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Evaluation of psychotropic microorganisms throughout the steps of production, collections and transport of chilled raw milk

Avaliação de microrganismos psicotrópicos ao longo das etapas de produção, coleta e transporte do leite cru resfriado

Evaluación de microorganismos psicotrópicos a lo largo de las etapas de producción, recolección y transporte de leche cruda enfriada

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Abstract
The objective of this study was to evaluate the count of psychrotrophic bacteria, the composition of the milk and the standard plate count (CPP) in the production links, starting from the rural property until the arrival of the milk to the industry. Fifty-five producers were selected, divided into four routes in the southwestern region of Rio Grande do Sul. A form was applied to the producers to assess the conditions of structure and hygiene in milking and obtaining milk. In the results, the hygiene item of the facilities presented the worst result for the psychrotrophic count. The results of the samples presented for the psychrotrophic count and the standard plate count in the steps followed varied by 1.5 log10UFC / mL and 0.6 log10UFC / mL, respectively. Even with an increase in psychrotrophic and CPP counts throughout the stages, there was no change in the composition of the milk that was delivered to the processing industry. It is important to define actions with the rural producer so that the raw material delivered to the industry arrives with the least possible quality change.
Keywords: Dairy; Refrigeration; Psychotropics.

Resumo

O objetivo deste estudo foi avaliar a contagem dos microrganismos psicrotróficos (MP), composição do leite e contagem padrão em placa (CPP) e contagem de células somáticas (CCS) nos elos de produção, iniciando pela propriedade rural até a chegada do leite à indústria. Foram selecionados 55 produtores para a coleta do leite, divididos em quatro rotas da região sudoeste do Rio Grande do Sul destinado à indústria beneficiadora em SC. Aplicou-se formulário nos produtores para avaliar as condições de estrutura e higiene no manejo de ordenha e obtenção do leite. Nos resultados, o item de higiene das instalações apresentou pior resultado para a contagem de psicrotróficos. Os resultados das amostras ao longo de toda cadeia para contagem de psicrotróficos e Contagem Padrão em Placas nas etapas acompanhadas apresentaram variação de 1,5 log10UFC/mL e 0,6 log10UFC/mL, respectivamente. Mesmo com aumento da contagem de psicrotróficos e CPP ao longo das etapas não houve alteração na composição do leite que foi entregue a indústria processadora. É necessário o acompanhamento dos microrganismos psicrotróficos ao longo de todas as etapas e no futuro a definição de padrões para que a atividade leiteira defina ações para a redução e controle desse microrganismo.

Palavras-chave: Laticínio; Refrigeração; Psicotrópicos.

Resumen

El objetivo de este estudio fue evaluar el conteo de microorganismos psicrotróficos (PM), composición de la leche y conteo estándar en placa (CPP) y conteo de células somáticas (RCS) en los eslabones de producción, desde la propiedad rural hasta la llegada de la leche a la industria. Cincuenta y cinco productores fueron seleccionados para recolectar leche, divididos en cuatro rutas en la región suroeste de Rio Grande do Sul con destino a la industria de procesamiento en SC. Se aplicó un formulario a los productores para evaluar la estructura y condiciones de higiene en el manejo del ordeño y obtención de la leche. En los resultados, el ítem higiene de las instalaciones presentó el peor resultado para el conteo de psicrótrofos. Los resultados de las muestras a lo largo de toda la cadena para conteo psicrotrófico y Conteo Estándar en Placa en los pasos seguidos mostraron una variación de 1.5 log10UFC/mL y 0.6 log10UFC/mL, respectivamente. Incluso con un aumento en el recuento psicrotrófico y CPP a lo largo de las etapas, no hubo cambios en la composición de la leche que se entregó a la industria procesadora. Es necesario monitorear los microorganismos psicrotróficos en todas sus etapas y, a futuro, definir estándares para que la actividad lechera defina acciones para la reducción y control de este microorganismo.

Palabras clave: Lácteos; Refrigeración; Psicotrópicos.

