. 259/2002. According to the physical and chemical analyses, the pH showed no significant difference ($p<0.05$) between the sample (C and D), although there was a significant difference with A and B. The moisture content ranged from 48.91±0.68% (sample B) to 57.54±0.97% (sample C). Ash values ranged from 2.31% to 3.66%. In the instrumental texture parameters, sample A was considered as soft cheese (0.0287±0.00 N) and sample B was the sample with the highest hardness (0.2517±0.39 N). There was no significant difference ($p<0.05$) for the cut, elasticity, adhesion and chewiness parameters when compared with the control sample (D). In terms of cohesiveness, there was no significant difference with the samples (A, B) when compared with sample D (control), as for the microbiological evaluation, 50% of the cheeses collected were in accordance with RDC N°12/2001. Therefore, it is evident that there is a need to create awareness projects to train fairgoers who produce and handle cheeses, as well as the supervision by the current agencies to properly verify the production and marketing of these products.

Keywords: Dairy products, Analyses, Quality.

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INTRODUCTION

The origins of cheese date back to antiquity, when nomadic peoples from Africa and the East moved around in caravans, transporting milk in bags made from the leather of the animals' stomachs. The contact between the milk and the substances contained in the leather (enzymes), caused the milk to coagulate. The coagulated dough was tasted and enjoyed, and they realized that they had arrived at an excellent way to preserve the milk milk proteins. The serum was used as a refreshing drink during the trip (MELO, 2015).

In Brazil, the consumption of cheese began with the arrival of the Portuguese, who consumed the product on a large scale, due to the wide variety of cheeses produced from goat's milk, which was highly sought after by this population. There are no reports of Brazilian Indians producing cheese. Perhaps this challenge was almost impossible for them, since they did not practice any kind of dairy farming, no matter how rudimentary it might be. There were also no native cattle, goats and sheep in the territory (BOARI, 2017).

According to Barboza (2020), fresh cheese is that which is ready for consumption after being obtained; Matured cheese is one that undergoes modifications and undergoes physical and biochemical changes to have different characteristics.

Artisanal cheese, when made without the slightest hygienic conditions, these products can become vehicles for the transmission of microorganisms, due to poor manufacturing conditions. Therefore, the poor manufacturing conditions and its nutritional composition make cheese an efficient product for microorganisms to multiply, making it a vehicle for contaminants, relevant in public health issues, capable of causing foodborne diseases (DTA) (SANTOS, 2019).

According to Germano (2015) there are a number of problems related to the quality of informal or artisanal cheeses, ranging from high levels of microbiological contamination that are attributed to excessive handling as well as lack of knowledge of the pasteurization process, high cases of mastitis, lack of hygiene in milking, inadequate facilities, lack of hygiene in the manufacturing process, in the storage of products, incorrect transport and handling, and the exposure of the product to inappropriate temperatures during its commercialization. The high moisture content favors the development of undesirable microorganisms, making it a potential cause of food poisoning and/or infections.

According to Feitosa (2016), many Brazilians are exposed to the consumption of artisanal cheeses, which, on some occasions, do not have adequate hygienic sanitary control. The option for this artisanal product is often related to the fact that consumers judge it as a healthier, tastier and more nutritious option in relation to food submitted to industrial technological processes.

Silva and Costa (2020) state that street markets are popular public places: people go in search of varieties of fresh products and price differentiation. Trade fairs in Brazil take on different

functions and social and economic aspects. Its model is open-air retail, where foodstuffs are regularly offered on certain days of the week. Cheese is common among the animal products sold in these places. It is a product that stands out among dairy products for being rich in protein and other nutrients.

The Technical Regulation of Identity and Quality of Fresh Cheese, contained in Normative Instruction No. 30, of June 26, 2001 of the Ministry of Agriculture, Livestock and Property (MAPA), explains that cheese must be obtained from the coagulation of milk by means of rennet or other appropriate coagulant enzymes, with or without the addition of the action of lactic acid bacteria, and normally sold up to ten days of production. Fresh cheese is classified as medium to high moisture, semi-cooked or cooked pasta (BRASIL, 2001).

