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Investigations on the relationship of dry matter intake and energy balance to health in German dairy cattle using conventional and genomic breeding values

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The implementation of genomic selection has enabled selection for difficult-to-measure traits, like dry matter intake (DMI) or energy balance (EB). To improve health traits like metabolic stability, a less pronounced energy deficit postpartum is considered to be a key challenge. On the other hand, feed efficiency is gaining economic importance possibly leading to conflicts in the design of breeding goals.

Although several significant phenotypic associations between health and EB traits were reported in the literature, little is known about their genetic relationship as datasets containing the necessary information are still scarce and usually small. For first lactating Holstein cows of the Karkendamm research herd it could be shown that animals belonging to the best 20 % of the herd with regard to classically estimated breeding values for EB represented the only group with positive average breeding values for metabolic stability.

Karkendamm data from 336 cows have recently also been used within the project “optiKuh”. The aim of this project was to build a German reference population for the traits DMI and EB. The total data set contained DMI records from 1.341 cows and EB records from 1.322 cows, respectively. 1.163 cows were also genotyped. Applying a random regression model and using the Single Step method, genomic breeding values for DMI and EB were estimated. In this year, vit (Verden) publishes for the first time genomic breeding values for direct health traits (RZudderfit (mastitis resistance), RZhoof (- health), RZrepro (-duction), RZmetabol (-ic stability), RZhealth (total)) and this open up the possibility to investigate the relationship of DMI and EB to health using genomic breeding values. A subset of 269 Karkendamm cows had genomic breeding values for both, EB traits and health traits. On average, the cows in the optiKuh reference population exhibited a negative EB during the first 75 days. Thus, health breeding values were correlated with both, the average lactation day 1 to 75 breeding values for DMI and EB (hereinafter referred to as „BV1-75“) and the average lactation day 1 to 350 breeding values for DMI and EB. Correlations were all positive and generally stronger if the BV1-75 were considered. The closest relationship was found between the BV1-75 for EB and RZhealth ($r=0.41$, $P < 0.0001$). RZmetabol was most closely correlated with BV1-75 for DMI ($r=0.35$, $P < 0.0001$ vs. $r=0.27$ ($P <0.0001$) with BV1-75 for EB), indicating that selection for decreased DMI might have detrimental effects on metabolic stability. This is especially relevant if DMI can be considered in the breeding goal, but genomic evaluation for health traits is not (yet) possible. International collaboration (e.g. within the framework of the global Dry Matter Initiative II) is necessary to further enhance our knowledge on the associations between DMI, EB, and health traits.