1. Introduction

Milk production has been reaching a quick and constant technological evolution (Ângelo et al., 2014) and though facing challenges, the activity has been standing out in the agriculture market, contributing to the income of families in the field, to the country's economy and to the development of producing regions (Matte Júnior & Jung, 2017). Milk is considered an important food for the human diet, as it is rich in nutrients in relation to its energy supply (Lima *et al*., 2016). Due to nutritional value, milk and derivatives are inserted in the diet of a significant number of people, being a rich culture medium, largely used in the food industry (Franco & Landgraf; Jay, 2005), though if it is not produced and benefited in a hygienic way, it can cause damage to human health (Jesus et al., 2020).

Raw milk, due to its high nutritional value, provides a good way for the development of different types of microorganisms (Yuan et al., 2019). According to studies that evaluated raw milk, 169 species of microorganisms were identified (Neubeck *et al*., 2015).

Through the implantation of IN 51/2002 (Brasil, 2002) and IN 62/2011 (Brasil, 2011), standardization of raw refrigerated milk production has been regulated, defining standards to be reached by milk producers and standardization of the collecting and transportation stage. More recently, two new norms were published: a) Normative Instruction n° 76/2018 (Brasil, 2018a) that defined which characteristics and identity should be presented by raw refrigerated milk, pasteurized milk and pasteurized milk type A; b) Normative Instruction n° 77/2018 (Brasil, 2018b) that stablishes criteria and procedures for the production, packaging, conservation, transportation, selection and reception of raw milk in establishments registered in the official inspection service. For Vallin et al. (2009), flaws in management of animals, milking, inadequate sanitation and temperature control of milk storage, become important indicators to the quality of this product.

The refrigeration of raw milk and its storage under these conditions is a practice applied worldwide, in order to control the development of mesophilic and thermophilic microorganisms (Yuan et al., 2019). Consequently to the implementation of milk refrigerating systems in properties, there was the alteration of bacterial flora in the raw material (Espindola *et al*., 2020), which before was composed basically by mesophilic microorganisms, reaching also psychotropic microorganisms (Kumaresan et al., 2007).

Kumaresan et al. (2007) verified that refrigerating of milk at 2 ºC might complicate psychotropic multiplication, as well as reduce its proteolytic and lipolytic action, though only if its initial number is < 1,000 UFC.mL^{-1}. The psychotropic microorganisms are producers of protease and lipase enzymes resistant to the thermic processes employed by industries, degrading respectively proteins and fats, causing irreversible losses in the quality of milk and derivates (Alvarenga et al., 2019).

The development of psychrotrophic bacteria under strong interference from factors such as animal husbandry, which include water, food, air, bedding, and hygiene with milk and machinery (Lan *et al*., 2017). A highly concentrated animal feed influences the microorganisms present in the milk, causing a high amount of psychotrophic bacteria (Zhang et al., 2015).

In this regard, this study had the goal of evaluating the counting of psychotropic microorganisms, milk composition and Plate Count Agar (PCA) in refrigerated raw milk collected on rural property, first journey transportation, stored on refrigeration station and its transportation to the processing industry. There was also the objective of evaluating the structure and hygiene conditions in management of milking by producers who provide raw material to the beneficiary industry.

2. Methodology

There were selected only the first 4 routes that arrived at the refrigerating station, and there were collected raw refrigerated milk samples of a group of 55 producers with coverage in 13 municipalities in Northwest RS. This selection was necessary to gather minimal volume of milk to be set to the beneficiary industry in SC. The timeframe of experimental research was from June to November 2018. The study is classified as descriptive and experimental (Gil, 2010).

The first step of this research consisted of defining the rout of milk collection with the selection of producers. Next there were visits to the rural producers to apply the evaluation form of structure and hygiene conditions in the management operations, in accordance to Chart 1. The visits to properties to apply the form, made by the region's technical team, had the goal of evaluating, in a visual manner, conditions of property structure and hygiene in management operations, through criteria of good, regular and bad. The criteria "good" in the formulary evaluated if the producer did milking and hygiene procedures and kept a clean and adequate workspace. For the "regular" concept, it was evaluated if the producer didn't perform in adequate manner any of the milking and hygiene procedures, or if it was evidenced that the environment wasn't organized. For the "bad" concept, it was evaluated the lack of any of the tools for milk management, such as paper towels, detergents, hygiene problems in equipment and installations, as well as organization of the workplace.

