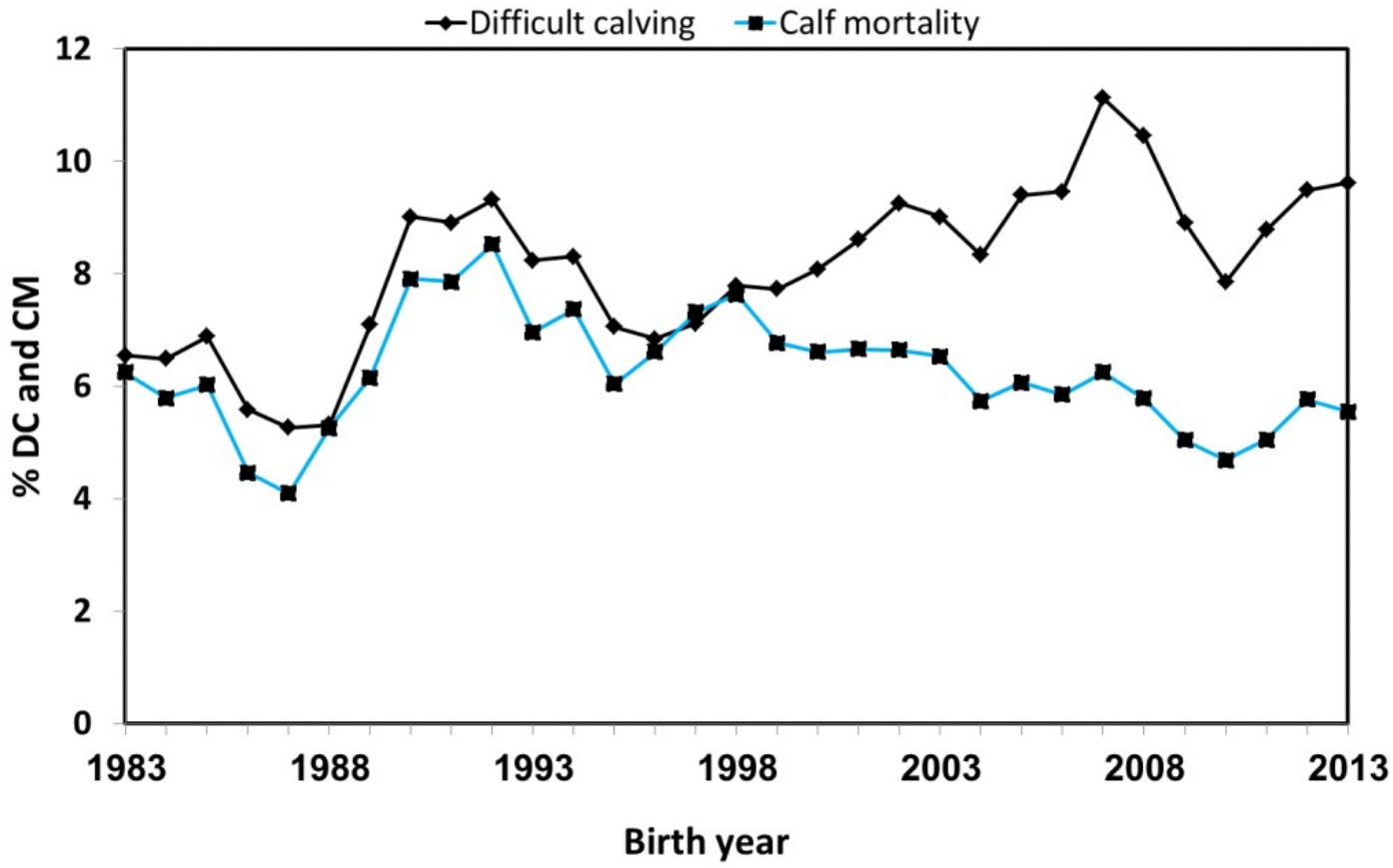
Breeding dairy cattle for calving ease

Over the last fifty years breeding of dairy cattle in has led to very major increases in milk production, especially with respect to the Holstein strain, which is the main dairy breed in all western countries. However, improvement for other traits, especially those related to fertility have been minimal, or even negative. Although more emphasis has been put on secondary traits in recent years, calving difficulty and calf mortality remain as major problems that affect profitability of dairy farming, especially for first calving cows. Over the last 100 years early maturing cows have been selected, and now the age of most cows at first calving is 24 months, even though dairy cows reach their mature size at only 4-5 years of age. In some populations the frequency of difficult calvings, which require farmer intervention, and sometimes surgery, is greater than 10% of all first calving cows. Our results show that a difficult first calving reduced herd-life of Israeli Holsteins on the average by nearly half a year. Incidence of calf mortality is nearly as high, and limits the farmer's choices for cow replacements. Also, all male calves from the dairy herd are sold for beef production, and a dead calf is a net loss for the farmer. Many of the same genes affect both traits.



Means of dystocia (DC) and stillbirth (SB) of first calving cows by birth year.

Breeding for calving traits is complicated first because these traits are less heritable than milk production traits. Second, because calving difficulty is a categorical trait, and is generally scored as either "normal" or "difficult." Likewise, for calf mortality, the possibilities are either "live" or "dead." It is much more difficult statistically to compute genetic values for traits with discrete distributions, and compared to traits with continuous distributions, such as height, weight, or milk production. Finally unlike milk production, calving traits are affected both by the cow calving and the father of the calf. That is, a difficult calving may be caused by a large calf, due the genetic contribution of the calf's father, or a mother with poor conformation with respect to calving. Genetic control of these two factors is completely different.

Using advanced statistical methodology we have developed a computer program that evaluates all cows in the milk-recorded population for their genetic propensity to difficult calving and to produce live calves. Likewise the program also evaluates the bulls for their "father effects" on these traits. All first and second calvings are included in the analyses, which accounts for the fact that the incidence and genetic control of these traits are somewhat different for the two calvings.

A total of 899,223 Israeli Holstein cows with first calvings between 1985 and 2015 were included in the complete analysis. Mean incidences of difficult calving and calf mortality in this population were 8.2% and 6.25%. As for most mammals, including humans, males are larger than females even at birth. Thus frequencies were 6.2% and 4.3% higher for male, as compared to female calves for these traits. Among the fathers of calves differences between the best and worst bulls were 15% for difficult calving and 10% for calf mortality. Therefore in Israel one year old female calves are generally mated only to bulls known to cause easy calvings. The time trends for first parity calvings are shown in Figure 1. Incidence of difficult calving has increased over time, while incidence of calf mortality has remained stable. Implementation of the new methodology for analysis of calving traits, should aid in breeding for these traits, especially in the new age of "genomic selection" based on genotyping breeding animals for tens of thousands of genetic markers.

Publication

Genetic analysis of calving traits by the multi-trait individual animal model.
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