The cheese has the following characteristics: semi-hard consistency and elasticity, compact and soft texture, and may have some mechanical eyes, with a uniform yellowish white color, mild flavor, slightly acidic, reminiscent of the coagulated cheese mass. Its crust should be thin, without cracks, with some eyes (BRASIL, 2001).

The National Congress sanctioned Law No. 13,860/2019, which provides for the elaboration and commercialization of artisanal cheeses, defines artisanal cheese as: The product made by traditional methods, with territorial, regional or cultural valorization, according to the specific protocol established for each type and variety, and with the use of good agricultural and manufacturing practices. In disciplinary terms, the law establishes that the artisanal cheesemaker is responsible for the identity, quality, and health safety of the cheese produced by him, and he must comply with the sanitary requirements established by the government (BRASIL, 2019).

Resolution RDC No. 259/2002 determines that the labels of packaged foods must mandatorily present: Denomination of sale of the food; List of ingredients; Net contents; Identification of the origin; Name or legal name; Batch identification; Shelf life; Instructions on the preparation and use of the food, if applicable. In addition to this information, the package must present the Stamp of the Department of Agricultural Inspection and Supervision SIM, SIE or SIF, so that it can then be marketed (ANVISA, 2002).

According to the guidelines of Decree No. 9,918/2019 and Law No. 13,860/2019, producers who comply with all the established requirements will be able to obtain the Art Seal that authorizes the commercialization of artisanal foods throughout the national territory, as long as they meet the sanitary requirements, manufacturing and good agricultural practices. Although the seal is federal, the inspection of food quality will be the responsibility of state agencies (MÁXIMO and VILELA, 2019).

Because it is a perishable food product that is often produced and marketed in inadequate conditions, such as in street markets, there is concern about the quality of these cheeses, especially

about the occurrence of foodborne diseases (DTA). Most DTA's are caused by bacteria, such as *Escherichia coli,* which can cause diseases such as hemorrhagic colitis, diarrhea, and even meningitis (BRASIL, 2022).

The lack of quality criteria of some producers for the raw material and for the processing techniques allows low quality products, both from the hygienic-sanitary point of view and in relation to the product standards, to reach the market. It is necessary for producers to follow the evolution of cheese production methods, adopting changes according to legislation (SOBRAL et al., 2017).

Thermotolerant coliforms are bacteria that come from the feces of warm-blooded humans or animals and can cause diarrhea and other intestinal disorders. These bacteria are considered the main contaminating agents, their presence in food indicates contamination of fecal origin, which proves poor hygienic conditions. They can grow in media containing an active strained agent (antimicrobial) and ferment lactose at temperatures of 44º-45ºC. In addition, they also cause deterioration of the cheese, which causes abnormal fermentation and early stuffing (LEÃO, 2018).

According to the legislation, cheeses must be inspected by a government agency at all stages, from the rural area where milk is obtained or homemade cheese is produced, to the industries and places where they are exposed for consumption. It is believed that such research can contribute not only to alert state and municipal health authorities to the high potential risk that this problem can cause to the health of consumers, but also to sensitize them to the need for the immediate adoption of measures that allow the effective inspection and/or supervision of these products (CINTRÃO, 2016).

The study by Marinheiro et al. (2015), evaluated the microbiological pattern of sliced mozzarella cheese sold in the southern region of Rio Grande do Sul, it was observed that 12.5% of the samples of sliced cheese and 5% of cheese in piece were in disagreement with the standards established by Brazilian legislation. These results indicate the need for greater monitoring of these products and greater hygienic-sanitary care during processing by the industries.

According to the research by Reges et al. (2017), based on the results obtained in the samples of mozzarella cheese in bulk, it was found that 20% tested positive for *Salmonella spp.*, 40% for the bacterium *Staphylococcus aureus* and 20% for total Coliforms. Regarding the pH results, they remained between 5.25 and 6.13 and the values obtained for total fat ranged from 26.8 to 31.4%.

Mendes et al. (2020) conducted a historical analysis of the compliance profile of 2,580 samples of industrial cheeses under inspection in the state of Minas Gerais, in relation to the physicochemical parameter, over a period of seven years. A total of 1997 samples were assigned as compliant, representing 77.4% of the total analysed in the period. In addition, the number of non-compliant samples was 583 units, corresponding to 22.6 % of the total.