The steps of sample collection followed the procedures defined by the field manual for collecting raw refrigerated milk samples by the Centralized Laboratory of Milk Analysis of PARLPR (Horst & Moro, 2018). It was also utilized, as reference, the document 150 of Embrapa that addresses the Procedure for collecting milk samples for CCC, CBT and detecting antibiotic residue (Dias et al., 2014).

For each truck there was the following of a field technician who performed the collection of milk samples in the selected properties. In each collection on property the refrigerated raw milk had its temperature verified by a smart digital thermometer (brand Testo), performed the homogenization by mechanical agitator of refrigeration equipment, during five minutes in expansion thanks, or manually through ten movements up and down in equipment of refrigeration by immersion (Santos & Fonseca, 2007; Dias et al.,2014). For the sample collection on refrigerating thanks (expansion or immersion) it was

utilized an scoop made of stainless steel, with a smooth surface and round corners properly cleaned, being sanitized with chlorinated water (50 ppm) (Menegaro *et al*., 2016), always performing the ambiance of the scoop on raw material before the collection.

Chart 1: Form of rural property evaluation.

DAIRY	VERIFICATION LIST OF THE MILK PRODUCER		
1. PRODUCER Date and time of the verification		SIF received by the milk:	
Name:		Registration number:	Rout:
Address:	Municipality:	State:	Phone:
2. MILKING 2.1. Nº of animals in milking:	2.2. Number of milkings:	2.3. Liters of milk/day:	
2.4. Equipment – Type: □ Manual □ Bucket at feet □ Pipeline Observations:	2.5. Equipment – Hygiene: □ Good □ regular □ bad Observations:	2.6. Water: source _____ □ Treated (chlorinated) □ not treated □ Hot water for equipment hygiene □ yes □ no □ Known potability (has been analyzed) □ yes □ no	
2.7. Walls – Type:		2.8. Floor – Type:	
2.9. Basic hygiene conditions of the installations: □ Good □ regular □ bad Observations:			
3. MILK STORAGE – REFRIGERATION EQUIPMENT			
3.1. Type: □ Expansion □ Immersion □ other _	3.2. Capacity: _____	3.3. Milk temperature: Measured: ___ºC. Recorded by the equipment: ____ºC. 3.4. Alizarol: _____	
3.4. Hygiene condition: □ Good □ regular □ bad Observations:			
4. MILK COLLECTION – TRANSPORTER			
4.1. ( ) 24 hour ( ) 48 hours		4.2. Approximated time:	
5. CLIMATE CONDITIONS OF THE REGION:			
5.1. Medium T°C of the region:		5.2 Rainfall index of the region:	
6. MILK STATION		6.1 Time of arrival at the route:	
6.2 Unloading time:		6.3 T°C of arrival at the station:	
6.4. Which silo was unloaded of milk:		6.5 Silo condition:	
6.6 T°C of the Silo:		6.7 Storage time:	
6.8 Unloading of the truck time:		6.9 Exit of the truck time:	
7. INDUSTRY		7.1 Arrival of the truck time:	
7.2 T°C of arrival at the industry:		7.3 Unloading time:	
Technician responsible for the visit:		**Producer:**	

Source: Authors.

For each producer, there were collected a sample for psychotropics, centesimal composition (fat, protein, lactose, dry total extract, dry degreased extract), SCC and PCA. The samples for centesimal composition, SCC and PCA were stored in sterile vials, there were collected 300 mL of refrigerated raw milk in sterile sacks 3M. After collecting, the vials and sacks were packaged in refrigerators (4,0 °C ± 2 °C) made of stainless steel for transportation of milk samples installed in the trucks. At the arrival of trucks at the milk station, the samples collected on rural properties were packaged in refrigerator with temperature 4,0 °C ± 2 °C until shipping to the laboratory for analysis.

