Conjecturas

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Extension team trained to improve milk quality on small dairy farms in Southeastern Brazil

Equipe de extensão treinada para melhorar a qualidade do leite em pequenas propriedades leiteiras do Sudeste do Brasil

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RESUMO

O objetivo do estudo foi avaliar o efeito do treinamento de extensionistas na qualidade do leite de propriedades leiteiras. Durante 12 meses, 240 propriedades da região Sudeste do Brasil foram avaliadas para os parâmetros de qualidade: composição, contagem de células somáticas (CCS) e contagem bacteriana total (CBT). Do total, 60 propriedades foram atendidas por extensionistas que receberam treinamento para melhoria da qualidade do leite, e as 180 propriedades restantes tiveram leite avaliado sem assistência técnica treinada. A diferença entre as propriedades assistidas e não assistidas foi positivamente significativa, principalmente para CCS e CBT. A taxa de rejeição de leite das propriedades não assistidas foi de 59%, enquanto para as propriedades que receberam assistência técnica treinada foi de 49%. Os percentuais de amostras em desacordo com os padrões foram CCS (32%), seguido de CBT (25%), ESD (13%), gordura (11%) e proteína (5%) das amostras de leite total. A extensão rural é importante para a melhoria da qualidade do leite, realizada principalmente por uma equipe bem treinada.

Palavras-chave: Agricultura familiar; Qualidade do leite; Extensão rural; Vigilância; Treinamento.

ABSTRACT

The aim of the study was to evaluate the effect of training of extension agents to improve milk quality of dairy farms. During 12 months, 240 dairy farms in the Southeast region of Brazil were monitored for milk quality parameters: milk composition, somatic cell count (SCC) and total bacterial count (TBC). Of this total, 60 farms were assisted by a rural extension team who received training related to milk quality improvement, and the remaining 180 farms had only their milk evaluated without any trained technical assistance. The difference between assisted and non-assisted farms was positively significant for all variables studied especially SCC and TBC. The milk rejection rate of non-assisted farms was 59% and for farms that received trained technical assistance was 49%. The highest percentages of samples in disagreement with standards were SCC (32%), followed by TBC (25%), SNF (13%), fat (11%) and protein (5%) of the total milk samples. The rural extension is important for improving milk quality, mainly performed by a well-trained team.

Keywords: Family farming; Milk quality; Rural extension; Surveillance; Training.

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INTRODUCTION

According Brasil (2017), family farming has the capacity to collaborate with the eradication of world hunger and achieve sustainable food security because accounts for 84% of all rural properties in the country and employs at least five million families. Family farming in Brazil is responsible for most of the food that comes to the table of the population such as milk (58%), cassava (83%) and beans (70%). Due to the great importance of the dairy activity for family farming in Brazil, this activity is also the focus of the work of private and public institutions and their extension, research and surveillance professionals.

The current Normative Instruction (NI) No. 76 (BRASIL, 2018) establishes that the milk quality of each farm should be monitored by laboratory analyses to identify problems in the origin, unlike in the past, when the quality of the raw material was only inspected upon milk receipt by the industry and little could be done to correct failures (DÜRR, 2004).

The transfer and diffusion of useful and sustainable production and commercialization technology and techniques to rural producers through educational methods is the mission of rural extension (ARAÚJO, 2007). Thus, the rural extension agent is the key element in achieving these goals, and training is the way to achieve the expected results. In milk production, in line with legal requirements for milk quality, the training of extension agents can bring promising results through the transfer of specialized technology to producers in the form of services, products and processes. Therefore, the aim of the present study was to evaluate the effect of training of extension agents to improve milk quality of dairy farms in the Southeastern region of Brazil.

MATERIALS AND METHODS

This study is exempt from the ethics committee for not handling animals.

A total of 240 farms among 550 milk suppliers from dairy cooperatives in the northeastern region of the State of São Paulo were selected. The selection of farms was based on farmers' responses to a questionnaire for socioeconomic diagnosis of farms, infrastructure and constitutive characteristics of producers. Based on farms classified as small and medium-size farms, mostly related to family farming, farms that would be

visited by trained extension agents to improve milk quality (Dairy Farm Assisted for Milk Quality - DFAMQ) and farms that would have only milk monitored (Dairy Farm Monitored -DFM) were selected. Of these 240 farms, 60 were visited by trained extension agents and 180 farms were only monitored for milk quality. The experiment was conducted between January to December 2012.