MATERIAL AND METHODS

SAMPLE COLLECTION

Samples of artisanal cheeses were purchased, sold in fairs of the North and South coordinates of the municipality of Dourados/MS.

The samples were kept in the original sales packaging and packed in isothermal boxes and transported to the laboratories of the Federal University of Grande Dourados (UFGD), where they were immediately submitted to physical, chemical and microbiological analyses. The samples acquired were designated as: A, B, C (artisanal cheeses from street markets) and D (cheese control of industrial production).

PHYSICAL AND CHEMICAL ANALYSIS

The physical and chemical analyses that were performed are: pH; Acidity; Moisture; Water, Ash and Texture Activity – according to Normative Instruction No. 68, of December 12, 2006, all analyses were performed in triplicate (BRASIL, 2006).

INSTRUMENTAL COLOR ANALYSIS

The quantification of instrumental color was carried out through a digital colorimeter, previously calibrated on a white surface according to pre-established standards (BASAGLIA et al., 2021), whose measurements were made after the removal of the packages, placed on a flat surface, which was measured through direct reading in the device, and the color parameters were evaluated: L*, a* and b*. The value of a* indicates staining in the region from red (+a*) to green (-a*), the value b* indicates staining in the range from yellow (+b*) to blue (-b*). The L value indicates the luminosity, which ranges from white (L=100) to black (L=0).

INSTRUMENTAL TEXTURE ANALYSIS

The texture profile was determined in the Laboratories of the Faculty of Agricultural Sciences, whose analyses were done in triplicate, through the compression test of the cylinders in the texture analyzer (Stable Micro Systems Texture Analyser, model TA-XT plus). The probe used for compression was a (p36r) and the dimensions of width, height and length of the cheeses analyzed was 3x3x3. The conditions used in this test were: test speed: 2.00 mm/second; distance: 10 mm; time: 5 seconds and force: 0.04903 N. The following parameters were analyzed: hardness, fracturability, adhesion, elasticity, cohesion and chewability.

MICROBIOLOGICAL ANALYSES

The microbiological analyses were carried out in accordance with IN No. 62/2003: Total

coliforms; Thermotolerant and *Escherichia coli* – Normative Instruction No. 62, of August 26, 2003.

STATISTICAL ANALYSIS

The results obtained were analyzed by analysis of variance (ANOVA), using the STATISTICX 10.0 software, using Tukey's test to compare the means, with a significance level of 5%.

RESULTS AND DISCUSSION

A survey of artisanal cheeses produced and sold for purchase in the fairs of the city of Dourados was carried out. According to the survey, some producers did not heat treat the milk and the cheeses were produced with raw milk. The industrial cheese is produced with pasteurized milk, and has the certification that the cheese purchased is a high quality cheese. Artisanal cheeses are often sold as consumers appreciate the rustic character of cheese and are more affordable. Table 1 presents sales information for artisanal fresh cheese and industrial cheese (control).

Table 1 - Comparative physical evaluation of artisanal and industrial fresh cheeses

Observations	Handcrafted	Industrial
Manufacturing	Farms/ranches in the region of Dourados-MS	Dairy Dourados-MS
Visa Inspection	They did not contain	SIE/MS
Sale Display	No refrigeration, at room temperature	Refrigerated in a cold room
Shell	Low-density polyethylene, knotted closed	Nylon Poli and sealed to the void
Labelling	No labeling	printing of the description as required by law
Regularity of sales	Constant	Moderate

Source: Author's own.

Table 1 shows that when evaluating the wrapper and packaging of the artisanal cheese samples, they did not contain labels or printing, with brand, date of production and expiration date. Therefore, municipal/state inspection of these products is necessary, with the objective of inspecting and inspecting them from a sanitary and technical point of view to ensure their consumption.

