



Genetic Evaluations for Body Maintenance Requirements

March 21, 2023

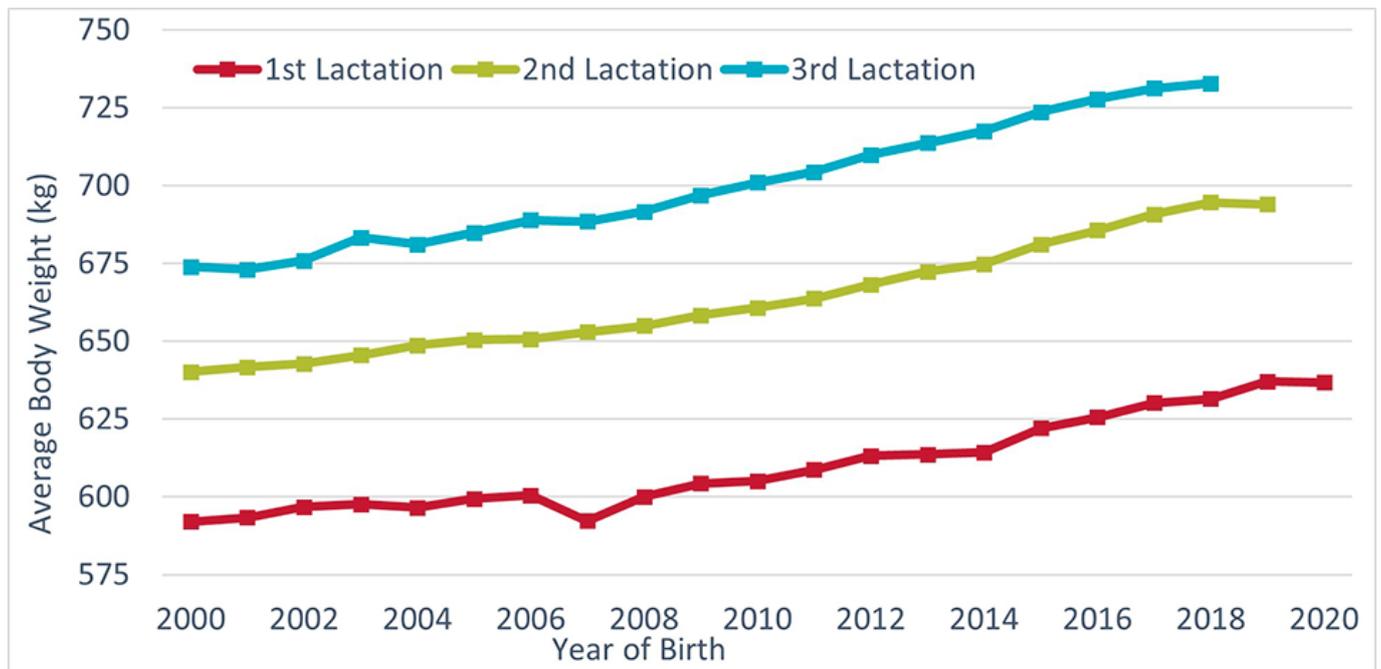
In April 2023, there will be another way to select for reduced feed costs in the Holstein breed. While historically, genetic selection focused on increasing performance and revenue, the value of genetics in reducing inputs and expenses is also pivotal. Feed represents the greatest expense for dairy farmers and as prices continue to rise year-over-year, finding ways to lessen these costs or the amount of feed required can help boost farm profitability. Body Maintenance Requirements (BMR) is a genetic evaluation characterizing the feed requirement for maintenance based on the metabolic body weight of the animal.



Feed Required for Maintenance

Over the last several decades, cow body weights have been recorded in the Lactanet database for feed management purposes, mainly in Quebec herds. As shown in Figure 1 the average weight of a Holstein cow has been steadily increasing over time. This also means that the feed required for maintenance has increased accordingly. Maintenance energy is needed to maintain the vital body functions and normal daily processes like eating and walking. The net energy required for maintenance, excluding any additional external stressors, is proportional to the animal's metabolic body weight. Metabolic body weight is simply the animal's measured body weight to the power of $\frac{3}{4}$ ($BW^{0.75}$) and represents the amount of metabolically active tissue in the body. As a cow increases in weight, so does the metabolic body weight and the amount of feed required for maintenance.

Figure 1. Trend in average body weight (kg) for Holstein cows recorded within the first ten weeks of lactation



Relationship with Feed Efficiency

Since 2021, Canadian producers have had the opportunity to select for Feed Efficiency and breed for animals that are able to convert feed to milk more efficiently. Feed Efficiency evaluations account for the differences in feed consumption observed between animals due to their production level or body weight and targets true metabolic feed efficiency. Feed Efficiency and BMR are therefore uncorrelated with each other. To maximize selection toward lowering feed costs, both Feed Efficiency and BMR can be considered, but no matter your strategy with BMR, there will be desirable bulls for Feed Efficiency.