To perform the collections at the milk station, the truck went first through external cleaning, being subsequently sent to the reception and analysis platform. Afterwards, with an manual agitator of stainless steel was done the milk homogenization for at least 5 minutes to conduct the collection. Later, there was the measurement of milk temperature and ambience of the stainless steel scoop, performing the sample collection in volumes equal to 300 mL for truck compartment. The truck samples were made in composed form. This procedure was repeated 4 times. The milk was unloaded through aseptic pump and sent to the storage silo, where the milk stayed storage in temperature of 2,4 °C. The collections at the silo were made through the exit register at the lower part, where it was sanitized externally and stayed opened for around 1 minute for subsequent sample collection. There were 4 psychotropic samples collected, centesimal composition, SCC and PCA. For each collection there was a break of around 3 minutes.

The storage of milk in the silo, for around 90 minutes, it was carried out the loading of the truck with the processing industry as destination. For sample collection, both in the milk station and in the industry, the procedure performed was the same followed in the routes. After collection, the samples were packaged in refrigerator at 4,0 ± 2 °C and subsequently shipped to the laboratory for analysis. Afterwards, the truck was freed for transportation of the milk to the industry distant by around 140 km, at the West of Santa Catarina. In this study, three times happened the complete path between milk producer, going through the refrigeration station, to the arrival at the processor establishment, in different days, causing a variation in the number of producers and consequently in the volume collected. This variation is due to alterations that milk routes go through for the necessity of adjust the routing of paths.

The samples of psychotropic microorganisms were sent to the Microbiologic Laboratory of Food of the industry and followed the methodology defined by the Manual of microbiologic analysis of food and water (Forsythe, 2013) and the composition samples, SCC and PCA were sent to RBQL's laboratory in Curitiba. The PCA analysis were made through quantitative determination through the method of flow cytometry (IDF, 2004) in an electronic counter BACTOCOUNT – IBC (Bently Instruments Inc.). For the evaluation of centesimal composition: fat, protein, lactose, total solids, non-fats solids and casein, and SCC analysis were made on the equipment SOMACOUNT 500 (Bentley Instruments Inc.), through techniques of flux cytometry and infrared absorption (IDF, 2000). The data, both in the form applied to producers, as well as in the analysis in each followed stage, were submitted to variance analysis utilizing the procedure MIIIXED from the statistic package SAS®, being previously tested for residue normality through the Shapiro-Wilk test. The averages were compared through the Tukey Test and considered different if $p \leq 0,05$. The PCA and Pm were expressed in logo 10 UFC/mL.

3. Results and Discussion

In the evaluation of the idicators of the applied form, the results presented on Chart 2, demonstrate points verified on the rural properties, their percentage of participation and PM variation.

The milk's quality is related to animal care and feeding, hygiene with the machines used for milk collection and milk storage (Lan *et al*., 2017), and in accordance it is observed that the biggest impacts in variation of PM, through application of the form to producers, are related to conservation and hygiene of the refrigeration system, installations hygiene, use of chlorinated water, and hygiene of the milking equipment. When comparing models of refrigeration tanks, where the expansion system is the majority, it is verified that the variation is not significative in the PM evaluation, which reinforces that the impact on milk quality refers to handling, conservation and hygiene of equipment and environment, have greater relevance at the quality of raw material produced. Milk with low bacterial count can go through alterations when the measures of equipment hygiene aren't followed (Netto et al., 2009). Carvalho and Silva (2013) and Reche *et al*. (2015), conclude that flaws at maintenance of equipment and utilized tools and problems related to infrastructure, present relation to the milk quality and

high bacterial count. This demonstrates that a minimal structure and investment condition is fundamental to the production of milk within the standards.

Chart 2: Results of the evaluated items in the form at rural property.

