Selection Against Metabolic Diseases

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Metabolic stability or resistance to metabolic diseases can be improved by genetic selection. Strategies include direct selection based on clinically observed traits, and indirect selection using indicators or predictors of metabolic diseases. The most prevalent metabolic diseases in dairy cattle for which genetic parameters were published included ketosis (clinical and subclinical), displaced abomasum, milk fever, and tetany. In this review we present genetic parameters for these metabolic diseases, discuss possible indicator traits, and give a status of genetic evaluation of metabolic diseases.

Incidences of clinical cases of metabolic disease were in most cases low (<10 % of cows per herd per year), while considerably higher incidence rates were found for subclinical metabolic diseases. Heritability estimates of clinical metabolic diseases were in general low: threshold (linear) model estimates were 0.02 to 0.16 (0.01 to 0.39) for ketosis, 0.12 to 0.35 (0.00 to 0.08) for displaced abomasum, 0.07 to 0.18 (0.01 to 0.08) for milk fever and 0.02 (0.004) for tetany.

Genetic correlations among metabolic diseases were positive, indicating that selection to improve one of them will result in positive indirect selection responses in others. Metabolic diseases have also been found to be positively genetically correlated to other disease traits, such as mastitis. This implies that selection for general disease resistance and robustness may be possible. There was a lack of consistency in genetic correlation estimates between metabolic diseases and milk production traits. Limited number of studies, small datasets, large standard errors, and large ranges of estimates, make it difficult to draw conclusions.

Even if subclinical cases per definition not show signs of disease, they are often precursors for other diseases and reasons for reduced production and economic losses. Challenges related to recording and under-reporting, and difficulties in diagnosis of subclinical cases of metabolic disorders have resulted in an increasing interest for predictors. These can be sensor data or results of milk- or blood tests (e.g. ß-Hydroxybutyrate), changes in body condition score or other predictors based on data from routine milk recording (e.g. mid-infrared spectral data). These new phenotypes may support more efficient selection against metabolic diseases.

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