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Effects of heat stress and supplementation of rumen-protected methionine during the transition period on immune function and liver functionality index of Holstein cows

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Exposure to heat stress during the transition period is associated with impairment of immune function. Feeding rumen-protected Met (RPM) during the transition period improves immune function. Therefore, we aimed to evaluate the effects of supplementing RPM to Holstein cows under heat stress during the transition period on immune function and liver functionality index (LFI), which assesses transition cow's metabolic health. Cows blocked by parity and ME305 were assigned to thermoneutral conditions (TN, avg THI 63, n=19), heat stress induced by electric heat blankets (HS, n=17), and HS with inclusion of RPM in the total mixed ration (MHS, 0.1% of DM of Smartamine®M Adisseo Inc., Antony, France, n=17) for 4 weeks pre- and 4 weeks post-calving. Blood samples were collected at 1, 8, and 28 days in milk (DIM) for hemogram, leukogram, albumin, cholesterol, and total bilirubin quantification, and granulocyte's phagocytosis and oxidative burst analyses. Data were analyzed using generalized linear mixed models in SAS, considering the fixed effects of treatment (TN, HS, MHS), DIM, and block. Contrasts included C1 (TN vs average of HS and MHS) and C2 (HS vs MHS). Cows in TN had greater hematocrit and lower neutrophil count (C1 P=0.04; 31.3±0.69% and 2.27±0.30×10⁹ cells/L) than cows in HS and MHS (29.8±0.69% and 2.83±0.30×10⁹ cells/L). Cows in TN had greater granulocyte's phagocytosis percentage (C1 P=0.01; 47.1±9.67%) than HS and MHS cows (17.4±9.67%). Cows in HS had lower albumin concentration at 28 DIM (C2 P=0.03; 26.3±2.04 g/dL) than cows in MHS (32.3±2.04 g/dL). There was a lower (P=0.01) proportion of cows classified as high LFI in HS (18%, 2/11) than in TN (75%, 12/16) and MHS (60%, 9/15). Finally, the odds of being classified as high LFI were lower in HS than in MHS (OR=0.15, P=0.06) and TN cows (OR=0.07, P=0.01). In conclusion, HS induced with heat blankets alters immune function mainly related to neutrophils' count and phagocytosis activity. Feeding RPM to transition cows under HS improved LFI, but effects on immune cells and granulocyte's function are limited.

Adisseo Message:

As climate change occurs, heat stress will continue to cause losses for the livestock industry. Supplemental methionine during the peripartum period has been increasing on commercial farms due to the beneficial effect of methionine on milk production, immune function, inflammation, and metabolism. This study aimed to further understand the beneficial effects of methionine during the peripartum period by examining the effects of rumen-protected methionine supplementation during exposure to heat stress during the peripartum period. The results underscore the negative impacts of heat stress on immune function and liver function. However, supplying methionine to peripartum cows under heat stress improved liver function, which can help the cow to better handle the negative metabolic effects associated with heat stress.