Evaluated Item	*PM (log UFC/mL)	% of partip.
Evaluation of hygiene at the installations – good	4,04±0,17	69
Evaluation of hygiene at the installations – regular	5,27±0,20	31
Evaluation of hygiene at the refrigeration tank – good	4,11±0,19	55
Evaluation of hygiene at the refrigeration tank – regular	5,14±0,21	45
Use of chlorinated water for cleaning – yes	4,18±0,19	58
Use of chlorinated water for cleaning – no	5,12±0,22	42
Higiene do equipamento de ordenha – bom	4,26±0,19	58
Higiene do equipamento de ordenha – regular	5,02±0,23	42
Conservação do sistema de ordenha – bom	4,53±0,16	89
Conservação do sistema de ordenha – regular	4,97±0,47	11
Evaluation of T°C of milk at collection – less than 4,0 °C	4,43±0,18	69
Evaluation of T°C of milk at collection – more than 4,01 °C	4,91±0,27	31
Milking system bucket at feet	4,78±0,17l	73
Milking system pipeline	4,02±0,28	27
Cooling system utilized – expansion	4,56±0,16	89
Cooling system utilized – immersion	4,73±0,47	11
Conservation of the cooling system – good	4,44±0,16	85
Conservation of the cooling system – regular	5,41±0,39	15
Milk collection - 24 hours	3,93±0,37	16
Milk collection - 48 hours	4,70±0,16	84

*PM: psycotrophic microorganisms. Source: Authors.

From results of the 3 collections, weighted averages by producer were made. The results of PCA and psychotropic analysis on rural producers are presented on Figure 1 and 2.

The maximum values for PCA and psychotrophic count were 6,76log10UFC/mL and 7,04log10UFC/mL, respectively. The minimun value found for PCA and psycotrophics at the samples of the producers were 2,17log10UFC/mL and 3,85log10UFC/mL. It is noted in these values that the PCA results are more stable, with less variation among producers, compared to PM results. One of the points that contribute to this condition is due to the fact that we have a legislation with a defined limit to this analysis, of 3,0 x 10^5 UFC/mL for milk from the refrigerated tank at rural property (Brasil, 2018a). Another important point is the technical assistance and knowledge of the producer regarding PCA. When we evaluate the PCA results, it evidences an increase in all followed stages, tough with less intensity, being under the standard. In the milk that was sent to the industry, this value was also within the expectation, according to Chart 1, since the IN nº 77/2018, defined the standard of 9,0 x 10^5 UFC/mL for milk before processing.

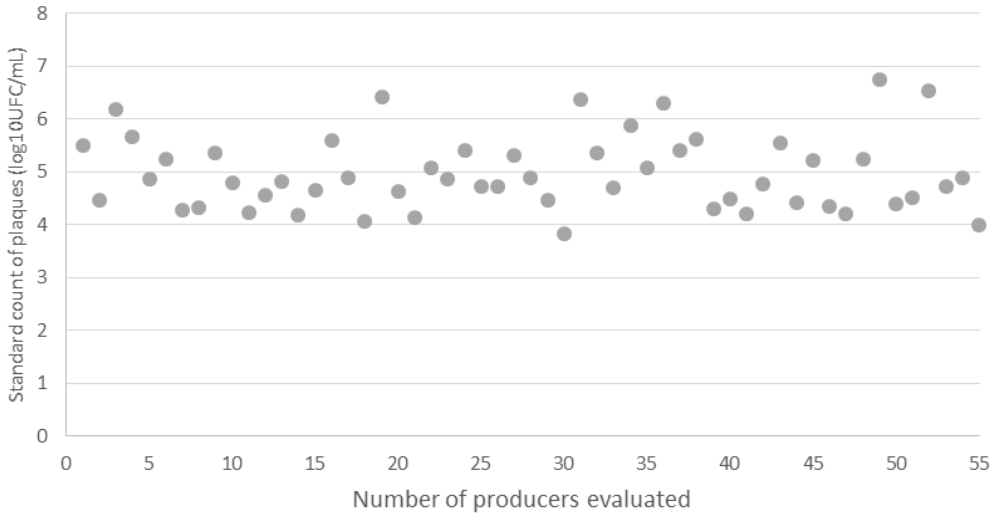
The results of psychotropic microorganisms present a different behavior. Individual results of the producers had a greater dispersion throughout the study (Figure 2), when compared to the PCA values (Figure 1).

