

Variability of oligosaccharides in milk from native Nordic cattle breeds

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Milk oligosaccharides (OS) are complex sugars of high interest due to their bioactive properties. The OS play key roles in stimulating the growth of beneficial microorganisms in the gut by their prebiotic effects, contributing to brain development, as well as preventing pathogen adhesion in the gut. The content and complexity of OS are significantly lower in bovine milk compared to human milk, which leads to some challenges in the process of isolating bovine milk OS for use in e.g. infant formula.

Until now, OS profiling in bovine milk has been conducted on milk from modern, high-yielding dairy breeds, and no studies have profiled the OS distribution in milk from native Nordic cattle breeds. However, recent studies have shown that these breeds possess a great phenotypic as well as genotypic diversity that may also be reflected in their milk composition. Compositional variations have previously been shown for protein and fat. These Nordic indigenous breeds have evolved in different directions over thousands of years due to varying climatic challenges and their co-evolutionary history with humans. To address this knowledge gap, the present study investigated the OS content in milk from a unique sample set of eight native Nordic cattle breeds. This investigation included a qualitative characterization of OS. The milk samples were collected from native breeds originating from Norway (Dølafe cattle, Telemark cattle), Sweden (Mountain cattle),

Denmark (Red Danish cattle), Iceland (Icelandic cattle), Lithuania (native Black- and White cattle) and Finland (Western Fincattle and Eastern Fincattle).

The analysis of OS was conducted by high-performance liquid-chromatography chip/quadrupole time-of-flight mass-spectrometry (HPLC-Chip/Q-TOF MS). The study showed a significant variation ($p \leq 0.05$) in the amount of several OS between breeds. The highest total relative abundance of OS was seen in milk from the Western Fincattle, representing approximately double the intensity that was detected in milk from conventional cows. Further, the results showed interesting variations in the OS distribution, sialylated and neutral OS showed the highest relative abundance in milk from the Western Fincattle, while the highest content of fucosylated OS was monitored in milk from Western Fincattle, Norwegian Dølafe cattle and Icelandic cattle. Milk from Red Danish cattle and Norwegian Telemark cattle contained higher relative abundance of sialylated OS compared to neutral OS, whereas the opposite was observed for the remaining breeds. In general, the breeds that are known to be closely related genetically tend to produce OS in a total relative abundance close to each other. Findings of the present study indicate that the high genetic divergence between native Nordic cattle breeds seems to be reflected in the resulting OS distribution.