Likewise, the samples of artisanal fresh cheeses did not have seals from the State, Municipal or Federal Inspection service. Sample D (control), on the other hand, had the SIE/MS seal, in accordance with the recommendations of the Legislation. According to BECKER (2019), for consumer safety it is essential to acquire products with some information such as origin, registration with the competent body and proper labeling, since in 2018, the "Art Seal" was created, exclusively for artisanal food products of animal origin, through Law No. 13,680, of June 14, 2018, of MAPA (BRASIL, 2018). The presence of the seal on the packaging means that, although produced in a more rudimentary way, artisanal food is manufactured with the application of Good Practices and the

establishment has undergone official inspection by public health agencies. Raw foods of animal origin, including milk, contain autochthonous microorganisms (GUEDES et al., 2023).

It can also be seen in Table 1 that the control cheese (D) is within the parameters of the certification, which has the seal of the State Inspection Service (SIE/MS).

The legal commercialization of all products of animal origin must be registered with agencies, therefore, to ensure the safety of the product (cheese purchased), the cheese must have the inspection seal or the stamp of some body, such as: YES - Municipal Inspection Secretariat (sale allowed in the city); SIE-State (state only); and SIF-Federal (valid for all of Brazil and for export); the S.I.F. (Federal Inspection Seal) and the S.I.S.B.I. (Brazilian Inspection System) (SEALS, 2019; ARAÚJO et al.,2020; SEAL, 2020).

Thus, for artisanal cheeses, Law 13,680/2019 was approved, which determines that the production of artisanal cheeses from raw milk is limited to cheese dairies located in rural areas with a certificate of exemption from tuberculosis and brucellosis. Producers who meet these requirements can apply for the SIM, SIE or SIF seal (Brasil, 2019).

The artisanal cheeses that were purchased were produced in rural areas, so they should have the inspection seal or at least the "art seal" for artisanal food products of animal origin (BRASIL, 2018). Therefore, the artisanal cheeses bought in the fairs of the north and south region of Dourados-MS are products without identification or origin, without any official stamp, leading to the understanding that those who sell and/or produce them is subject to penalties according to the law No. 13,680/2019, because it puts public health at risk, as no one will be held responsible for the product in the event of an outbreak or spread of diseases (BRASIL, 2019).

According to Menezes (2017), the seal on cheeses, in addition to expanding the potential consumer market, adds value to the product because the certification allows these products to be marketed safely.

It was observed that the label of the control cheese packaging had a clear impression, such as: company data, production date, specific expiration date of the batch, specifications for consumption after opening, list of ingredients and country of origin. According to Resolution No. 259/2002, the product label must be printed and contain the day and month of expiration for products that have an expiration date of less than three months or the month and year for products that have an expiration date of more than three months, **as established by the guidelines of the legislation (BRASIL, 2002).**

According to Silva (2016), packing in food products is Very important for to preserve the integrity and safety of the product, as the packaging acts as as a barrier against deterioration factors. The control sample (D) had a vacuum-sealed Poly Nylon packaging in its wrapper. Highly

resistant material mechanical damage and deformations, increasing the preservation efficiency of the cheese and Keeping the physical, chemical, nutritional and sensory properties of product.

In the samples of artisanal cheeses obtained at the fairs, the packaging did not comply with Resolution No. 259/2002, the cheeses were packed in common plastic bags (low density polyethylene). Such polymers are less suitable for long-term storage of the product due to their lower mechanical strength and density (thin material, lower cost), which can easily lead to perforation of the packaging and contamination of the product (BRASIL, 2002), accelerating the process of degradation or contamination, in addition to not having a good closure or seal to maintain harmlessness. The closure of the samples was rudimentary (closed with a knot).

According to Law No. 4,380/2019, the inspection of the products offered is carried out by authorized employees identified by the Municipal Secretariat of Family Agriculture, by the Posture Inspectors, by the Sanitary Surveillance, by PROCON and Agents of the Municipal Guard. In practice, there is a lack of supervision by the responsible bodies in an efficient way in the fairs organized in the city of Dourados, so this leads the stallholders to be silent to disobey the law and constantly sell fresh cheeses without a seal and without the appropriate standards (BRASIL, 2019). As a result, in addition to not complying with legislative provisions, they also violate the internal legislation of the municipal fairs. All cheeses purchased at the fairs are kept at room temperature for a long period of time, which favors the development of microorganisms, reducing the shelf life of fresh cheeses. Fresh cheese, according to the Ministry of Agriculture, should be kept at a temperature not exceeding 12°C due. The municipal law establishes that non-compliance will result in a fine from the 17th State Fiscal Reference Unit of Mato Grosso do Sul and seizure of any and all suspicious cargo, but in practice this does not happen (BRASIL, 2019).

