Evaluation of the use of good practices in dairy cattle herds*

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ABSTRACT. Oliveira A.A., Seixas L., Azevedo H.C., Teixeira K.M., McManus C. & de Melo C.B. **Evaluation of the use of good practices in dairy cattle herds.** [Avaliação da utilização de boas práticas em rebanhos bovinos leiteiros.] *Revista Brasileira de Medicina Veterinária, 37(1):73-77, 2015.* Universidade de Brasília (UnB/FAV/DINO), Campus Universitário Darcy Ribeiro, ICC Sul, Asa Norte, Brasília, DF 70910-900, Brazil. E-mail: cristianomelo@unb.br

The aim of this work was to evaluate and monitor milk quality using good practices (GP) for milking procedures, and thereby improve sanitary conditions and milk safety during milking process, storage and transportation. For each milk sample, the somatic cell count (SCC), total bacteria count (TBC) and milk components were determined. Initially, 236 dairy farms were monitored in the Tabuleiros Costeiros, Agreste and Semi-arid regions of the State of Sergipe, in the northeast of Brazil. Twenty family farms were then selected for implementation of GP procedures. It was verified that, before the use of GP, only 12.94% of the farms produced milk that had hygienic quality consistent with the legislation in Brazil. The use of GP procedures during milking and subsequent cooling raised this rate to 32.53%. The results demonstrated the importance of a hygiene program during milking, storage and transportation of milk.

KEY WORDS. Milk quality, somatic cell count, dairy cow.

RESUMO. O objetivo deste trabalho foi avaliar e monitorar a qualidade do leite no uso de boas práticas de ordenha (BP) para os procedimentos de ordenha, e assim, melhorar as condições sanitárias e de segurança do leite durante a ordenha, o armazenamento de processos e transporte. Para cada amostra de leite, a contagem de células somáticas (CCS), contagem de bactérias totais (CBT) e componentes do leite foram determinadas. Inicialmente, 236 explorações leiteiras foram monitorados nas regiões dos Tabuleiros Costeiros, agreste e semi-áridas de Sergipe, no nordeste do Brasil. Vinte destas fazendas familiares foram selecionados para a implementação de procedimentos de BP. Verificou-se que, antes do uso das BP, apenas 12,94% das explorações produziram leite que tinha qualidade higiênica consistente com a legislação em vigor. O uso de procedimentos de BP durante a ordenha e refrigeração subseqüente aumentou esta taxa para 32,53%. Os resultados demonstraram a importância de um programa de higiene durante a ordenha, a embalagem e o transporte do leite.

PALAVRAS-CHAVE. Qualidade do leite, contagem de células somáticas, vaca leiteira.

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INTRODUCTION

The Northeast of Brazil, contrary to perspectives, is showing high potential for dairy farming. Nevertheless, there is heavy reliance on importation of milk and its derivatives from other states, as internal production meets only 10% of domestic consumption. The region, mostly due to a semi-arid climate, has been unable to stabilize production which is based on family farms and milk is the vector for integration of small producers in the market (Oliveira et al. 2009). Despite small farm sizes, located mainly in areas with severe climate problems, this activity is a major source of income and the region is becoming an important milk producing area.

The dairy industry constitutes practically the only stable agricultural activity in this region, so it is important to introduce more efficient management systems. Small farms have traditionally produced milk and the semi-arid region is recognized for the industrialization of different dairy products, such as cheese curds, cheese, sweets, among others. These constitute the economic base for the activity and are responsible for maintaining the rural population in the area. Family farming, organic farming and farmers' associations broaden their role by generating employment and income (Leite et al. 2002). The focus on milk quality refers primarily to its inference on the quality of industrial products and the preeminent risk to public health. Well-defined socio-economic prospects and problems for dairy farming in the region are needed, focusing mainly on improvement in quality and safety of dairy products.

The Normative Instruction 62 (IN62 MAPA, 2011) regulates technical procedures for the collection, storage and transport of milk produced in Brazil sets new standards of quality, which should to beachieved gradually, enhancing competitiveness of the farms and opening up new markets.

According to Refsholt et al. (2007), historically, the quality of milk has been defined in relation to product (cheese, fresh milk, yogurt etc) quality. Measurement of this quality has been made preferentially in terms of fat and protein levels, sensory quality, number of bacteria and somatic cell counts. In recent years more focus has been given to items related to quality of production, including product performance, manufacturing and functional properties as well as freshness. Perception is also a part of the term quality. Consumers demand fresh, healthy and safe food, but, at the same time, are concerned about the taste and price of products. The products must also be functional in terms of culinary use. There is growing concern about the health and welfare of animals and the possibility of tracing the product back to the individual farmer. Modern milk production must therefore be aware of and try to meet market demands for the factors above.

