Telomere length: any perspective as a biomarker for longevity in dairy cows?

Susanne Häussler & Lilian Laubenthal
Institute of Animal Science, Physiology and Hygiene Group, University of Bonn Katzenburgweg 7-9, 53115 Bonn, Germany susanne.haeussler@uni-bonn.de

Telomeres protect chromosome ends from DNA degradation (Chan & Blackburn 2002) and shorten with every cell division (Bouazzaoui et al. 2013). This shortening is associated with age-related pathologies as well as aging in humans (Blasco 2007). In high-yielding dairy cows, increased metabolic activity and lipolysis right after calving is accompanied with increased susceptibility to metabolic disorders. To evaluate stress in animals, cortisol concentrations are often measured; however, cortisol is inadequate to evaluate chronic stress conditions. Telomere lengths might represent a novel biomarker in dairy cows, since they respond to environmental changes and stressors and can mirror long-term effects (Theall et al. 2013). In relation to age and herd environment, telomere length measured in blood was shown to be reduced in cattle (Brown et al. 2012). However, telomere shortening implies also a decrease of the cell lifespan. With the onset of lactation high-yielding dairy cows mobilize body reserves, mainly body fat, to cope with the increased energy demand. In consideration of this, we hypothesize that telomeres shorten significantly on a cellular level, i.e. in adipose tissue of cows, in association with increased oxidative stress. Over-conditioned cows mobilize more body tissue than lean cows and are thus more prone to metabolic stress with the onset of lactation. Therefore, we examined adipose tissue from cows after exemplarily inducing excessive fat accumulation. Using multiplex PCR, we observed that fat accumulation was accompanied by both increased oxidative stress and reduced telomere length. We assume that telomere shortening might serve as a biological marker in dairy cows. In order to identify a non-invasive medium for measuring telomere shortening, saliva containing both lymphocytes and buccal epithelial cells, might serve as an ideal medium to monitor long-term effects of metabolic stress due to lactation.

Acknowledgements

This article is based upon work from COST Action FA1308 DairyCare, supported by COST (European Cooperation in Science and Technology, www.cost.eu). COST is a funding agency for research and innovation networks. COST Actions help connect research initiatives across Europe and enable scientists to grow their ideas by sharing them with their peers. This boosts their research, career and innovation.