Law 4,380/2019 also determines that the inspection of the products offered must be carried out by accredited employees designated by the Municipal Secretariat of Family Agriculture, Posture Inspectors, Sanitary Surveillance, PROCON and Municipal Guards. However, in practice, these responsible bodies do not effectively supervise the fairs, where stall owners are free to break the law and constantly sell fresh cheeses without an inspection seal and not refrigerated (BRASIL, 2019).

Table 2 shows the values of pH, titratable acidity expressed % in lactic acid, % moisture, water activity (Aw) and fixed mineral residue (% ash).

Table 2 - Results of physicochemical analysis (g/100g) of 4 fresh cheeses

Cheeses	ph	Acidity%	Humidity %	Aw	Ash%
The	5,96±0,02b	0.79±0.02a	54,92±0,78b	0,98±0,00b	3.66±0.06A
B	6,03±0,01b	0,38±0,08b	48.91±0.68a	0.97±0.00A	2.31±0.04c
C	7.07±0.05A	0.37±0.02c	57.54±0.97a	0,97±0,00b	3,26±0,06b
D	6.63±0.38A	0.29±0.01c	50.53±0.64c	0,98±0,00b	3,08±0,01b

Source: Author's own.

*[A to C] Different artisanal fresh cheeses sold in fairs in Dourados-MS; *[D] Control; *Average of three repetitions ± coefficient of variation in %; * a, b, c, d Distinct superscript lowercase letters in the same column indicate a significant difference ($p < 0.05$) between fresh cheeses by Tukey's test.

According to Table 2, the pH in the samples was one of the important parameters observed, because cheeses with higher pH values have a shorter shelf life, since pH closer to neutrality favors the multiplication of microorganisms. It can also be observed that sample A presented the lowest pH value (5.96±0.02) and, consequently, the highest value of titratable acidity (0.79±0.02), it is believed that it may have been caused by the use of raw milk of low hygienic sanitary quality, in which the presence of acidifying bacteria were responsible for the low pH.

The sample (C) showed high pH values (7.07±0.05). Very high pH values indicate that the milked cows could have mastitis. Embrapa (2021) says that a pH of 7.3 to 7.9 can be an indication of bovine mastitis. Another factor that can raise the pH of cheese is the production of lactic acid from the degradation of lactose by undesirable microorganisms (BRASIL, 2021). The data found for pH differ from those found by Castilho (2019), evaluating artisanal cheeses from Paraná, found pH values of 4.96 to 5.96. De Souza et al. (2017) found pH values of 5.41 to 5.90 fresh Minas cheese marketed in the Zona da Mata Mineira, that differed from those found in the present study.

The high acidity found in the G sample may be due to the influence of the high temperature at which the cheese was exposed, the lack of temperature control during the marketing period may lead the product to start the deterioration process, thus increasing the acidity. Sousa et al. (2017), found acidity values in fresh cheeses sold in street markets in the city of Montes Claros from (0.56 to 1.32); Dias et al,. (2016), found acidity values of (0.57 to 0.14), these values differ from the acidity found in the present study of (0.79 to 0.29).

Aw above 0.91 is a minimum value for bacteria multiplication, this is favored by the availability of water, and free water is necessary for the metabolism of microorganisms. The water activity ranged from (0.97 to 0.98), this value is very similar to those found by De Souza et al. (2017), who obtained an Aw of 0.96 in artisanal cheeses, as well as by Lima and Leal (2017), who obtained an Aw of 0.95 to 0.98.