Genetic Evaluation for Body Maintenance Requirements (BMR)

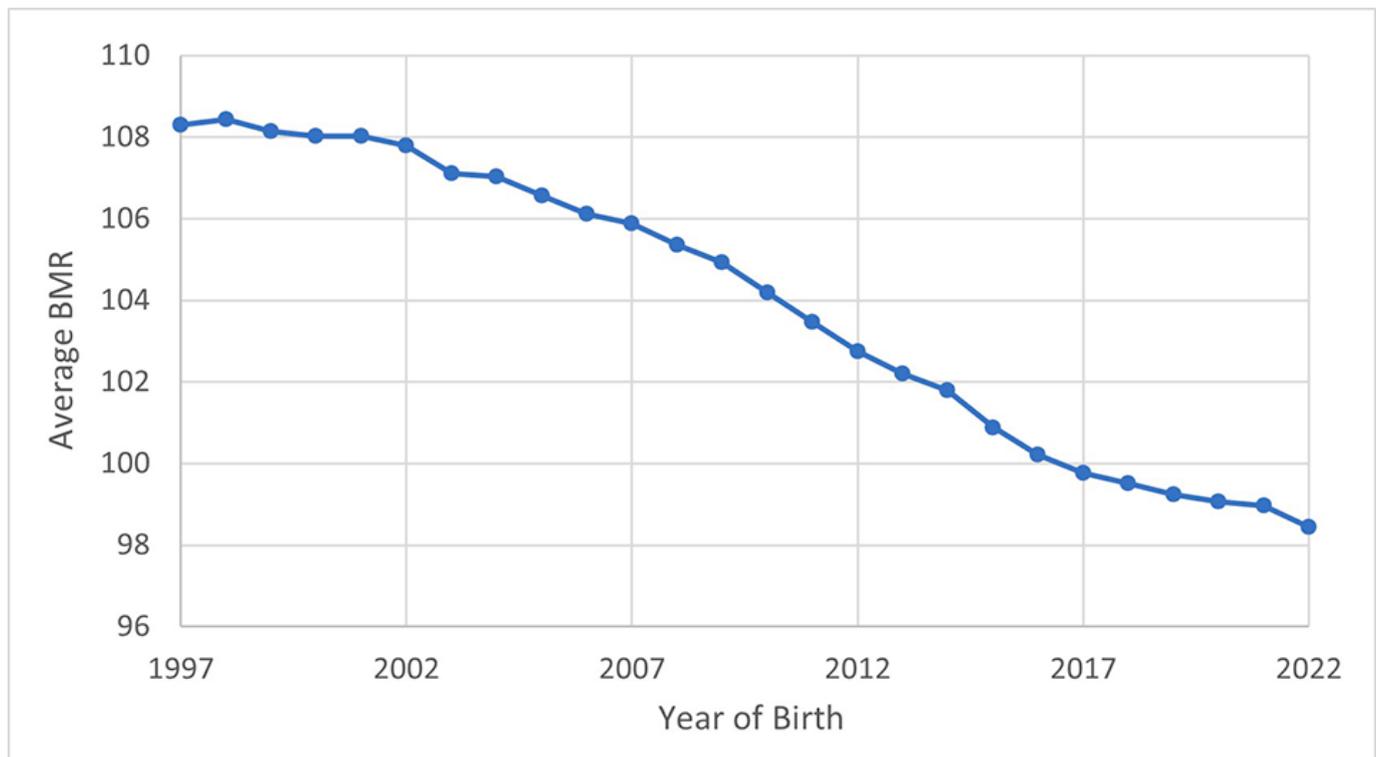
For BMR genetic evaluations, metabolic body weight recorded in first, second, and third lactation are analyzed together in a three-trait, single-step genomic evaluation system. The published BMR evaluations are an equal combination of the three lactation evaluations, which have a strong genetic correlation with each other (78% to 86%). Like many other traits

describing physical characteristics, BMR has a relatively high heritability of 47%. Bulls with an official proven status have a minimum of 20 daughters with records in at least 5 herds and a reliability above 70%. On average, young genomic bulls and heifers achieve a reliability for BMR of nearly 70%.

Trait Interpretation

Like all functional traits, BMR is expressed on an RBV scale where the average is set to 100 and typically range from 85 to 115. Sires with a higher RBV are expected to have daughters with lower body maintenance requirements (i.e.: daughters lower in weight) and less feed needed to meet these requirements. In the past, there has been indirect selection for increased body weight in the Holstein breed, whether intended or not. This has been observed at the farm level and is further seen in the declining genetic trend for BMR (Figure 2). With this trend, it is expected that many of the more recently born males and females will fall below the breed average BMR of 100, which is set according to officially proven sires born between 2008 and 2017 for this April release.