This study aimed at monitoring milk quality on dairy farms in Sergipe State and use of the good milking practices to improve sanitary conditions and safety of milk during the milking process, storage and transportation.

MATERIAL AND METHODS

This study has two stages: 1. Monitoring the quality and safety of milk. A diagnosis involving 236 dairy farms, in the municipalities of Arauá, Tobias Barreto, Poço Verde, Ribeirópolis, Frei Paulo, Itabaiana, Pinhão and Carira in Sergipe State, Brazil (Figure 1) was carried out over an 18 month period. Somatic cell count (SCC), colony-forming units (CFU), total bacterial count (CBT), as well as the composition of milk produced were evaluated, as well as fat, protein and lactose at least three times on each farm. 2. Twenty of the above farms were selected for application of actions related to good agricultural practices in pre-milking and milking processes. This was over a six month period (three times before applying GP and three after). The farms were selected by the local cooperatives for both stages of the study. Of the farms diagnosed, three had mechanical milking while the rest had manual. All farms where good practices were applied were family farms and had manual milking.

Milk was collected from the tank(s) on each farm and placed in tubes with bronopol or azidiol, cooled and sent to the Milk Quality Laboratory using an automatic flow cytometer using International Dairy Federation norms (Milk 1995 *apud* Souza et al. 2009).

After the diagnosis carried out on all the farms, twenty small properties were selected to implement GP. Farming procedures studied included health and feed management, pre-milking, milking, storage and distribution of milk. All herdsmen were trained in GP procedures during their normal service for two weeks and were accompanied by technicians for three months. The only difference in the procedure used in the latter stage compared to the first was that milk samples were cooled immediately after milking.

These regulations were defined by Moreira et al. (2007) for this type of service and include techniques for hygiene of the herdsman, the milking environment and milking routine, including cleaning teats, testing for mastitis, pre and post dipping as well as herd management. The farms were supplied with the material necessary to apply the GP such as paper towels, dips, gloves etc. The manual milking Kit (Kit Embrapa de Ordenha Manual®) includes a low cost collection of utensils, parts, inputs and procedures which aid the farmers with small herds meet the parameters defined by legislation. The
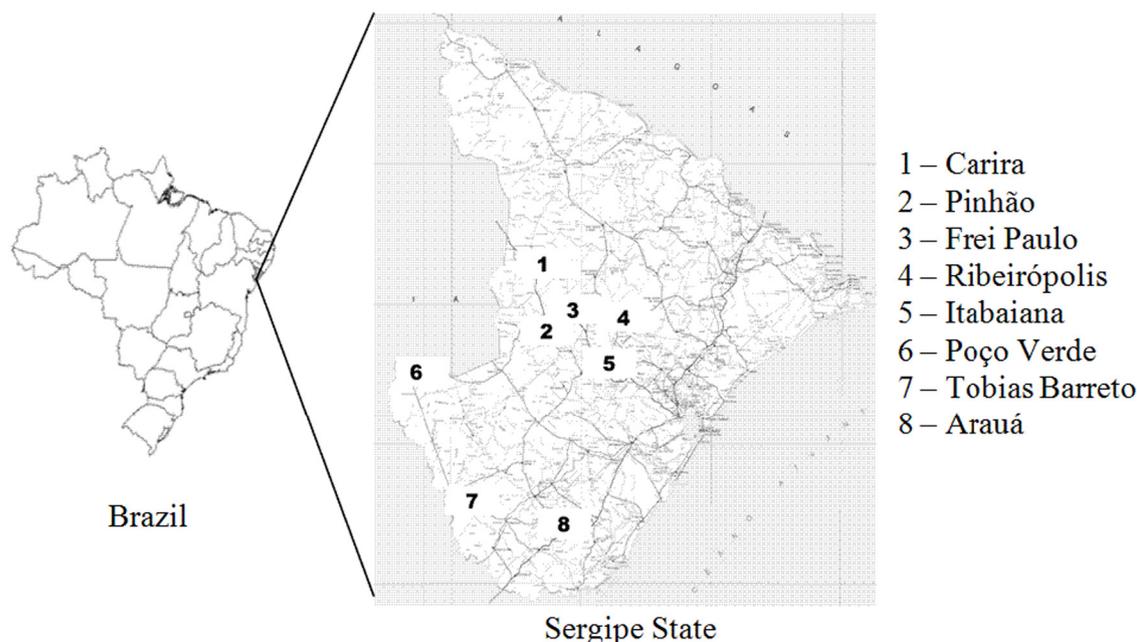
Figure 1. Representation of the localization of the municipalities of Carira, Pinhão, Frei Paulo, Ribeirópolis, Itabaiana, Poço Verde, Tobias Barreto and Arauá in the State of Sergipe, Brazil, 2011.

objective is to produce quality milk, by reducing microbial contamination of raw milk and control of mastitis in small dairy herds. The average cost of the Kit is about US$ 75.00. Maintenance, such as paper towels, commercial chlorine and powdered alkaline detergent, costs approximately US$ 7.00 per month (Moreira et al. 2007).

