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## Effect of Heat-Treatment on Nutritional and Immune Factors in Bovine Colostrum

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Studies have demonstrated that heat-treating colostrum at 60°C for 60 minutes results in a significant reduction in colostrum bacteria counts with no overall reduction in colostrum IgG concentrations. Preweaned calves fed HT colostrum have enhanced efficiency of absorption of IgG and reduced morbidity. Despite these benefits, limited research exists to describe if the heat-treatment process harms other colostrum components. The objective of Study 1, described herein, was to describe the effect of heat-treatment on concentrations of several nutrient and immune factors in bovine colostrum. The objective of Study 2 was to describe the effects of heat-treatment on leukocyte viability, alkaline phosphatase (AP) enzyme activity and IgG concentrations in bovine colostrum.

In the first study 25 unique batches of first milking bovine colostrum were first sampled as fresh (FR) colostrum, heat-treated at 60°C for 60 minutes using a commercial on-farm batch pasteurizer, and then sampled immediately after as heat-treated (HT) colostrum. Paired FR and HT colostrum samples underwent laboratory testing for levels of dry matter (%), true protein (%), crude fat (%), lactose (%), solids not fat (%), other solids (%), insulin (ng/ml), lactoferrin (mg/ml), IGF (ng/ml), IgG (mg/ml), pH, total plate count (TPC, cfu/ml), total coliform count (TCC, cfu/ml) and somatic cell count (SCC, cells/ml). Analysis of variance demonstrated that treatment had no effect on any of the aforementioned components with the exception of TPC and TCC, which were significantly reduced in HT samples ( $\log\text{TPC} = 1.2 \pm 0.9$ ;  $\log\text{TCC} = 0.7 \pm 1.0$ ) as compared to FR samples ( $\log\text{TPC} = 4.2 \pm 0.8$ ;  $\log\text{TCC} = 3.7 \pm 1.2$ ) ( $P < 0.0001$ ). Unexpectedly, SCC, as measured using a NIR assay, was unaffected by treatment, prompting the investigators to complete the second study to investigate if treatment affected leukocyte viability.

In the second study 22 unique batches of first milking bovine colostrum were sampled as FR colostrum, heat-treated at 60°C for 60 minutes using a commercial on-farm batch pasteurizer, and then sampled immediately after as HT colostrum. Paired FR and HT colostrum samples underwent laboratory testing for levels of IgG (mg/ml), total WBC count ( $\times 10^6$  cells/ml), total viable WBC count ( $\times 10^6$  cells/ml), the percentage of WBC that were viable (%), TPC (cfu/ml), TCC (cfu/ml) and AP enzyme activity (mU/L). As for previous studies, ANOVA showed that treatment had no effect on colostrum IgG (FR =  $77.8 \pm 17.5$ ; HT =  $75.2 \pm 17.0$  mg/ml) but significantly reduced colostrum TPC and TCC counts (FR  $\log\text{TPC} = 5.2 \pm 1.4$ ; HT  $\log\text{TPC} = 1.2 \pm 1.0$ ) and TCC (FR  $\log\text{TCC} = 4.1 \pm 1.8$ ; HT  $\log\text{TCC} = 0.3 \pm 0.5$ ). The proportion of WBCs that were viable was significantly lower in HT colostrum ( $8.3 \pm 2.7\%$ ) as compared to FR colostrum ( $28.2 \pm 11.3\%$ ) ( $P < 0.0001$ ). Chi squared analysis showed that treatment reduced AP enzyme

activity, which was present in 100% and 77% of FR and HT colostrum samples, respectively ( $P = 0.02$ ).

The implications of this research are that, with the exception of colostrum leukocyte viability, veterinarians and producers can be confident that all immune and nutritional parameters tested in these two studies were not negatively affected by heat-treating the colostrum. The viability of colostrum leukocytes was not eliminated, but was significantly reduced by HT. The function and biological significance of colostrum leukocytes in neonatal calves still requires research. However, the reduction in viable leukocytes caused by HT may be less important than the benefits gained, given that a previous study demonstrated that calves fed HT colostrum suffered less morbidity than calves fed FR colostrum. Since the HT procedure did not consistently inactivate the AP enzyme in colostrum samples, this test does not hold potential to be used as a monitoring tool for colostrum HT programs on dairy farms.