According to Normative Instruction No. 30/2001, fresh cheese can be classified as medium humidity: 36 to 46%; High humidity: 46.0 to 54.9% and very high humidity: not less than 55.0% (BRASIL, 2001). The higher the moisture content of a cheese, the faster proteolysis will occur, resulting in a change in the consistency and flavor of the cheese. Sample C was cheese with the

highest moisture content with (57,54%) and cheese A was the second cheese with the highest moisture content with (54,92%), in this way the proteolysis process will occur rapidly in cheeses A and C. Castilho (2019) They find values of 30.93 to 53.20 for humidity. De Souza et al. (2017) found values of (56.0% to 63.3%) when they analyzed the moisture content of artisanal cheeses. These values differ from the values found in the present study (42.54% to 58%), but the humidity values found were in accordance with current legislation.

According to Amaral et al. (2020), variations in the moisture content of cheeses may be related to the production processes, as they are artisanal and do not follow a specific production standard, the moisture content of cheeses influences the texture and flavor of the product, being difficult to control when it comes to artisanal manufacturing. One of the steps that can influence moisture content is the pressing time, which differs greatly between producers, as well as the salt content that directly reflects on the moisture content.

The determination of ash makes it possible to verify the addition of inorganic matter to food, the Legislation does not establish standards of ashes for cheeses, so the values found will be compared with the values in the literature. In sample A, a total mineral content of (3.66%) was found, so there was no significant difference ($p<0.05$) with samples (C, D), Salt added during salting accounts for a large proportion of the ash, calcium forms the structure of the cheese and also contributes to the ash content. Guiné et al., (2015) found gray values that differed from (2.45% to 10.51%). Da Nunes and Santos (2015), on the other hand, found ash values in colonial cheeses of 2.76 to 5.70 that differed from the present study.

Table 3 shows the values of the parameters (L*,a*,b*) in the different samples of fresh cheeses.

Table 3 - Values of the parameters (L*, a*, b*) in the fresh cheese samples

Cheeses	L*	the*	b*
The	90.60±0.80A	-1.75±0.07A	21.84±0.74a
B	92.48±0.27a	-1.42±0.01a	17.07±0.69c
C	91.10±0.87a	-1,45±0,06b	19,27±0,69b
D	92.18±1.04a	-1.04,±0.07C	17,93±1,80b

Source: Author's own.

*[A to C] Different artisanal fresh cheeses sold in fairs in Dourados-MS; *[D] Control;
*Average of three repetitions ± coefficient of variation in %.; * a, b, c, d Distinct superscript lowercase letters in the same column indicate a significant difference ($p < 0.05$) between those of fresh cheeses by Tukey's test.

As can be seen in Table 3, in the color parameter L*, cheeses B (92.48±0.27) and D 92.18±1.04 (control) were the samples with the highest luminosity, with a tendency to whiter. Color is a parameter that indicates the quality of the product and directly influences consumer acceptance. Castilho (2019), evaluating artisanal cheeses, found luminosity values of (L* 77.16 to 89.51) these

values differed from the values found in the present research with fresh cheeses in the city of Dourados.

Regarding parameter a*, it was noted that control sample D differed significantly ($p<0.05$) from the other samples. The values of the parameter a* range from (-1.75±0.07 to -1.04.±0.07). The parameter a* being negative in all samples demonstrates the white color is characteristic in fresh cheeses, as was found. Roncatti (2016), when he developed and characterized typical cheese from the Paraná region, found values for a* of (-7.76 to -6.81) that differed from those found in the present study.

Table 3 shows that for parameter b*, the sample (C) did not have a significant difference ($p<0.05$) with the control sample (D), it is noted that with the other samples (A, B) there was a significant difference ($p<0.05$) with sample D. Castilho (2019), evaluating artisanal cheeses, found values of b* (18.54 to 23.98), which differed from those found in the present research. Figueiredo et al. (2015) found b* values of (25.38 to 35.51) that differed from the present study.

Table 4 shows the parameters found in the instrumental analysis of the texture profile in the fresh cheese samples.

Table 4 - Texture parameters found in samples of artisanal fresh cheeses

Cheeses	Hardness(N)	Cut (N)	Adhesion(N)	Elasticity(N)	Cohesion(N)	Mastigabilidade(N)
A	0.0287±0.00A	0.0413±0.02A	-1.233±0.34A	0.9013±0.04A	0.6433±0.06c	0.0167±0.00A
B	0.2517±0.39A	0.0433±0.01a	-6,595±7,74A	0.9167±0.02a	0,6657±0,03bc	0.1523±0.23A
C	0.0453±0.04A	0.0447±0.03a	-6.921±2.12A	0.8370±0.08A	0.8170±0.02A	0.0293±0.02a
D	0.1527±0.12A	0.1093±0.11a	-5.753±4.18A	0.8917±0.00A	0,7723±0,04ab	0.1053±0.09A

Source: Author's own.