RESULTS AND DISCUSSION

The results of the 236 farms surveyed (Tables 1 and 2) for milk components and determination of parameters indicative of udder health and milking hygiene show that the average level of the milk solids was 12.3%, above the minimum define by legislation of 11.4%.

The levels of fat and protein in the herds met the standards established by the legislation in more than 90% of cases. This may be associated with the use of feed supplementation, especially during times of fodder scarcity, even though quantity and quality may still be insufficient. Lactation may also be suspended in a herd because of the shortage of forage when there are not sufficient financial resources to meet food demand during the dry season. This is crucial to avoid steep declines in the mean fat and protein content.

In terms of fat content on the 20 farms that underwent GP training (Table 3), the number of farms not meeting regulatory limits fell from 21.4% to 15.5%, but in terms of protein levels, the farms that did not meet the levels rose from 5.2% to 6.7%. These results appear to indicate a need for greater attention on feed offered to these cows in terms of

Table 1. Fat and protein levels in milk from 236 dairy herds studied.

Fat		Protein	
Limits (g/100g milk)	% Farms	Limits (g/100g milk)	% Farms
< 2.99	8.7	< 2.9	8.5
3.00 - 3.59	47.7	2.9< 4.00	90.1
> 3.60	43.5	>4.00	1.3

Table 2. Somatic cell count (SCC) and Colony Forming Units (CFU) in milk from 236 dairy herds.

SCC[1]		CFU[2]	
SCC/mL	Farms (%)	CFU/mL	Farms (%)
<400,000	69.88	<100,000	2.61
< 750,000	20.36	<300,000	10.33
<1,000,000	4.31	<750,000	16.08
>1,000,000	5.45	<1,000,000	4.75
		>1,000,000	66.23

[1] Somatic cell count per mL of milk.
[2] Colony forming units per mL of milk.

quantity and a balanced diet as it was observed that many herds received feed supplementation below that recommended.

In terms of SCC for the 236 farms (Table 2) the results can be initially considered satisfactory because 69.88% of the herds met the levels set in IN 51/2002 for 2012. However, the average production of 4.7 liters of milk per cow per day and daily production of 46 liters per property are extremely low. Other regions show similarly low production levels (McManus et al. 2011, Assis et al. 2005). This is probably due to feed quantity and quality, general herd health, combined with the genetics of the cows produ-

cing milk, as these farmers do not have resources to carry out breed improvement and reproduction is by natural service. In this case animals were *Bos indicus* crosses with some *Bos taurus* (Holstein) blood but of no defined breed or cross and feed was based mainly on buffel grass (*Cenchrus ciliaris*) with the use of forage palm (*Opuntia spp*) and corn silage in the dry season. It was also seen that the greater the specialization of the farm for milk production (in terms of daily production), the higher the production indices and this was accompanied by increased health problems, particularly mastitis, increasing somatic cell count (SCC) levels. For quality control, the increase of SCC in milk is the main marker for the detection and diagnosis of mastitis (Viguier et al. 2009, Le Maréchal et al. 2011).

SCC (Table 2) can be considered important if compared to results found by other authors. Vallin et al. (2009) found an average, before the implementation of good practices on 46 farms studied, 611,913 cells/ mL, and six (13.04%) properties were above the standard allowed. Considering only farms with manual milking, the average was 607,844 cells / mL, and five (15.63%) of 13 samples were above 1,000,000 SCC. On properties with mechanical milking in our study, the average was 621,224 cells/ mL. Only one (3.13%) sample, obtained from the expansion tank, had a score above 1,000,000 cells / mL. Zanela et al. (2006), analyzing dairy herds in Rio Grande do Sul with manual milking and buckets, found an average 803,000 cells/ mL.

With respect to the presence of CFU (Table 2), only 12.94% of properties were within the standards established by IN51/2002. 70.98% of properties had 1,000,000 CFU / mL of milk or higher. Studies in other regions of Brazil showed similar results while some authors found better sanitary management of herds. Vallin et al. (2009) found that, of 46 milk samples analyzed, 21 (45.65%) had UFC above 1,000,000/mL, with an average of 2,410,870 CFU / mL. Considering the farms with manual milking, 14 (43.75%) had more than 1,000,000 CFU / mL, much better results than those found in this work. The highest averages were found by the authors in the milk cooled in expansion and dip tanks, with counts of 3,657,000 and 2,712,429 CFU / mL, respectively. The authors noted that with mechanical milking, seven (50%) of 14 farms showed CFU greater than 1,000,000/mL milk.

