T132 Variation of nutrient content and bacteria count of pasteurized waste milk fed to dairy calves.

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ABSTRACT

From October 2006 to January 2017, pre- and post-pasteurized waste milk samples from 618 dairy farms across the United States were collected and analyzed to better understand how the nutrient content and bacteria count of waste milk varies within and across dairy farms. Both batch and high temperature short time (HTST) pasteurizers were used, as well as ultraviolet (UV) treatment of milk. Milk samples at each farm were collected for 7 consecutive days to determine total solids (TS), protein, butterfat, somatic cell count, and antibiotic presence, as well as bacteria count. Samples were stored between 1.67°C and 5.56°C, then sent to Eurofins DQCI (Mounds View, MN) for all analyses. Data were analyzed by PROC FREQ and PROC MEANS of SAS; PROC UNIVARIATE of SAS was used for within and across farm variation. Mean TS, protein, and fat of post-pasteurized waste milk across all farms were 12.8%, 3.41%, and 3.92%, respectively. Minimum TS, protein, and fat of post-pasteurized waste milk were 7.67%, 2.13%, and 1.55%, respectively. Maximum TS, protein, and fat of post-pasteurized waste milk were 18.1%, 4.96%, and 9.47%, respectively. The coefficient of variation for TS, protein, and fat were 6.58%, 7.90%, and 17.3% within a farm, respectively; and 8.54%, 11.8%, and 19.2% across farms, respectively. Bacteria counts post-pasteurization were categorized as failed (>100,000 CFU/ ml), poor (20,001 – 100,000 CFU/ ml), or good (≤20,000 CFU/ ml). The percentage of farms in each category were as follows: failed- 27.44%, poor- 14.14%, good- 58.42%. In terms of last calf fed, 36.11% of farms failed, 18.23% were poor, and 45.66% were good. Antibiotics were detected in 56.8% of samples collected. Pasteurized waste milk is a highly variable source of nutrition for dairy calves and on-farm pasteurization does not consistently deliver waste milk with a low bacteria count.

INTRODUCTION

In 2014, 5.1% of very small, 1.5% of small, 9.9% of medium, and 43.8% of large dairy farms fed pasteurized milk (saleable or waste; USDA NAHMS, 2014). Waste milk includes low-quality colostrum, transitional milk, milk from cows administered drugs, and milk with high somatic cell counts. When waste milk is left untreated, it exposes the calf to harmful endotoxins, potential pathogenic bacteria, and antibiotic residues (De Collo et al., 2017; Deng et al., 2017; BAMN, 2008b; Selim, 1997). Pasteurization has been shown to be a highly effective tool to reduce microbial load by 98-99% in waste milk (BAMN, 2008b); however, proper operation, sanitation, management, and milk handling are all critical areas of concern (BAMN, 2008a; Kesler, 1981).

OBJECTIVE

The purpose of this study was to better understand how the nutrient content and bacteria count of pasteurized waste milk varies within and across dairy farms.

MATERIAL AND METHODS

From October 2006 to January 2017, pre- and post- pasteurized waste milk samples from 618 dairy farms across the United States were collected and analyzed. Of the 383 farms that reported, number of calves fed ranged from 5 to 5000 calves, with a mean and median of 170 and 72, respectively. Of the 339 farms that reported, gallons of pasteurized milk available ranged from 3 to 2500 gallons, with a mean and median of 115 and 59, respectively. Both batch and high temperature short time (HTST) pasteurizers were used, as well as ultraviolet (UV) treatment of milk. Milk samples at each farm were collected for 7 consecutive days to determine total solids, protein, butterfat, somatic cell count (SCC), and antibiotic presence, as well as bacteria count. On days 1 through 6, a post-pasteurized milk sample was collected at morning or evening calf feeding. On day 7, three samples for bacteria count were taken at the morning calf feeding: pre-pasteurized, immediately post-pasteurized, and post-pasteurized before feeding the last calf. Samples were stored between 1.67°C and 5.56°C, then sent to Eurofins DQCI (Mounds View, MN) for all analyses. Fourier transform infrared spectroscopy (FTIR) was used to measure total solids, protein, and fat. Antibiotic presence was detected using Charm SL®, Charm II, and Delvotest®. Flow cytometry was used to measure SCC and plate loop for bacteria count. Data were analyzed by PROC FREQ and PROC MEANS of SAS; PROC UNIVARIATE of SAS was used for within and across farm variation.

RESULTS

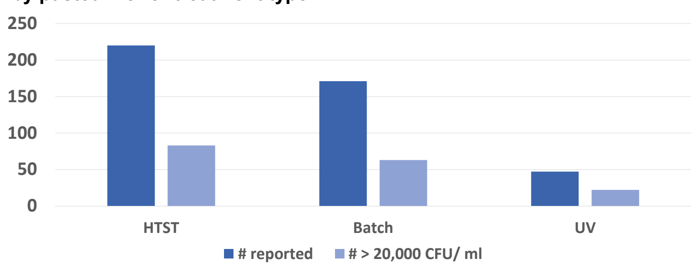
Table 1. Mean, maximum, minimum, and variation of total solids, protein, and fat (%) of post- pasteurized waste milk across and within 618 dairy farms.