The concentration of psychrotrophic bacteria microorganisms are one of the biological parameters that indicate the bacterial quality of raw milk. Values above 1.3 x 10^5 CFU/mL are high, which can lead to poor milk quality in the storage and transport stages (Marchand *et al*., 2009).

As there isn't a limit defined by legislation of PM for raw refrigerated milk, it is important to follow this property indicators, transport and industry for evaluation of impacts at the activity.

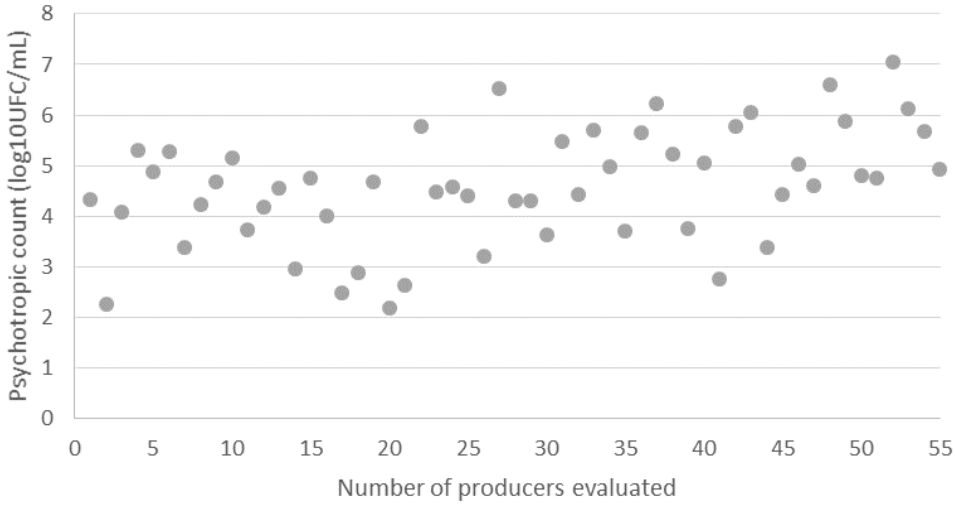
High counts of psychotropic microorganisms and PCA indicate problems of obtaining of this raw material, especially at management operation and hygiene at the operations (Pinto et al., 2006). A study made by Decimo et al. (2014) demonstrated that milk management and storage conditions and cooling of raw milk are important factors that determine the composition of microbial load.

Figure 1: Standard count of plaques within the selected producers.



Source: Authors.

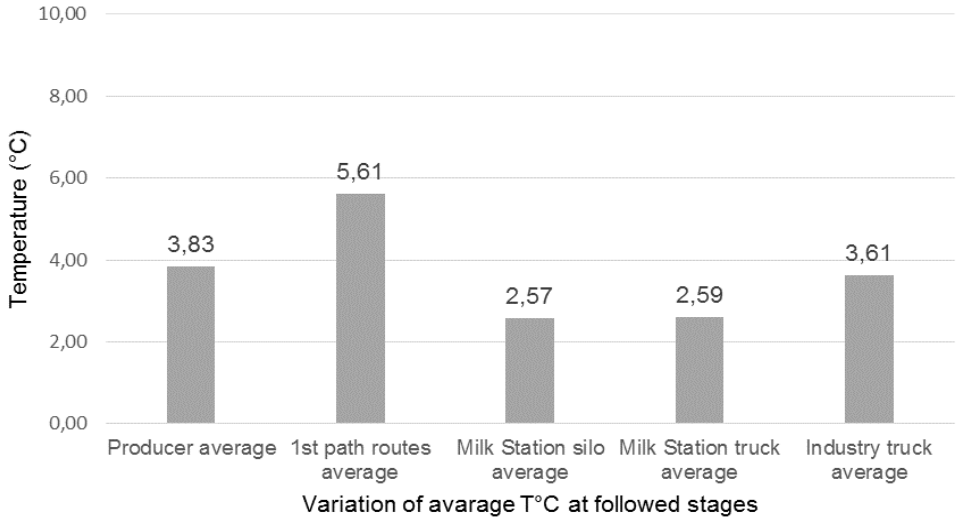
Figure 2: Psychotropic count within the selected producers.