Extension training was carried out in a theoretical-practical way addressing the following topics: milking management, reproduction, genetics, nutrition and animal health. These themes were selected according to questionnaire responses filled by producers during the selection process. In the questionnaire, producers were asked to respond if they were interested in participating in a milk quality improvement program, and if the response was positive, they should choose up to five topics that they considered to be of greatest importance for improving dairy activity and milk quality.

Monthly, all farms selected for the DFAMQ group were visited by the extension team who filled the routine questionnaire to evaluate changes in management procedures and in the herd, among other occurrences. In addition to questionnaire filling, milk samples were collected from the expansion tank for composition analysis, total bacterial count and somatic cell count. For farms in the DFM group, the visit comprised only sampling of milk from the expansion tank for the same milk analyses as the other group.

For 12 months, after the training of extension agents, the quality of milk produced in participating farms was monthly evaluated. Each farm had milk sampled directly from the expansion tank in two vials (two types of preservatives), which were then refrigerated and sent to the Milk Laboratory of ESALQ / USP in Piracicaba, SP. All samples were collected by the trained extension agents, participants of the project.

The following analyses were carried out in one of the two milk samples (50mL) from each farm: composition (fat, protein, lactose, fat-free dry extract and milk urea nitrogen) and somatic cell counts (SCC), which sample was preserved with the use of the Bronopol® preservative. The second sample (50 mL) intended for total bacterial counts (TBC) was preserved with Azidiol bacteriostatic preservative (BARCINA; ROS; RINCON, 1987). Throughout the process, from collection to analyses, samples were kept under refrigeration at 4°C. Milk composition analyses (protein, fat, lactose, solids-non-fat) were electronically performed by infrared absorption in Bentley 2000 equipment (BENTLEy 2000, 1995). Somatic Cell countwas performed through electronic counting by flowmetriccytometry, using Bentley Somacount 300 equipment (SOMACOUNT 300,

1995). Total Bacterial Countwas analyzed adopting the flow cytometry methodology using IBC Bactocount equipment.

In the milk quality diagnosis, all statistical analyses were performed using the Statistical Analysis System, version 9.1 (SAS, 2006). The analysis of variables related to milk quality according to trained and untrained producers was carried out in an experimental design with measures repeated in time through PROC MIXED (SAS, 2006).

The values for the milk composition, SCC and TBC were based on the limits established by NI 62, the current legislation at the time the experiment.

RESULTS

During the year 2012, with monthly collections, 2059 milk samples from the 240 selected small farms were analyzed. Table 1 shows the milk quality results for parameters recommended by NI 62 (BRASIL, 2011), comparing farms of the DFAMQ group to farms that were only monitored (DFM), with no recommendation to improve milk quality. Parameters such as fat and fat-free dry extract increased in the presence of the trained extension team, whereas protein had no significant difference ($p > 0.05$). However, for the three parameters, presenting difference or not, values were within recomendend standards (BRASIL, 2011).

Others importants milk quality parameters related to milking hygiene and mammary gland health, represented by total bacterial counts (TBC) and somatic cell counts (SCC), respectively, were also evaluated. The Brazilian legislation established through NI 62 (BRASIL, 2011) that refrigerated raw milk should not exceed the limit of 600 thousand CFU/mL for TBC and 600 thousand cells/mL for SCC (in the period of execution of the present study) in the Mid-western, Southeastern and Southern regions of Brazil. Table 1 shows that there was a positive influence of the presence of trained technical assistance on the properties related to milk quality improvement, with decrease of SCC and TBC ($p < 0.01$). In order to better visualize the effect of the presence of trained technical assistance on the improvement of SCC and TBC, the interaction between time and presence of trained technical assistance (treatment) was used, and this effect was significant ($p < 0.01$) for both counts throughout the experimental period.

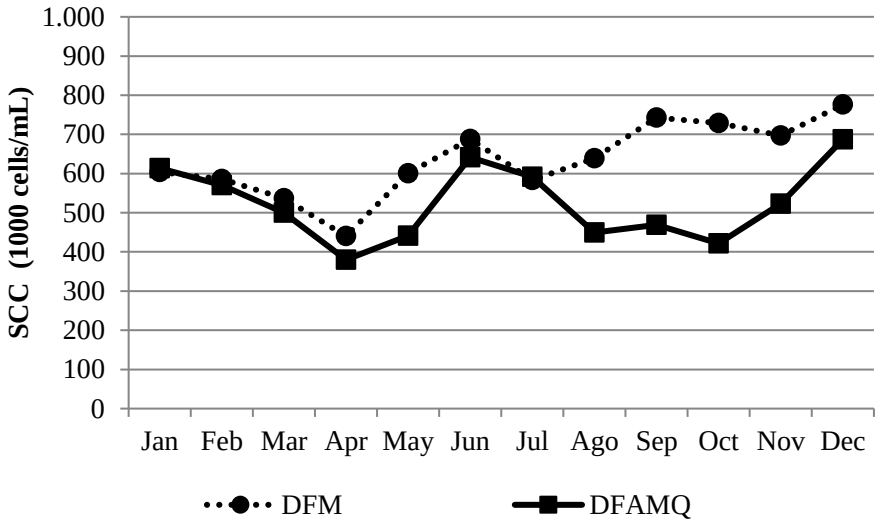
Table 1. Mean values for the Normative Instruction 62 milk quality parameters for the dairy farm groups.

