Using body condition score to select for better reproductive performance

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Body Condition Score (BCS) is commonly used as an indicator of the extent and the duration of the postpartum energy balance status of the dairy cow. It is therefore related to economically important traits such as production, reproduction and health. A recent study conducted on Holstein and Ayrshire BCS data from Québec indicated that BCS is genetically linked to fertility but also to calving performance. The inclusion of BCS in selection programs should therefore be considered in order to select for or maintain better reproductive performances.

Body Condition Score: definition and interest

Body Condition Score (BCS) is a subjective measure of body tissue reserves and indicates the energy balance status of the dairy cow. It is generally based on the observation of the rump regions, hip and pin bones, tail head, etc. Different scales are used around the world, but the BCS (scale) generally varies between emaciated cow (1 in Canada) and obese cow (5 in Canada). The BCS profile changes throughout the lactation: fresh cows in peak lactation tend to be in a negative energy balance and therefore lose condition; late lactation cows, dry cows and low producers are in a positive energy balance and gain condition. BCS is collected by farmers, veterinarians, field staff or classifiers. If regularly recorded in a herd, BCS can become a valuable management tool giving farmers the ability to fine-tune feeding and management practices (e.g. the timeliness for artificial insemination).

Furthermore, BCS could also be integrated in selection programs. Previous studies indicated that BCS has a moderate heritability (from 0.15 to 0.35) and that genetically low BCS suggests poor fertility and health. Furthermore, BCS is negatively related to angularity but also to milk, fat and protein yields. A study recently published in the Journal of Dairy Science assessed the genetic relationship between BCS and reproduction traits for first-parity cows in Québec.

Data and methodology

In this study, data used were Ayrshire and Holstein first-parity BCS collected by Valacta field staff several times over the lactation between January 2001 and September 2008 in herds from Québec. Reproduction records for herds that scored BCS were extracted from the official database of the Canadian Dairy Network. Genetic correlations between BCS and the following reproduction traits were studied: days between calving and first service (CTFS); days between first service and conception (FSTC); days between calving and conception or days open (DO); 56-days non return rate at first insemination (NRR); calving difficulty (CD); and calf survival within 24 hours from birth (CS). Both maternal and direct (or "calf") components of calving difficulty (CDm and CDd) and calf survival (CSm and CSd) were analysed. Analyses were undertaken on data from 12,000 Ayrshire cows in 108 herds and on data from 43,000 Holstein cows in 342 herds. For each breed, six two-trait models (BCS and one of the reproduction traits) were run. These models included random regressions that allowed the estimation of genetic correlations between BCS over the lactation and reproduction traits that are measured as single lactation record; i.e. they could estimate the genetic relationship between the fertility of the cow and BCS at different stages of the lactation (illustrated in Figures 1 and 2).

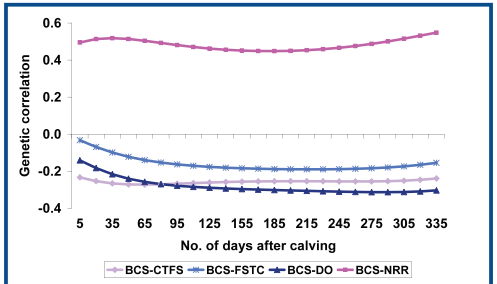

Figure 1: Genetic correlations between BCS and fertility traits for Holstein first-parity cows

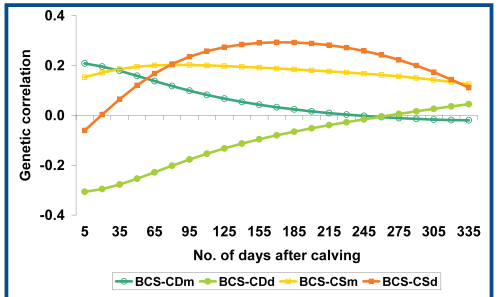

Figure 2: Genetic correlations between BCS and reproduction traits for Holstein first-parity cows

Relationship between BCS and fertility traits

Average daily heritabilities for BCS were close to 0.13 for both breeds; these relatively low estimates could be explained by the high variability among herd and BCS evaluators. Genetic correlations between BCS and interval fertility traits (days between calving and first service, days between first service and conception, and days open) were negative and ranged between -0.77 and -0.58 for Ayrshire and between -0.31 and -0.03 for Holstein (illustrated in Figure 1). Genetic correlations between BCS and 56-days non return rate were positive and moderate. Trend of genetic correlation over the lactation suggested that a genetically low BCS in early lactation would increase the number of days that the primiparous cow was not pregnant and would decrease the chance of the primiparous cow to conceive at first service. This indicated that cows that were genetically low for BCS may not have been able to maintain energy levels sufficient to activate ovarian function or display oestrus. These types of cows were likely inseminated for the first time at a later date and would likely conceive later as well.

Relationship between BCS and calving traits

Genetic correlations between BCS and calving traits were generally the strongest at calving and decreased with increasing number of days after calving. The correlation between BCS at calving and the maternal component of calving difficulty was 0.21 for Holstein (illustrated in Figure 2) and 0.31 for Ayrshire, which emphasize the relationship between fat cows around calving and dystocia. Indeed, previous studies reported that animals carrying excessive body condition resulting in intra-pelvic fat deposition and a reduction in pelvic area (especially for heifers) were more likely to develop dystocia. Genetic correlations between calving traits and BCS during the subsequent lactation were moderate and favorable, indicating that primiparous cows with a genetically high BCS over the lactation would have a greater chance of producing a calf that survived (maternal component of calf survival), and would transmit the genes that allowed the calf to be born more easily (direct or "calf" component of calving difficulty) and to survive (direct or "calf" component of calf survival).

Inclusion of BCS in selection programs

Current breeding programs tend to combine both productive and functional aspects to select high-producing and robust cows. In support of this global objective, interest in functional traits such as BCS is increasing, especially because of its relationships with economically important traits like fertility and calving. As these traits are difficult to measure, are often not readily available and have low heritabilities, BCS can serve as predictor for estimating breeding values for reproduction traits. It is particularly interesting given that BCS has a greater heritability than reproduction traits and that the correlation between BCS and reproduction were generally moderate. Therefore, developing selection tools based on BCS would allow indirect selection for reproduction traits.

Summary

Except for the maternal component of calving difficulty, favorable genetic correlations were found between BCS and fertility and calving traits. This was in support of previous studies that reported that genetically low BCS was more common in less robust cows presenting impaired fertility or heatlh disorders. Genetic correlations were stronger in mid-lactation for fertility traits and in early lactation for calving traits. Genetic correlation trends were the same for both breeds, but were generally greater for Ayrshire than Holstein. This might reflect a different focus of selection between the breeds. Finally, these results supported the interest of including BCS as an indicator trait in the current breeding programs in order to improve cow robustness.