INFLAMMATORY RESPONSE IN HOLSTEIN FRIESIAN VERSUS A LOCAL CATTLE BREED (RENDENA) AT DIFFERENT TIME POINTS

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The selective pressure for increased milk production in dairy cows brought about great difficulties in the adaptation of cows to their environment. This normally translates into increased culling rates, reduction of life expectancy and fertility, higher propensity to develop diseases (including mastitis), especially when compared to less selected and lesser producing dairy breeds which are typically characterized by higher resilience. However, not much is known about the biological mechanisms behind the relationship between genetic selection and higher risk of metabolic and infectious diseases (1). It is well known that during the calving period, high-yielding dairy cattle are more susceptible to common environmental stressors. This may have crucial repercussions on disease occurrence and on milk production levels (2).
With the aim of investigating the factors associated to this phenomenon, in this study we compared innate immune response patterns of 6 Holstein Friesian (HF) and 4 Rendena cows reared in the same farm and under the same management conditions. Quarter milk samples and blood were collected from all cows at dry-off (T1), 1 day after calving (T2), 7-10 days after calving (T3) and 30 days after calving (T4). Quarter milk samples were subjected to measurement of the inflammation marker cathelicidin and assessment of different innate immune-related mediators such as lysozyme, CD45, IL-1β, TNF-α, PTX3, IL-1R8. Blood samples were used for the analysis of plasma metabolites indicators of systemic inflammation such as haptoglobin, ceruloplasmin, total protein, albumin, total bilirubin, and globulin.
HF cows showed a more severe systemic inflammatory response at T2 and T3 in comparison with Rendena cows in terms of haptoglobin, total proteins, globulins and bilirubin. Concerning the milk protein abundance profile, pronounced differences were observed in the colostrum (T2), with significantly higher amounts of protective molecules (immunoglobulins and other immune-related proteins) in Rendena. Moreover, at all time points HF showed higher levels of the inflammation marker cathelicidin in milk. In addition, the expression of innate immune related genes, as well as the CD45/KRT5 expression ratio in milk cells (indicators of epithelial and leukocyte components) were different in HF compared with Rendena. Our results suggest that HF cows develop a systemic and local mammary inflammatory response that could impair the capability of the animal to face the peripartum period and make them more susceptible to disease compared with Rendena cows.

Our findings reveal the importance of the autochthonous breeds in the understanding of the immunity mechanisms and indicate that fundamental effector activities of innate immunity in the mammary gland should be included in the breeding programs of HF cows. This kind of integrated approach can be conducive to a substantial reduction of antibiotic usage in dairy farms as a result of greater disease resistance.

1) Oltenacu and Broom, 2010 .“The impact of genetic selection for increased milk yield on the welfare of dairy cows” Animal Welfare, 19(S): 39-49

2) Bach, A. 2011. “Associations between several aspects of heifer development and dairy cow survivability to second lactation” J. Dairy Sci. 94:1052- 1057.