Source: Authors.

Figure 3 presents the results of avarage temperatures verified in each collection stage from property to industry.

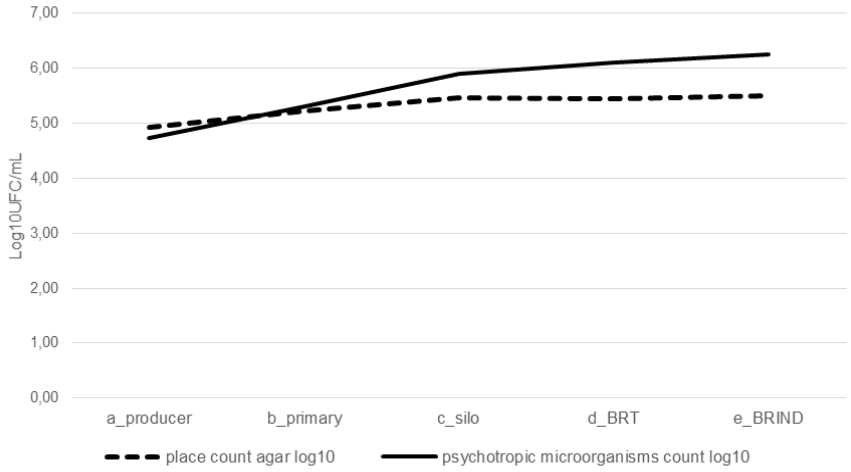
Figure 3: Evaluation of average temperature at each followed stage.



Source: Authors.

The temperature variation on the studied stages demonstrate that there is an accentuated gain between rural producer to the arrival of milk at the refrigeration station. This temperature rise directly influences the rise of microbial load of the raw material. The effects of low temperatures over food are reverted once that the temperature arises again, allowing the return of bacterial development (Alvarenga, Zanela & Ribeiro, 2019). Pinto, Martins & Vanetti, (2006), concluded that 16,7% of milk samples from producers of collective tanks had their temperature above the limit set by legislation. In this study, 31% of milk samples (Chart 1) had temperature above 4,0 ºC, which demonstrates a problem that the producer has on milk conservation within the standards of legislation. The behavior of PM and CPA through the chain are presented on Figure 4. It can be noted that the variables studied here tend to an evolution to the same direction, though not with the same growth rate.

Figure 4: Growth of place count agar (PCA) and psychotropic count (PM) through the dairy chain.



Source: Authors.

The PM growth went from 4.74 log10UFC/mL at rural property to 6,26 log10UFC/mL at the arrival of milk at the industry, with a rise of 1,5 log. For PCA, the values at rural property went from 4.93 log10UFC/mL, going to 5.51 log10UFC/mL, a rise of 0.6 log, a value 2.5 times lower than the PM growth. Mörschbächer et al. (2017), conclude that milk at the followed rural properties presented a greater quantity of mesophiles and that, after transportation to arrival at the

beneficiary industry, the dominant microorganisms became the psychotropics. Santos *et al*. (2009) identify that the psychotropic microorganism count was higher than the maximum limit set by TBC of raw refrigerated milk. After evaluation the results obtained the centesimal composition analysis (fat, protein, lactose, total dry extract and degreased dry extract), according to Table 1, it is verified that even with a rise of psychotropic count and of CPA, there wasn't a meaningful variation at the results of centesimal composition throughout the stages, they are within the standards set by NI 77/2018.

Study made by Pinto et al. (2006) found results similar to the ones n this study, for psychotropic count at raw refrigerated milk, of 4,49 Log10UFC/mL, 4,70 Log10UFC/mL and 6,20 Log10UFC/mL respectively at refrigeration tanks and storage silos. The presence of elevated psychotropic counts can interfere directly at the quality of milk and final products (Ângelo et al., 2014).

