Influence of somatic cell count and trace element supplementation on lactation performance and DNA methylation in PBMC and MEC during early lactation in Holstein dairy cows

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SESSION 3: IMMUNITY AND GENETICS

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Intramammary infections occur frequently during early lactation. Clinical mastitis during early lactation results in obvious losses of milk production. This experiment aims to study the influence of Somatic Cell Count (SCC) and trace element supplementation on lactation performance and global DNA methylation levels in bovine Peripheral blood mononuclear cells (PBMC) and Mammary epithelial cells (MEC). Holstein dairy cows were separated into two groups.

The control and supplemented groups (n=12) received after calving 240 g of mineral supplement. The supplemented group (n=12) received 160 g for 4 weeks before calving and 250 g of GENIAL® (Pilardière, France, a nutrient supplementation enriched in selenium from yeast, trace elements, extracts from plants and microalgae, and a cocktail of minerals) during the first 60 days of lactation. The cows were classified into 3 classes based on the SCC at D15: SCC_1 if SCC <105 (n=15), SCC_2 if 105 <SCC< 2.5.105 (for subclinical mastitis case, n=5) and SCC_3 if SCC> 2.5.105 cells/mL (clinical cases, n=4). Calving score, Milk Yield (MY), and Dry Matter Intake (DMI) were recorded. Body Condition Score (BCS) and milk composition for casein, whey protein,a-lactalbumin and lactoferrin were analyzed at 15 and 60 days of lactation. PBMC isolated from blood and MEC from milk were analyzed at the same lactation stages and genomic DNAs extracted to analyze global DNA methylation by luminometric assay combining an enzymatic cleavage and pyrosequencing (LUMA). All data were analyzed using the mixed procedure of SAS taking into account the effects of GENIAL® supplementation, SCC class, lactation stage and the interaction between supplementation x SCC class. As expected, each SCC class presented different SCC (P<0.001) associated with modification in lactoferrin concentration in milk. SCC class and supplementation did not affect daily MY (P=0.14, P=0.24, respectively) but a tendency for an interaction between supplementation and SCC class was observed (P=0.09). Compared with the two other SCC classes, daily MY was lower in SCC_3 class (P<0.05) in control group but not in supplemented group, suggesting a positive effect of GENIAL® on daily MY despite of an observed clinical mastitis. The milk composition was only lightly affected by mastitis with a tendency for higher concentration of whey protein (P=0.08) and for lower casein to protein ratio and a-lactalbumin concentration (P=0.09) associated with a tendency for lower a-lactalbumin mRNA level in MEC. The supplementation improved the calving score (P=0.02) and the BCS (P<0.01), while the SCC class did not affected it. A tendency for lower DMI was observed with SCC_3 class (P=0.07). The supplementation did not affect the DMI (P=0.18). However an interaction between supplementation and SCC class was observed for DMI (P=0.04). DMI was lower in SCC_3 class (P<0.05) in control group but not in supplemented group. SCC class had a tendency to increase the PBMC concentration (P=0.08), whereas the supplementation did not affect it. No modification of global DNA methylation in PBMC and in MEC was observed for the different groups of cows.

In conclusion, the GENIAL® supplementation had improved the calving score and BCS and had tendency to interact with the SCC class to improve the DMI and the MY. An immunity response to mastitis was observed without modification of global DNA methylation.