



Milk quality in small farms from Southern Region of Brazil

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ABSTRACT: *This study aimed to evaluate some physical chemical aspects of chilled raw milk that meet Brazilian quality standards in smallholder farms from southern Region of Brazil. The fat content, crude protein (CP), total solids (TS), somatic cell count (SCC), and total plate count (TPC) of the chilled raw milk from 78 smallholder farms was analyzed between Oct 2014 and Feb 2017. It was found that 96% of the samples met the Brazilian regulations for fat content, 87% for CP, and 91% for TS. The mean values of TPC and SCC were higher than the maximum limits established by Brazilian regulations. Smallholder farms from Southern Region of Brazil produce milk with an adequate standard for the main chemical indicators. However, there is an important gap in compliance with hygienic-sanitary practices, leading to high levels of chilled raw milk that does not meet the limits of Brazilian regulations.*

Key words: somatic cell count, total plaque count, fat.

Qualidade do leite em pequenas propriedades da Região Sul do Brasil

RESUMO: *Objetivou-se avaliar alguns padrões físico-químicos do leite cru refrigerado em relação ao atendimento aos padrões de qualidade brasileiros em pequenas propriedades da Região Sul do Brasil. O teor de gordura, proteína bruta (PB), sólidos totais (ST), contagem de células somáticas (CCS) e contagem total em placas (CTP) do leite cru refrigerado de 78 pequenas propriedades foram analisadas mensalmente entre outubro de 2014 e fevereiro de 2017. Verificou-se que 96% das amostras atenderam às regulamentações brasileiras para teor de gordura, 87% para PB e 91% para ST. Os valores médios de CTP e CCS foram superiores aos limites máximos estabelecidos pela regulamentação brasileira. Pequenas propriedades da Região Sul do Brasil produzem leite com adequado padrão para os principais indicadores químicos. No entanto, existe uma lacuna importante no cumprimento das práticas higiênico-sanitárias, levando a altos níveis de leite cru refrigerado que não atendem os limites da regulamentação brasileira.*

Palavras-chave: contagem de células somáticas, contagem total em placa, gordura.

The South is the region of Brazil with the highest milk production (SEAB, 2019). The region formed by the west of Santa Catarina, northwest of Rio Grande do Sul and southwest of Paraná is where the productivity of milk currently grows most in Brazil, due to the favorable climate, qualified labor and the presence of pasture all year round (SEAB, 2019). Milk production in southern Brazil is primarily focused on family farms (PICOLI et al., 2015). Pasture is an

important component in the milk production systems of this region, enabling farmers to have a satisfactory agricultural income (BREITENBACH, 2018). In recent years; however, there has been increased adoption of free-standing confined production systems, such as compost and free stall dairy barns, which enable higher agricultural income owing to the larger scale and quality of milk production in relation to pasture system (WINSTEN et al. 2000).

Confined systems; however, have their disadvantages, one of which is the high cost of implementation (BREITENBACH, 2018), which can limit widespread adoption of these systems within the family farming community. Improving milk quality; on the contrary, does not require major investment because they are closely associated with nutritional and hygienic-sanitary management (KUNDA et al., 2015; KAMANA et al., 2016). Dairy production systems that comply with quality regulations have higher productivity and better bargaining power with the industry for the marketing of milk (DEFANTE et al., 2019). In addition, non-conformity with quality regulations prompts dairy producers to operate in the informal market or even abandon the activity (SOUZA & BUAINAIN, 2013).

Information on the quality milk, in this context, is of great value to guide corrective and improvement actions. Thus, the objective of this study was to evaluate some physical chemical aspects of chilled raw milk produced by smallholder dairy farms that meet Brazilian quality standards in the Southern Region of Brazil.

The characteristics of milk collected from 78 family farms were analyzed monthly between Oct 2014 and Feb 2017 (29 months), which corresponds to a monthly analysis of one refrigerated raw milk sample per farm. Milk quality variables were provided by a commercial milk receiving unit (dairy) with a Federal Inspection System (FIS), located in Mariópolis, Paraná, Brazil. Quality analyses were conducted by an accredited institution according with the official methods of the Ministry of Agriculture (BRAZIL, 2011).

