

D4Dairy
Digitalisation, Data integration,
Detection and Decision support
in Dairying

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METABOLIC INDEX FOR DAIRY BREEDING

Dairy breeding focused solely on production traits such as milk yield for a long time. Great genetic gain has been achieved for those traits, but with time adverse effects on reproduction, health and longevity started to become evident. Consequently, fitness and health traits were incrementally considered in the breeding goal.

Ketosis in dairy cows

Ketosis presents a very important metabolic disorder in dairy cows, which is caused by a higher energy demand than supply, leading to a negative energy balance and mobilization of body tissue. Risk for ketosis is especially high in early lactation because the cow's feed intake is not yet adapted to the higher demand due to milk production. Apart from adapting management strategies, selection for more metabolically stable cows would be of interest from a breeder's perspective. Veterinary diagnoses of a clinical ketosis, which are recorded routinely, are rare

and thus challenging for breeding purpose. By contrast, subclinical ketosis indicates a metabolic disorder without clinical signs or before these are visible. Consequently, we are looking for auxiliary traits for ketosis. Auxiliary traits are characterized by a strong relationship (genetic correlation) to the target trait while being easier and less expensive to record. Ideally, they also have a higher heritability, which is favorable for genetic gain. Additionally, auxiliary traits for ketosis should be able to provide information on subclinical ketosis as well. So, which traits may be considered for this purpose?

Potential auxiliary traits for ketosis in D4Dairy

One possible auxiliary trait is the concentration of ketone bodies such as betahydroxybutyrat (BHB), which is elevated in blood and milk in the case of a ketosis. It can be measured using rapid tests (Ketotest) or estimated from mid-infrared (MIR) spectra from milk samples (KetoMIR) to deduce the

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presence of (subclinical) ketosis. Furthermore, studies revealed a relationship between ketosis and the fat-protein-ratio in the milk. With the increasing use of automatic milking systems (AMS) and sensor devices on Austrian dairy farms, a new source of information for deriving auxiliary traits opens up. Sensors, which are attached to the cow via collars, ear tags or rumen boluses, are able to continuously measure activity, rumination or rumen temperature. Real-time information is delivered and deviations from normal patterns can trigger alerts, so problems can be detected and tackled early enough. To identify the potential of this sensor information for deriving auxiliary traits a comprehensive data collection was performed on 99 pilot farms, which were already equipped with sensor devices and partly also AMS, between January 2020 and March 2021.

Metabolic index

Based on estimated heritabilities and genetic correlations some of the investigated traits emerged as promising auxiliary traits for ketosis. For the time being, three out of these auxiliary traits – Ketotest, KetoMIR, fat-protein-ratio – along with veterinary diagnoses should be included in the metabolic index for routine genetic evaluation. Activity traits from sensor data may also be considered promising for this purpose. However, they should be revised using larger data sets and their relationship with important fitness traits should be investigated. Increasing amounts of data and the application of latest methods in routine genetic evaluation (Single Step, genomics) are expected to enable a prompt implementation and lead to genetic gain for more metabolically stable dairy cows.

Project coordination (Story)

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Project partners



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