Item	Mean	Minimum	Maximum	Within Farm CV, %	Across Farms CV, %
Total Solids, %	12.8	7.67	18.1	6.58	8.54
Protein, %	3.41	2.13	4.96	7.90	11.8
Fat, %	3.92	1.55	9.47	17.3	19.2

Table 2. Percentage of farms with bacteria counts > 100,000, 20,001 – 100,000, or ≤ 20,000 CFU immediately post- pasteurization and at the last calf fed.

Item	% Failed (> 100,000 CFU)	% Poor (20,001–100,000 CFU)	% Good (≤ 20,000 CFU)
Immediately Post-Pasteurization	27.44	14.14	58.42
Post- pasteurization Last Calf Fed	36.11	18.23	45.66

Figure 1. Number farms with > 20,000 CFU/ ml immediately following treatment by pasteurizer or treatment type.



CONCLUSION

Mean, minimum, and maximum total solids (TS), protein, and fat of post-pasteurized waste milk across all farms are listed in Table 1. The coefficient of variation within a farm and across farms are listed in Table 1. Bacteria counts post-pasteurization were categorized as failed (>100,000 CFU), poor (20,001 – 100,000 CFU), or good (≤ 20,000 CFU), and are listed in Table 2. Approximately 49.4% of samples increased in bacteria count from post-pasteurization to the last calf fed. By pasteurizer or treatment type, 37.7% of HTST pasteurizers, 36.8% of batch pasteurizers, and 46.8% of UV treatment had > 20,000 CFU/ ml (Figure 1). Antibiotics were detected in 56.8% of samples collected.

Pasteurized waste milk is a highly variable source of nutrition for dairy calves. In order to meet quality goals of feeding > 12% TS, > 3.5% fat, and ≥ 3.0% protein (BAMN, 2008a), pasteurized milk can be supplemented with a milk replacer.

In addition, on-farm pasteurization does not consistently deliver waste milk with a low bacteria count. Exposing calves to milk with a high pathogen load can increase incidences of morbidity, leading to lower performance, and mortality. It is important to handle waste milk intended for feeding using the same methods recommended for saleable milk. This includes cooling milk to less than 4.4°C within 1 hr of milking and maintaining clean equipment through use of proper water temperature, detergents, and sanitizers (BAMN, 2008a). Pasteurizers must also be properly cleaned after each use, and sanitizing any feeding equipment, such as bottles and buckets, is crucial (BAMN, 2008a).

LITERATURE CITED

BAMN (Bovine Alliance on Management and Nutrition). 2008a. Managing a pasteurizer system for feeding milk to calves. https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/bamn/BAMN08_ManagingPastSys.pdf. Accessed May 24 2017.

BAMN (Bovine Alliance on Management and Nutrition). 2008b. Feeding pasteurized milk to dairy calves. https://www.aphis.usda.gov/animal_health/nahms/dairy/downloads/bamn/BAMN08_FeedPastMilk.pdf. Accessed May 24 2017.

Del Collo, L.P., J.S. Karns, D. Biswas, J.E. Lombard, B.J. Haley, R.C. Kristensen, C.A. Kopral, C.P. Fossler, and J.S. Van Kessel. 2017. Prevalence, antimicrobial resistance, and molecular characterization of Campylobacter spp. in bulk tank milk and milk filters from US dairies. J. of Dairy Sci. 100: 3470-3479.

Deng, Y.F., Y.J. Wang, Y. Zou, A. Azarfar, X.L. Wei, S.K. Ji, J. Zhang, Z.H. Wu, S.X. Wang, S.Z. Dong, Y. Xu, D.F. Shao, J.X. Xiao, K.L. Yang, Z.J. Cao, and S.L. Li. 2017. Influence of dairy by-product waste milk on the microbiomes of different gastrointestinal tract components in pre-weaned dairy calves. Nature:Scientific Reports 7: 42689.

Kesler, E.M. 1981. Feeding mastitic milk to calves: Review. J. of Dairy Sci. 64: 719-723.

Selim, S.A. and J. S. Cullor. 1997. Number of viable bacteria and presumptive antibiotic residues in milk fed to calves on commercial dairies. J. of Am. Vet. Med. Assoc. 211 (8): 1029-1035.

United States Department of Agriculture, Animal and Plant Health Inspection Service. 2016. Dairy 2014, Dairy cattle management practices in the United States. USDA:APHIS:VS:NAHMS. Fort Collins, CO #692.0216.