Figure 2. Genetic trend for Body Maintenance Requirements for Holstein females with a reliability of at least 30%



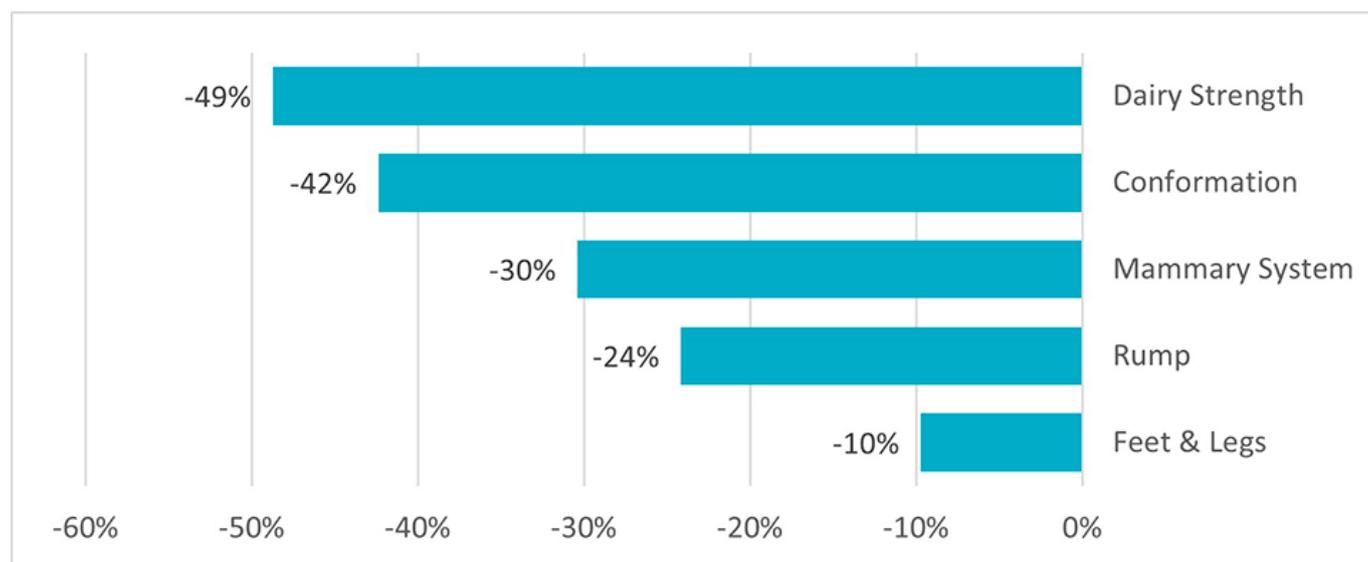
For each 5-point increase in a sire's RBV for BMR their daughters are expected, on average, to have a metabolic body weight that is $2.74 \text{ (kg BW)}^{0.75}$ lower, or approximately 20 kg less body weight. This difference is expected across the entire lactating lifespan. Considering net energy and metabolizable energy requirements for maintenance, each +5 points in sire RBV for BMR could save around \$70 in maintenance feed costs per daughter over three lactations. Savings are expected to be even greater since larger cows may also have greater dry matter intake above their requirements and will also have higher rearing, growth, and housing costs, which are not fully offset by a higher cull cow value.

Association with Other Traits

It should not come as a surprise that BMR and body weight in general are associated with many of the conformation traits evaluated in dairy cattle. High BMR bulls tend to have lower proofs for most conformation traits. Figure 3 displays the proof correlations between BMR and the major scorecard traits. Dairy Strength and its associated linear traits are the

most negatively correlated with BMR with Stature and Chest Width being the individual traits with the strongest relationship. Calving Ability is one trait positively correlated with BMR, where high BMR bulls have easier calving of their progeny. Because of the strong negative genetic trend that exists for BMR, many traits that have been improving with time will display a negative association with this new trait. High BMR bulls will be older proven sires that primarily also have lower LPI and Pro\$ values. Given the wide variety of bulls available today, however, there is still plenty of opportunity to select for BMR along with all other traits of interest.

Figure 3. Proof correlations between Body Maintenance Requirements and major type traits for proven sires with an official evaluation



Summary

Body Maintenance Requirements (BMR) will be available in April 2023 for producers who wish to reduce feed costs by decreasing the feed required for body maintenance. No matter your preferred strategy for BMR – which may be to reduce body size, maintain the current size in your herd by avoiding extreme BMR bulls, or to focus only on Feed Efficiency – Lactanet has the tools to help lower feed costs and increase profitability.



By Allison Fleming, Ph. D.

Allison enjoys sharing her knowledge of the dairy cattle genetic improvement landscape with all audiences from the technical to the end-user for the successful understanding and application of genetic selection tools.



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