Development of resilience indicators using deviations in milk yield from the lactation curve

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Cows encounter various environmental challenges during their lives, such as infectious agents and heat waves. The extent to which an animal is affected in its functioning by environmental challenges is called resilience. Intensive recording of animal performance provides the opportunity to detect short term fluctuations in functioning and possibly define resilience. The objective of this study is to define resilience indicators using milk yield records of automatic milking systems, and to perform a genetic analysis. The data will consist of approximately 210,000 lactations finished between 1997 and 2017 from first, second and third parity cows from 500 Dutch herds. Individual lactation curves will be fitted using smoothing and random regression. Three resilience indicators will be defined: the variance, first-order autocorrelation and skewness of the residuals from the fitted curve. The genetic variance and heritability of the resilience indicators and the genetic correlations among them will be estimated using ASREML. To test the usefulness of the resilience indicators, genetic correlations between the resilience indicators and mastitis, ketosis, claw health and heat tolerance will be estimated. Moreover, validation will be done by investigating differences between resilient and non-resilient cows in incidence of health disorders and the response in milk yield during periods with high ambient temperatures. It is expected that the resilience indicators will show sufficient genetic variation and will be heritable. Furthermore, it is expected that cows that are identified as resilient, will be more resistant to diseases, and will show lower declines in milk yield during heat waves than less resilient cows. It is expected that the best resilience indicators found in this study can also be used on other sensor data and other species.

Indirect traits for feed efficiency

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To meet the demand for sufficient food supply to provide for the world's growing population (around 10 billion in 2050), feed efficiency traits are gaining importance. Even in the age of genomic selection, enough phenotypes need to be available for the target traits. Feed efficiency traits are usually recorded at research stations. Smaller breeds do face the limitation of available phenotypes. In the framework of the Austrian project 'Efficient Cow' various indirect traits, which can be recorded on commercial farms, were analysed. The focus was on feeding information, body weight, possibilities of body weight prediction, mobilization and health. For predicted dry matter intake based on feeding information a heritability of 0.18 was estimated for Fleckvieh. Body weight as an indirect predictor for feed efficiency was assessed. Body weight prediction models were developed. The correlation between body weight (on scale) and predicted body weight varied depending on the information used for prediction. If only linear traits, which are routinely recorded, were used, the correlation between breeding values was up to 0.80. If muscularity or preferably heart girth were used, the correlation increased to 0.88. Various analyses within the project in the context of feed efficiency and fertility and health showed that e.g. more efficient cows mobilize more body reserves and have more fertility problems. If body weight is used as an indirect trait for feed efficiency the positive correlation to body condition score has to be taken into account. A selection for reduction of body weight will decrease body condition score. A lower body condition score results in increased health problems and higher culling rates. Therefore, it is recommended to include information on mobilization for prediction of feed efficiency. To fully exploit the potential of feed efficiency, animals have to be healthy as analyses within the project show.