EFFECT OF ORAL SUPPLEMENTATION OF MEDIUM CHAIN FATTY ACIDS (AROMABIOTIC®) ON BLOOD AND MILK NEUTROPHIL VIABILITY OF DAIRY HEIFERS AND COWS IN EARLY LACTATION

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INTRODUCTION

Polymorphonuclear neutrophilic leukocytes (PMN) play an important role in the first line immune defence of the mammary gland. Both heifers and multiparous cows suffer from immune suppression around parturition, characterized by a higher proportion of apoptotic (= less viable) blood and milk PMN. This phenomenon is most probably associated with the higher prevalence and increased severity of mastitis in that particular period. Because of public concerns about emergence of antibiotic resistance and drug residues in milk, attempts have been made to evaluate the efficacy of alternatives to antibiotic therapy in treating and controlling mastitis. Medium chain fatty acids (MCFA) have been hypothesized to modulate immunity in humans. Based on experiences from the field, oral supplementation of MCFA (Aromabiotic®) seems to improve udder health in bovine as well. However, results from clinical trials including both treated and control animals are still lacking although they are warranted to ascertain the potential efficacy of these lipid molecules as well as to reveal their potential effect on bovine blood and milk PMN survival.

The objective of the present study was to explore the effect of orally supplemented MCFA to heifers and multiparous cows starting 6 to 8 weeks prior to calving on blood and milk PMN apoptosis between 1 and 3 days after calving in a double-blinded clinical trial including treated as well as control animals kept under the same management.

MATERIALS AND METHODS

Study design

A randomized double-blinded clinical trial was conducted from June 2009 to June 2010 on the research dairy farm of Ghent University (Biocentrum Agri-Vet, Melle, Belgium). Twelve animals from all lactating cows in the herd as well as 10 animals from all pregnant heifers in the herd were selected according their expected calving date. These 22 animals were randomly assigned to either the control group (n = 11) or the MCFA (test) group (n = 11). From the start of the trial (on average 53 days before calving) until 4 months post partum, pregnant heifers and dry cows assigned to the test group received 25 gram of an MCFA-containing powder daily (Aromabiotic®) top-dressed on the feed while locked in the feeding barrier.

Data and sample collection

At the onset of the trial period, blood samples were collected from the tail vein of all multiparous cows and heifers included in the study to determine blood PMN viability. Additionally, composite milk samples for determination of the milk PMN viability (100 mL) and somatic cell count (30 mL), and duplicate quarter milk samples for bacteriological culturing were collected from the multiparous cows only just before they were dried off. Between 1 and 3 days after calving, duplicate quarter milk samples for bacteriological culturing were again collected from all multiparous cows as well as heifers enrolled in the study. The viability of PMN in both blood and milk was estimated by determining the proportion of apoptotic PMN using flow cytometry as described by Piepers et al. (2009).
Bacteriological culturing and isolate identification was done as previously described\(^5\).

Also, composite milk somatic cell count (cells x 1000 per ml) and milk yield (kg of milk per day) at test-day for the first 4 recordings after calving were used per animal on a four-weekly basis as part of the Dairy Herd Improvement program (VRV, Oosterzele, Belgium).

**Statistical analyses**

To evaluate the effect of MCFA supplementation before calving on the blood PMN viability shortly after calving, a linear mixed model with animal as random effect was fit. The model with blood PMN viability as outcome variable included supplementation before calving (main predictor of interest), parity, period and the different interaction terms as categorical predictor variables. An identical linear mixed regression model with animal as random effect was fit to determine the effect of MCFA supplementation before calving on the evolution of the milk PMN viability across the dry period of the multiparous cows. The association between MCFA supplementation before calving and milk PMN apoptosis of both heifers and cows shortly after calving was evaluated fitting a linear regression model including supplementation (main predictor of interest), parity and the interaction term between both variables as categorical predictor variables. A backward stepwise modeling procedure was used to eliminate non-significant terms from the initial models. Statistical significance was defined at P < 0.05.

**RESULTS AND DISCUSSION**

At the onset of the study, significant differences in neither blood nor milk PMN viability were found between treated and control animals. In non-supplemented animals, blood PMN apoptosis significantly increased between start of supplementation and the first days after calving (P < 0.001) whereas no substantial change in blood PMN apoptosis could be observed in the MCFA supplemented animals (P = 0.69) (Figure 1). As was expected based on literature, blood PMN apoptosis shortly after calving was higher in multiparous cows than in heifers (P < 0.05). Still, an identical effect of oral MCFA supplementation on blood PMN apoptosis was observed for both heifers and multiparous cows. Similar results were obtained for milk PMN apoptosis in multiparous cows. Overall, the proportion of apoptotic milk PMN in early lactation was lower in the MCFA supplemented group compared to the non-supplemented group (P < 0.001) (Figure 2). As compared to blood PMN apoptosis, milk PMN apoptosis shortly after calving was higher in multiparous cows than in heifers as well (P < 0.01).

**CONCLUSIONS**

Oral supplementation of MCFA to heifers and multiparous cows from 6 to 8 weeks before calving appears to curb the natural “dip” in the systemic as well as the local innate immunity shortly after calving independently from the cows’ parity. To what extent the observed differences in blood and milk PMN viability will eventually result in a lower prevalence of intramammary infections and a better udder health and higher milk production throughout lactation merits further research.
Figure 1 The proportion of apoptotic blood PMN before and after calving of both control and MCFA supplemented multiparous cows and heifers. Different superscript letters indicate significant differences: * (P < 0.05); ** (P < 0.01) and *** (P < 0.001).

Figure 2 The proportion of apoptotic milk PMN after calving of both control and MCFA supplemented multiparous cows and heifers. Different superscript letters indicate significant differences: * (P < 0.05); ** (P < 0.01) and *** (P < 0.001).

REFERENCES