Variable	Dairy Farm Groups		SE	Efeito (*p*-value)
	DFM	DFAMQ		Treatment
Fat, %	3,54	3,60	0,012	0,05
Protein, %	3,24	3,26	0,005	0,11
Solids-non-fat, %	8,64	8,70	0,008	0,01
Somatic Cell Count, x1000 cells/mL	625	523	16,589	<0,01
Total Bacterial Count, x1000 CFU/mL	918	475	38,290	<0,01

DFM – Dairy Farm Monitored; DFAQM – Dairy Farm Assisted for Milk Quality; SE – Standard error.

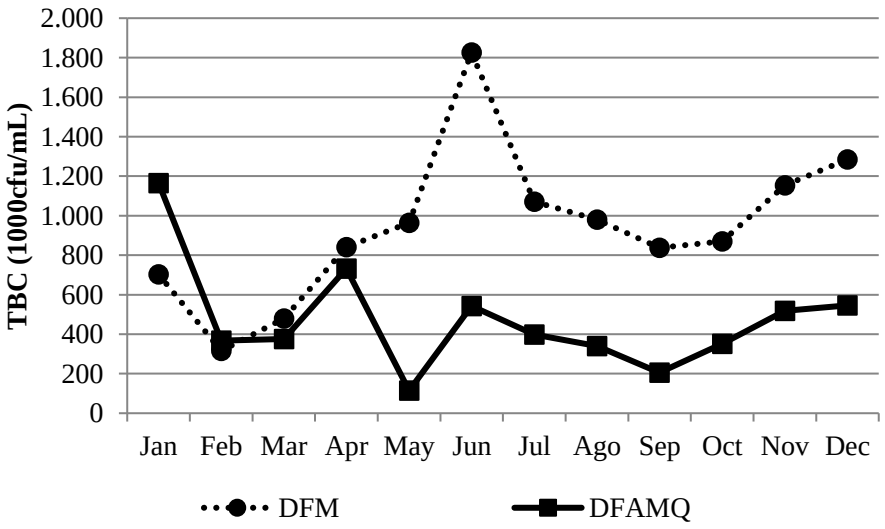
Figure 1 presents SCC data during the experimental period, in which the DFAMQ group presented averages above the minimum limit established by NI 62 (600,000 cells/mL) in the months from June and December. On the other hand, the DFM group presented means above the minimum limit established by NI62 in the month of June and in the period from August to December.

Figure 1. Somatic Cell Count (SCC) of milk samples from dairy farms that received (DFAMQ) or not (DFM) trained technical assistance for milk quality during the year of 2012 in the São Paulo State.



Another parameter with satisfactory result due to the presence of trained technical assistance was TBC, which presented significant decrease throughout the study. Figure 2 shows TBC data during the experimental period, in which the group that received trained technical assistance presented averages above the limit stipulated by NI62 in the months of January and April. On the other hand, the DFM group presented averages above the limit stipulated by NI62 in the months of January and in the period from April to December. The impact of training on TBC was much higher than in SCC, with significant difference between groups of 472 thousand CFU/mL, indicating an effective improvement in the milking hygiene, a theme that was approached during the training of extension agents, where they received information about techniques simple and easily adopted by producers.

Figure 2. Total Bacterial Count (TBC) of milk samples from dairy farms that received (DFAMQ) or not (DFM) trained technical assistance for milk quality during the year of 2012 in the São Paulo State.



When comparing the rejection indexes and the mean values, farms that received trained technical assistance (DFAMQ) showed improvement or maintenance of quality in all aspects in relation to farms only monitored (DFM). It was also verified that in the studied farms, the milk quality indexes that needed to be constantly improved by technical assistance were SCC (32% of samples outside limits) and TBC (25% of samples outside limits). The results of this study will help guide future training and research incentives in areas identified as critical to improve milk quality, seeking new technologies and methodologies for the transfer of knowledge to producers, especially to small farmers.