*[A to C] Different artisanal fresh cheeses sold at fairs in Dourados-MS; *[D] Control;
*Average of three repetitions ± coefficient of variation in %.; * a, b, c, d Distinct superscript lowercase letters in the same column indicate a significant difference ($p < 0.05$) between fresh cheeses by Tukey's test.

As can be seen in Table 4, all the cheeses evaluated did not show significant difference by Tukey's test at 5% for hardness. Normative Instruction No. 30/2001 states that fresh cheese must have a compact and soft texture, but does not bring the values for standardization. (BRAZIL, 2001). Sample B obtained (0.2517±0.39 N) hardness, it was the cheese that presented the greatest force to occur to deformation.

Sample A had a hardness value of (0.0287±0.00 N) thus, we can say that it was the softest cheese evaluated, it is possible that during storage the casein network weakens with the increase of proteolysis caused by residual coagulant in the cheese, resulting in a less firm texture. Roncatti

(2016) found values of (12145.88 g) for hardness in the development of typical Paraná cheese, these values differ from those found in this study.

Regarding the cutting strength, it was observed that there was no significant difference ($p<0.05$) for all samples when compared with the control sample (D) (0.1093±0.11). Santos et al. (2020) evaluated the texture profile of curd cheese and found cut-off values of 7.34 N, values high from those found in this study.

According to Table 3, there was no significant difference ($p<0.05$) in the samples when compared with the control sample. Cangussu (2020), found elasticity value (4.0224 N), these values differed from those found for elasticity in the present research that were in the range (0.8217 to 0.9167 N), the same author found adhesion of (1.9959 N), these values differ from the values of the present study.

In terms of cohesiveness, there was no significant difference ($p<0.05$) with the samples (A, B) when compared with the control sample (commercial fresh cheese), and the sample (C) differed significantly with the control sample. The results found for cohesiveness were (0.8170 to 0.6433 N). These values differ from those found by Santos et al. (2020), whose cohesiveness values were (0.481 to 0.547 Luz et al. (2022) found cohesiveness values (0.51 to 0.55 N) that also differed from the cohesiveness of the present study.

Through the analyses performed, it was verified that there was no significant difference for chewability between the samples when compared to the control sample. Sample B showed the highest chewing resistance (0.1523±0.23) and sample A had the lowest chewing resistance (0.0167±0.00). These values differ from those found by Hachiya (2015) who found (7,200 N). Guzman et al. (2015) found a value of (48.4 N) for chewiness in cheeses, whose values also differed from the present study.

Table 5 shows the results found in the microbiological analyses of the samples of fresh cheeses purchased.

Table 5 - Results of the microbiological evaluation of fresh cheeses

Cheeses	**Thermotolerant coliforms (MPN/g)**	**E. coli *Differentiation***	**Totais coliforms (NMP/g)**
The	1,1x 103b	Presence	>1,1x 103b
B	3x10A	-	1.6x102A
C	>1,1x 103b	Presence	1.1x103c
D	<3x10A	-	1.2x102A

Source: Author's own.

*[A to C] Different artisanal fresh cheeses sold in fairs in Dourados-MS; *[D] Control. *Average of three repetitions ± coefficient of variation in %.; * a, b, c Distinct superscript lowercase letters in the same column indicate a significant difference ($p < 0.05$) between fresh cheeses by Tukey's test.

