EVALUATION OF THE ERYTHROCYTE MEMBRANE LIPIDOME PROFILE IN HEALTHY HEIFERS BEFORE AND AFTER CALVING

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In dairy cows, the transition period is marked by nutritional, metabolic, hormonal and immunological changes that have an impact on the incidence of infections and metabolic diseases [1]. In humans, analysis of red blood cells (RBC) membrane lipidome represents a powerful diagnostic tool for assessing the quantity and quality of fatty acids composition and for the follow-up of the membrane remodeling under physiological and pathological conditions [2]. Therefore, the aim of this study was to evaluate RBC membrane lipidome profiles in healthy heifers 30 days before calving (T0) and 7 (T1) and 30 days (T2) post calving.
The RBC membranes were isolated from EDTA-treated blood of 13 friesian heifers and a cluster of 10 saturated [SFA (palmitic; stearic)], monounsaturated [MUFA (palmitoleic; oleic; vaccenic)] and polyunsaturated [PUFA (linoleic; dihomo-γ-linolenic (DGLA); arachidonic; EPA; DHA)] fatty acids was determined by Gas-Chromatography. Relevant lipid parameters [SFA/MUFA, SFA/PUFA, ω6/ω3, PUFA balance, Peroxidation (PI) and Unsaturation (UI) indexes] were calculated. When compared to T0 increased levels of palmitic at T1 ($p<0.0001$) and stearic acid at T2 ($p<0.001$) were observed. The ω6 PUFA, DGLA ($p<0.0001$) and arachidonic acids ($p<0.0001$), decreased after calving, with DGLA levels further decreased constantly at T2 when compared to T1 ($p<0.001$). EPA levels were decreased at T2 ($p<0.0001$) with a subsequent increase in the ω6/ω3 ratio ($p<0.001$). MUFA levels did not show any change during the entire study. Also, UI and PI were significantly decreased after calving ($p<0.0001$).
The increase in the biosynthesis of SFA during post-partum period provide an energetic source to the cows but also induce a profound variability at the membrane properties, with an increase in the rigidity and a reduction of the permeability. Therefore, an excessive increase of SFA could result in a metabolic blockage that should be avoided. The ω6 changes may be related to the cow's metabolic status form pre- to post-partum period. The found reduction of DGLA, that is a precursor of the prostaglandins with anti-inflammatory activity, is probably due to a need of these mediators in order to maintain the post-partum metabolism. An excessive decrease of DGLA lead to a reduction of the anti-inflammatory defenses with the possible onset of inflammatory diseases during the post-partum period. Moreover, changes in the ω6/ω3 ratio can be considered as valid indicators in order to predict and monitor the inflammatory diseases in cattle during the critical post-partum period.
In conclusion, the erythrocyte membrane lipidome can be a useful tool providing important information for the transition period of dairy cows. In particular, an early knowledge on lipid membrane changes during transition period allows personalized nutritional intervention in order to promote a healthy status reducing a metabolic stress, promoting anti-inflammatory activity and improve the productivity of high-yielding dairy cows.

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