The farms were located in the municipalities of Mariópolis, Pato Branco and Clevelândia, within the state of Paraná, and in São Domingos in the state of Santa Catarina (Figure 1). Dairy farms were selected from a list provided (170 properties) by commercial milk receiving unit, using the criteria showed in table 1. We chose to select small dairy farms with family labor, using the farm size and milk productivity criteria (NEUTZLING et al., 2017). Additionally, it was decided to select only farms with milk production in pasture and semi-confinement, as described by BREITENBACH (2018).

Five variables were analyzed: crude protein (CP), fat, total solids (TS), somatic cell count (SCC)

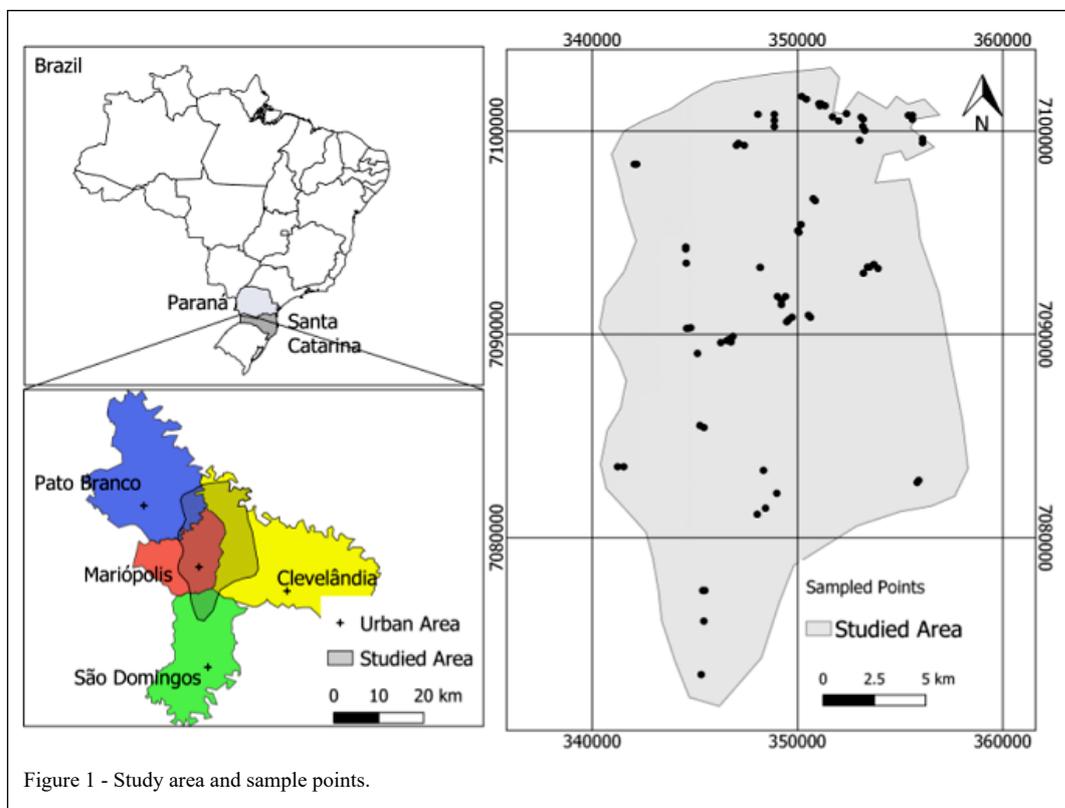


Table 1 - Criteria to select the farms.