Tables 3 and 4 show milk quality constituents obtained before and after application of GP on twenty farms. There was no change in fat and protein quality before and after GP implementation. There

was a slight decrease in SCC / mL of milk for the 400,000 cell limit. However, the same was not observed for UFC, which showed an improvement in hygienic quality, although the results do not show significant differences. This fact shows that despite the in-service training carried out on each farm, the care necessary for GP with the daily milking procedure daily was not applied properly. This was evident by the quantity of material distributed by the project (such as paper towels, chlorine etc) and was found on all farms during routine visits stored in cupboards in a quantity greater than expected for the size of the herd milked. Nevertheless, significant improvements can still be observed when comparing Table 4 with Table 2 for CFU / mL of milk. One factor that clearly contributed to this result was when, after milking, the milk sample was immediately refrigerated to be sent to the laboratory. Numerous reports in the literature suggest that pasteurization failures in the dairy industry are a possible cause for an end product with a poor quality. Studies have been carried out to overcome

Table 3. Fat and protein levels in milk from 20 dairy farms in Sergipe State before and after the application of best practices in milking procedures and with immediate cooling of the milk.

Fat[a]		Protein[b]	
Limits (g/100g milk)	% Farms	Limits (g/100g milk)	% Farms
Before			
< 2.99	21.4	< 2.9	5.2
3.00 to 3.59	35.7	2.9< 4.00	93.5
> 3.60	42.9	>4.00	1.3
After			
< 2.99	15.5	< 2.9	6.7
3.00 to 3.59	37.8	2.9< 4.00	88.9
> 3.60	46.7	>4.00	4.4

[a, b] Percentage of farms in each category before and after BP are not significantly different using chi square test (P>0.05).

Table 4. Somatic cell count (SCC) and Colony Forming Units (CFU) in milk from 20 dairy herds before and after the application of good milking practices in milking procedures and with immediate cooling of the milk.

SCC[1]/mL	Farms (%)[a]	CFU[2]/mL	Farms (%)[b]
Before			
<400,000	73.68	<100,000	29.41
<750,000	17.54	<750,000	60.30
<1,000,000	7.02	<1,000,000	4.41
>1,000,000	1.75	>1,000,000	5.88
After			
<400,000	64.15	<100,000	32.73
<750,000	28.30	<750,000	45.45
<1,000,000	7.55	<1,000,000	16.36
>1,000,000	0.00	>1,000,000	5.45

[1] Somatic cell count per mL of milk.
[2] Colony forming units per mL of milk.
[a, b] Percentage of farms in each category before and after BP are not significantly different using chi square test (P>0.05).

this. Cameron et al. (2009) used ultrasound for eliminating microbes from milk. In France, the probability of a herd having very low somatic cell score (SCS) was maximized when winter cleanliness of dry cow shed was good; use of teat spraying was carried out and California Mastitis Tests was performed at milking. The study highlighted milking and hygiene variables and attitudes appearing as key practices to control herd SCS through precise and safe milking and more attention paid to individual animals and cleanliness of dry cow shed (Chassagne et al. 2005).

Some issues limit the full development of the milk production chain in Brazil. For Oliveira et al. (2010) there are severe infrastructure problems in the production system, mainly related to the electrification and roads, as well as the high cost of farm implements and equipment, training and capacity building, all of which constitute a barrier to the implementation of legislation. In the present study, the reluctance of farmhands to use the supplied material is also a barrier and shows the need for continuous training and monitoring of milk producing establishments.

The results of previous studies (Oliveira el al. 2009, Oliveira et al. 2010) demonstrated the need to urgently implement new practices for pre-milking and milking in herds in Sergipe to significantly improve the standard of care and, consequently, decrease CFU. The improvement in quality after immediate refrigeration of the milk samples collected for laboratory analysis constitutes a clear direction for the farmer. Most of the milk used in the fabrication of dairy products in Sergipe State exceeds the length of time without proper cooling determined by legislation. Thus, we should also consider the need for changes in storage and transportation of milk, added the other measures, which should result in considerable improvement in the quality of milk.

CONCLUSIONS

In the application of good practices related to herd care in the 20 farms studied, the farmers did not use all the recommendations that were passed during the training. However, the procedure for immediate refrigeration of the milk samples collected for laboratory analysis, constituted a clear direction for the farmer to chill the milk within the time period required. In the majority of cases, the milk delivered for making dairy products is found exceed the length of time without proper cooling determined by the legislation.

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