Regarding milk quality parameters present in NI 62, it was possible to classify bovine milk samples as within standards or not, according to the legislation limits. The percentage of milk samples outside limits established by NI 62 showed that there was a significant effect ($p < 0.001$) of treatment, that is, higher performance of farms that received trained extension agents (DFAMQ group) in relation to the group that did not receive trained extension agents was observed (Table 2). When comparing the rejection indexes and also the mean values, farms that received trained technical assistance (DFAMQ) showed improvement or maintenance of quality in all aspects in relation to farms only monitored (DFM). It was also verified that in the studied farms, the milk quality indexes that needed to be constantly improved by technical assistance were SCC (32% of samples outside limits) and TBC (25% of samples outside limits). The results of this study will help guide future training and research incentives in areas identified as critical to improve milk quality, seeking new technologies and methodologies for the transfer of knowledge to producers, especially to small farmers.

Table 2. Index of milk samples in disagreement with the parameters recommended by Normative Instruction 62 throughout the year 2012.

	Milk samples in disagreement with Normative Instruction 62		
VARIABLE	DFM	DFAMQ	TOTAL
Fat %	12	7	11
Protein %	5	5	5
Solids-non-fat %	13	12	13
SomaticCellCount %	32	30	32
Total Bacterial Count %	29	17	25
General*	59	49	56

* at least one parameter in disagreement with NI 62 (BRASIL, 2011).

DISCUSSIONS

Gonzalez et al. (2004) reported variations in milk quality, more specifically in chemical composition, according to the time of year and climatic conditions. The authors also reported the influence of the availability and quality of food to be used in the feeding of cows. Socioeconomic problems of some farms that received information from trained

extension agents prevented adherence to changes suggested in the nutrition of animals, collaborating with the absence of differences in the mean values of results. This and other factors were observed in the monitoring reports of farms delivered by extension agents every month.

According to Kitchen (1981), milk obtained from mammary quarters of healthy animals contains 50 to 200 thousand cells/mL. Depending on the infection severity and extent and type of microorganism involved, counts may range from 200 to 5000 x 103 cells/mL of milk. Philpot and Nickerson (1991) observed a decrease in production, ranging from 5% to 25% with SCC between 140,000 and 2,280,000 cells/mL of milk. In this study, SCC was one of the parameters that were significantly influenced by the presence of trained technical assistance. Teixeira et al. (2003) monitored 189 herds in the State of Minas Gerais and found higher SCC values in the period from February to June and lower values in the month of October. In the present study, for both groups, the lowest value was found in April and the highest value in the month of December. During the 12-month experimental period, the mean SCC for the DFAMQ group was 523,000 cells/mL, while 625,000 cells/mL were found for the DFM group. The difference between groups was significant ($p < 0.01$), reaching 102 thousand cells/mL. This difference may be considered small, but it indicates a considerable evolution regarding the decrease in SCC, mainly due to the innumerable factors related to the occurrence of mastitis.

Total Bacterial Count reflects the cleaning efficiency of equipment, handling, milking hygiene and milk storage temperature (HAYES et al., 2001). Paixão et al. (2015) reported that TBC control is related to the adoption of simple measures through technical assistance, where positive results can be observed immediately after the application of the suggested actions. Vallin et al. (2009) studied the effect of adopting good practices on milk quality and observed a 92% decrease in TBC count in refrigerated raw milk samples. Before the adoption of good practices, farms had an average of 1,166 thousand CFU/mL and, after the implantation of good practices, this value dropped to 84 thousand CFU/mL. This result reinforces the importance of the adoption of simple techniques and technologies to improve milk quality, especially in the microbiological aspect. Swinnen and Dries (2004) also found that extension programs have a positive impact on milk quality by introducing hygienic and sanitary standards and techniques in milk production.

Olival et al. (2004) studied the effect of educational programs on the milk quality of 10 dairy farms and observed that farms showed an average reduction of bacterial count

of 11.6% in a period of 8 months. In the present study, there was a significant reduction of 48% in TBC after the first four months in farms of the DFAMQ group, in relation to those of the DFM group.

Considering the conditions of the present study, milk quality was improved due to the diffusion of technology transmitted by trained extension agents to producers, in terms of average values of milk components in compliance with IN 62. The main problems found in obtaining quality milk were somatic cell counts (SCC) and total bacterial counts (TBC), which were considerably improved due to trained technical assistance.

CONFLICT OF INTEREST STATEMENT

The authors declare that they have no conflict of interest.

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