Variable	Category	Selected category
Family labor	Yes or No	Yes
Livestock systems	Pasture, semi-confinement or feedlot	Pasture and semi-confinement
Farm size	Absolute value	≤ 20 ha
Productivity	Absolute value	≤ 20 L cow ⁻¹ day ⁻¹

and total plate count (TPC). Descriptive statistics (mean and standard deviation) were calculated for each variable. The data were submitted to a frequency analysis to meet the Brazilian regulations. The average values of crude protein (CP), fat, and total solids (TS) were higher than the minimum requirements by Brazilian regulations (Table 2). When the frequency to the number of samples that exceeded the minimum requirements was analyzed, it was reported that 96, 87 and 91% of the samples met the minimum requirements of Brazilian regulations between Oct 2014 and Feb 2017, respectively. These results also meet the new Brazilian regulations (BRASIL, 2018), valid from May 2019, which remain the same in relation to the previous regulation. These results are associated with the fact that the production systems are based on pastures, use feed supplementation and herds are made up of Holstein and/or Jersey and/or crossbred Holstein × Jersey cows. All of these production system characteristics favor satisfactory values of milk components (WHITE et al., 2001; JAAKAMO et al., 2019).

The average values for somatic cell counts (SCC) and total plate counts (TPC) were higher than the limits in the Brazilian regulations (Figure 2 and 3), demonstrating that hygienic-sanitary management is deficient. The SCC is affected by incidence of

mastitis and TPC is closely linked with the hygienic aspects of milking (DALEN et al., 2019; KIRKEBY et al., 2019).

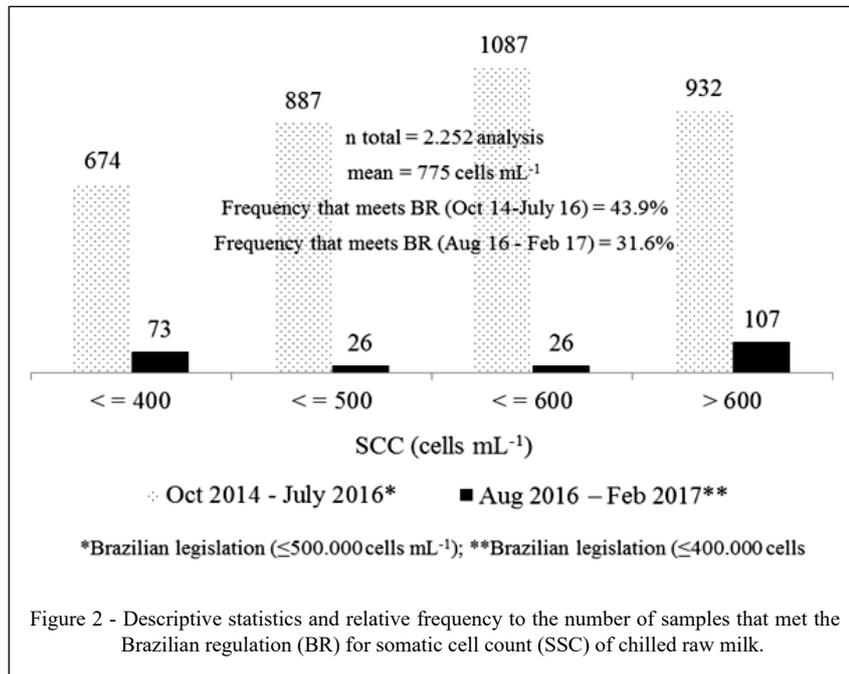
In the period from Oct 2014 to July 2016, it was reported that 43.9% of the samples met the Brazilian regulations for SCC and 56.8% met the requirements for TPC (Figure 2 and 3). Conversely, in the period from Aug 2016 to Feb 2017, it was reported that only 31.6 and 27.7% of the samples met the Brazilian regulations for both SCC and TPC variables, respectively. This reduction was associated with the tightening of Brazilian regulation, which reduced the maximum limits were 500,000 cells mL⁻¹ and 300,000 cfu mL⁻¹ at 400,000 cells mL⁻¹ and 100,000 cfu mL⁻¹ for SCC and TPC, respectively (BRASIL, 2011). This low meet the regulations are certainly associated with the fact that the farms do not receive technical assistance on a regular basis, as was also verified by PICOLI et al. (2015). Small farmers had a greater negligence of the management control and hygienic milk as compared to medium and large farmers (PAIXÃO et al., 2017).