Despite the constant growth of PM, there wasn't any variation at the results of milk composition, and the results found at the present study evidence that hygiene conditions of production and storage, transportation and refrigeration, at different stages at the milk production chain, are not adequate do minimize the microbial contamination and growth of psychotropic microorganisms, requiring the implantation of a strict control of cleaning and hygienization at all the stages to secure a low microbial load.

Table 1: Average ± standard deviation at the average of quality indicators for the results of rural property, 1st path trucks, storage silos, 2nd path truck at the milk station and second path truck at the industry.

Parameters	1*	2*	3*	4*	5*	6 - Standard
Fat (g/100g)	3,69±0,053a**	3,73±0,053a	3,67±0,107a	3,68±0,107a	3,66±0,107a	Min. 3.0
Protein (g/100g)	3,28±0,026a	3,25±0,026a	3,26±0,035a	3,26±0,035a	3,26±0,026a	Min. 2.9
Lactose (g/100g)	4,57±0,031a	4,55±0,031a	4,57±0,063a	4,56±0,063a	4,57±0,063a	Min. 4.3
TDE (g/100g)	12,49±0,067a	12,44±0,067a	12,43±0,098a	12,42±0,098a	12,41±0,098a	Min. 11.4
DDE (g/100g)	8,79±0,047a	8,71±0,047a	8,77±0,086a	8,75±0,086a	8,76±0,086a	Min. 8.4
SCC (log 10CS/mL)	5,70±0,044a	5,66±0,044a	5,66±0,053a	5,63±0,053a	5,64±0,053a	Max 5.70
PCA (log 10UFC/mL)	4,93±0,244b	5,23±0,244ab	5,47±0,305a	5,44±0,305a	5,51±0,305a	Max 5.48
Psychotropics (log 10UFC/mL)	4,74±0,307b	5,30±0,307ab	5,91±0,581ab	6,10±0,581a	6,26±0,581a	Max 6.0^{7}

[1] = Weighted values of rural properties.
[2] = Values obtained through analysis of the milk of each first path truck.
[3] = Values obtained through analysis of the milk of the storage silo, which represented a sample of the total capitation of the followed routes.
[4] = Values obtained through analysis of the milk of the second path truck at the milk station.
[5] = Values obtained through analysis of the milk of the second path truck at the industry.
[6] = Values defined by the Normative Instruction 77.
[7=] Limits set according to studies made by Nörnberg, Tondo, Brandelli, (2009).
* The weighted value at rural properties was obtained through multiplication of each component with its volume delivered at the milk station, divided by total volume of producers.
** Distinct letters at the lines differ statistically through the Turkey test at 5% significance.
Source: Authors.

4. Conclusion

The evaluation alongside producers highlighted the necessity of alignment of the process of hygiene of equipment, work environment and conservation of equipment and installations. Among the evaluated items, those who present the greatest

results for psychotropics were conservation of the refrigeration tank, hygiene of milk production installations, hygiene of refrigeration tank, use of untreated water and hygiene condition of milking equipment, with values of 5,41±0,39 log10UFC/mL, 5,27±0,20 log10UFC/mL, 5,14±0,21 log10UFC/mL, 5,12±0,22 log10UFC/mL e 5,02±0,23 log10UFC/mL, respectively.

The microbiologic quality of milk presented variation throughout all the followed stages. The psychotropic microorganisms count among the rural producer, going through the milk station until its arrival at the industry, presented a rise of 1,5 log10UFC/mL. For the Place Count Agar there was a rise of 0.6 log10UFC/mL. The alteration of microbial load of the milk didn't alter in a significative way the centesimal composition of the raw material received by the industry, staying within the legislation standard. For the psychotropic count the results pointed to a constant growth, since the producer to the industry, requiring the implantation of actions for adjusting this indicator throughout the chain, so that we can advance with the improvement of milk quality and food safety.

An important point for the evolution of the dairy activity is to establish, from researched data, a standard for psychrotrophic microorganisms in the legislation, in view of the great importance for the activity, given its characteristic of surviving industrial heat treatments, acting in a negative way in the final quality of dairy products.

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