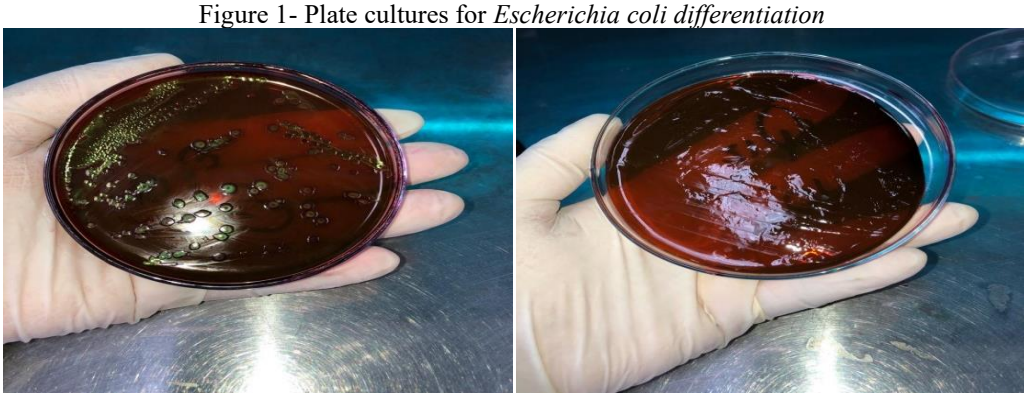
Table 5 shows that for total and thermotolerant coliforms, the sample (B) did not have a significant difference ($p<0.05$) compared to the control sample, while the other samples (A, C)

differed significantly with the control. It should be noted that thermotolerant coliforms belong to the group of microorganisms found in the intestinal tract of humans and other animals, so their presence in this food product justifies the direct contact of the product with feces, thus justifying the risk to human health.

Salotti et al. (2022), found results that indicated that 83.3% of the samples of Minas Frescal cheeses did not meet the standard of the Brazilian legislation. Pinto et al. (2020) observed that 100% of the samples of Minas Frescal cheese produced by hand and under inspection demonstrated the presence of thermotolerant coliforms.

Figure 1 shows the plates with striated cultures for the differentiation of the *E. Coli*. It is considered positive if the crop has a metallic green glow.

Figure 1- Plate cultures for *Escherichia coli differentiation*

A  B

(A) Positive plate B) Negative plate for *Escherichia coli*.
Source: Author's own.

Of the four samples acquired and analyzed as shown in Table 5, the samples (B, D) did not have the presence of *E. Coli*, the other samples confirmed the presence of this enterobacterium.

According to the microbiological standard established by RDC No. 12/2001, it states that the maximum limit of total coliforms and thermotolerant coliforms is 5x102 nmp/g. In the confirmatory test for total and thermotolerant coliforms, tubes that showed gas formation in the Duhram tube were considered positive. Therefore, the samples that were within the standard required by the legislation were the samples (B, D), the others were above the recommended value. Artisanally produced cheeses showed high levels of microorganisms due to improper processing, leading to product degradation and/or reduced shelf life. The microorganisms found are indicative of poor hygiene and sanitation of processing and handling, raw materials, utensils and inadequate equipment. In view of this, the potential risk that the consumption of these cheeses can entail for public health is evident.

Although in Brazil it is considered illegal to sell artisanal cheeses without seals and inspections, the sale of these cheeses is common in the fairs of Dourados-MS. Thus, it became crucial to create awareness programs for cheese producers and sellers, combined with the effective inspection action of the Municipality of Dourados-MS for products of animal origin, in order to

verify compliance with the rules related to the legislation, expand knowledge and bring new ideas and especially raise awareness about the quality of the product and public health.

CONCLUSION

According to the results obtained, it is noted that there is a divergence when it comes to artisanal products, whether this disparity is due to the lack of hygiene (good manufacturing practices), herd management, as well as the lack of training for safe production in its production and commercialization. Starting with the label on the packaging, only the control sample (industrial fresh cheese) was in accordance with the legislation, this lack of care can lead to major problems for the frequent consumer of fresh cheeses. In the microbiological requirement, 50% of the cheeses collected were not in compliance with the legislation, the high microbiological indices evidence inadequate hygienic conditions of production, which can cause food poisoning and other risks to the health of the population. In addition to this problem, it is also possible to perceive the lack of supervision and the commercialization of products without registration. Only 50% of the cheeses collected were in accordance with the microbiological attributes required by law. In view of the above, it is evident that there is a need to create awareness projects for fairgoers who produce and handle cheese and an efficient inspection of the current agencies to properly verify the production and commercialization of these cheeses.

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