If we consider that little technical evolution has occurred on the farms and that the new Brazilian legislation (BRASIL, 2018), that provides suspension of milk collection from producers if they do not meet the Brazilian regulations (300,000 cfu mL⁻¹ and

Table 2 - Descriptive statistics and relative frequency to the number of samples that met the Brazilian regulations (BR) for crude protein (CP), fat and total solid (TS) of chilled raw milk.

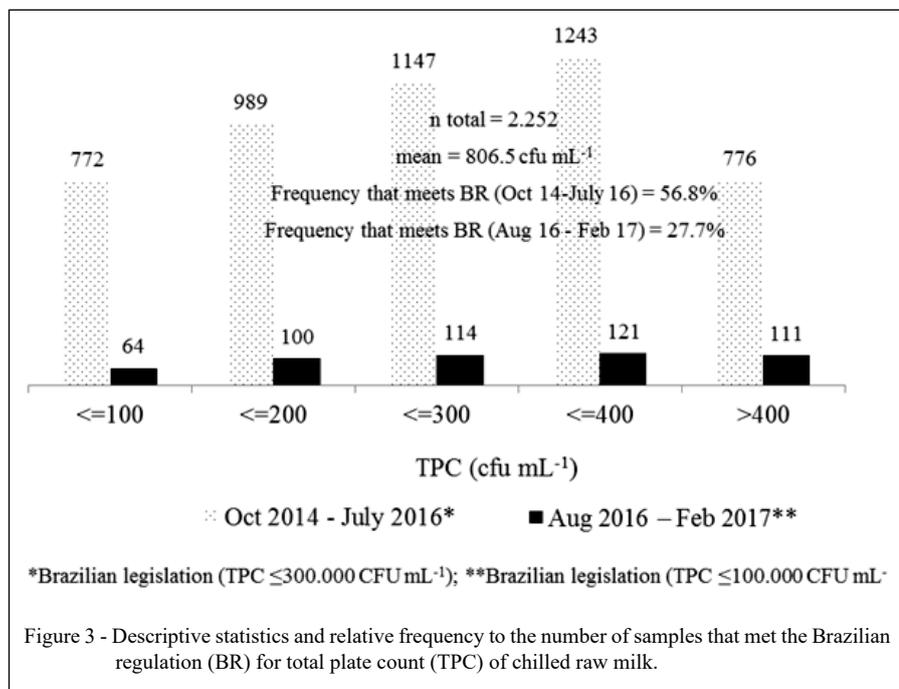
Item	-----Oct 2014 - Feb 2017*-----		
	CP (g 100g ⁻¹)	Fat (g 100g ⁻¹)	TS (g 100g ⁻¹)
Mean	3.20	3.80	12.20
Standard error	0.20	0.40	0.50
Frequency that meets the BR (n ^o)	2162.00	1960.00	2049.00
Frequency that meets the BR (%)	96.00	87.00	91.00

*Brazilian legislation: CP ≥ 2.9 g 100g⁻¹, fat ≥ 3.0 g 100g⁻¹ and TS ≥ 11.4 g 100g⁻¹.



500,000 cells mL⁻¹ for TPC and SCC, respectively), we can assume that the number of producers who will not be able to meet these requirements can be elevated. Arguably, this may result in a concentration

of milk production by large producers, who have production systems that are usually more specialized. This has the potential to have social and economic impacts on family farming in the region. However,



the success of the new legislation will largely depend on the intensification of inspection of commercial milk receiving units, which are responsible for the qualification of milk suppliers and field technicians (BRASIL, 2018).

It was evidenced in this study that smallholder dairy farms in the Southern of Brazil produce milk with an adequate standard for the main chemical indicators. However, there is an important gap in compliance with hygienic-sanitary practices, leading to high levels of chilled raw milk that does not meet the limits established by Brazilian regulations.

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DECLARATION OF CONFLICT OF INTERESTS

The authors declare no conflict of interest. The founding sponsors had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, and in the decision to publish the results.

AUTHORS' CONTRIBUTIONS

The authors contributed equally to the manuscript.

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