

## Ano-Genital Distance – An Indirect Fertility Trait in Dairy Cows?

Mohanathas Gobikrushanth<sup>1</sup> and Divakar Ambrose<sup>2</sup>

<sup>1</sup>University of Alberta, Edmonton, AB; <sup>2</sup>Livestock Systems Section, Alberta Agriculture and Forestry, Edmonton, AB.  
E-mail: [gobikrus@ualberta.ca](mailto:gobikrus@ualberta.ca) (or) [divakar.ambrose@gov.ab.ca](mailto:divakar.ambrose@gov.ab.ca)

### Why is this important?

Fertility is the fundamental element of reproduction, which, in the context of dairy production, is the capability of a cow to conceive and calve periodically to ensure repeated lactation cycles. The continued importance given for genetic selection of production traits, e.g. milk yield, while ignoring or placing less emphasis on reproductive traits may be considered a contributing factor for impaired fertility in dairy cows. Although traditional fertility traits, e.g. daughter pregnancy rate in the US and daughter fertility in Canada, have been recently introduced into the national selection indices, they are known to have poor heritability (ability to be passed genetically to offspring).

Thus, it is important to identify new fertility traits in dairy cows, in an effort to improve reproductive efficiency.



Figure 1. Measuring ano-genital distance (AGD); the distance from the centre of the anus to the base of the clitoris

### What did we do?

A reproductive phenotype is valuable for genetic selection when it has high variability, heritability and association with fertility. We evaluated ano-genital distance (AGD; the distance from the centre of the anus to the base of the clitoris; as shown in Figure 1), for its value as a novel reproductive phenotype in Canadian Holsteins. Based on previous studies conducted in mice, rabbits and women, female fetuses exposed to high levels of maternal testosterone (male sex hormone) during in-utero development (i.e. gestation period) are more likely to have a longer AGD and impaired reproductive functions during adulthood. Such studies, however, have not been conducted in dairy cattle.

Ano-genital distance was measured using digital calipers at mid lactation in 921 Canadian Holsteins from four dairy herds in Alberta. Reproductive data were collected from DHI records and the associations between AGD and fertility were analyzed retrospectively.

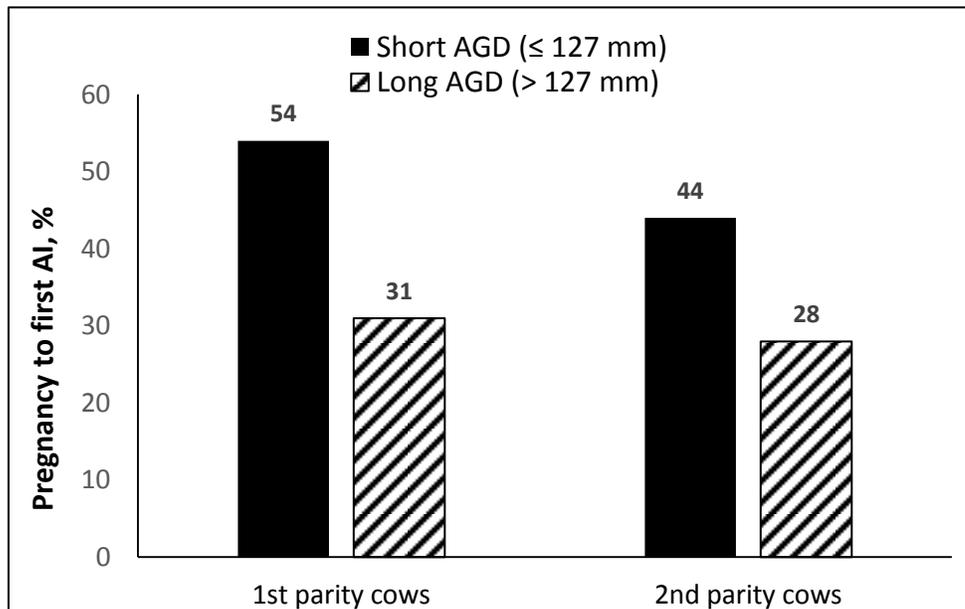


Figure 2. Pregnancy at first AI (%) in 1<sup>st</sup> and 2<sup>nd</sup> parity cows based on ano-genital distance (AGD).

### What did we find?

- (1) AGD was highly variable in the sampled population. While AGD in some cows was as small as 96 mm, some cows had AGD as high as 160 mm.
- (2) Neither age nor height of the cow had a major influence on AGD.
- (3) AGD had moderate heritability (0.52), which is far greater than that of conventional fertility traits used in genetic selection (usually below 0.10).
- (4) AGD was inversely related to fertility (e.g. pregnancy to first insemination was greater in 1<sup>st</sup> and 2<sup>nd</sup> parity cows with shorter AGD than those cows with longer AGD; see Figure 2).
- (5) AGD and fertility were not associated in mature cows (3<sup>rd</sup>+ parity cows), likely because only cows that excel in both fertility and milk production would typically remain in the herd beyond two lactations. This leaves a relatively fertile pool of older (third + parity) cows, within which the association between AGD and fertility was less evident.

### What does this mean?

The results from this study indicate that AGD may be a novel reproductive phenotype of value for genetic selection. However, while these initial findings on Canadian Holsteins are exciting, large scale validation studies are required in multiple populations to confirm the negative relationship between AGD and fertility in dairy cows.

#### Summary Points

- Identification of novel fertility traits is needed to select for increased fertility in dairy cows
- Ano-genital distance was estimated to have moderate heritability (0.52), much greater than conventional fertility traits (less than 0.10)
- A shorter ano-genital distance was associated with improved fertility in 1<sup>st</sup> and 2<sup>nd</sup> parity cows



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