Calf Shape and Calving Difficulty

Can We Select for Favorably Shaped Calves?

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Calf birthweight and pelvic area of the cow are the two most important factors associated with calving difficulty. Both traits are moderately heritable and can be used as selection criteria to reduce calving difficulty.

However, birthweight and pelvic area generally account for less than 50 percent of the variation in calving score (e.g., 1 = unassisted birth to 6 = Caesarean). Thus, even if cow pelvic area and calf birthweight were known, the predictability of calving difficulty for a single mating would be low.

The identification of a trait in addition to birthweight and pelvic area that could help consistently predict the occurrence of calving difficulty or dystocia would be helpful to every cow-calf producer.

A study at Virginia Tech determined that calf shape could be measured, was heritable, but most importantly was not consistently related to either observed dystocia or genetic merit for dystocia independent of birthweight.

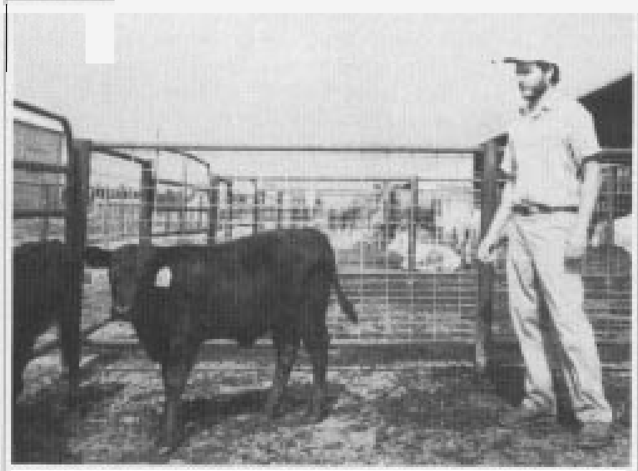
The conclusion is simple. Select bulls on birthweight EPD to control calving difficulty. Do not worry about the shape of a bull when trying to evaluate his potential for causing calving difficulty.

You are probably not wrong when you swear a certain calf was born with difficulty because he had a big head or wide hips, nevertheless, that big head or those wide hips probably just meant that he was big. The sire's birthweight or (better yet) birthweight EPD provides a more accurate estimate of a calf's chances for a difficult birth than any shape measure.

Reliable prediction depends upon consistent, repeatable trends. This does not mean that a long, skinny, 95-pound calf will never be born unassisted while a seemingly square, block-shaped 75-pound calf has to be pulled. What it does mean is that, on average, progress cannot be made in decreasing calving difficulty by selecting for body shape in addition to birthweight.

It is common to hear a breeder discuss the body shape of a possible herd sire when he's assessing the potential for dystocia in the bull's calves. Intuitively, the body shape of a calf should influence its ability to pass through the cow's pelvis and therefore be useful in predicting dystocia.

The study conducted at Virginia Tech, however, suggests that intuition and reality in this instance may not be the same.



Russ Nugent is studying calf shape and dystocia at Virginia Tech.

The objective was to examine the usefulness of calf shape in predicting and selecting against dystocia.

Before discussing the study, it is necessary to examine what is required of calf shape to be a functional selection criterion. To be a useful trait for selection, calf shape must be:

1) **easily measured -** how do we define calf shape and is there an easy way of measuring it?

2) **heritable —** if we expect to make progress selecting for the trait there should be differences among animals that are related to genes that they can pass on to their offspring;

3) consistently related to dystocia, **independent of birthweight.**

It is clear that birthweight is easily measured, heritable and strongly related to dystocia. Additionally, birthweight is commonly recorded and usually available for comparison of bulls. Furthermore, birthweight EPDs (expected progeny differences) can be used to predict the tendency of a bull to sire calves born with difficulty. If some measure of calf shape is to be useful, it has to be related to dystocia independent of birthweight. In simple terms, calfshape, in addition to birthweight, must consistently be helpful in predicting calving difficulty for that measure to be a trait worthy of selection.

Three separate sets of calves were used in the Virginia Tech study: 374 purebred Angus, 438 Polled Hereford x Angus and 204 Simmental x Polled Hereford-Angus. The first two groups of calves were out of mature cows, while the latter group was out of 2- and 3-year-old females calving for their first and second time, respectively. At birth, calves were weighed and measured for head circumference, shoulder width, heart girth, hip width, cannon bone circumference, cannon bone length and body length (Figure 1). These body measures were used as indicators of calf shape and were easily measured while the calf was held in the same body position that it assumes during delivery.

Birthweight was highly correlated to all seven body measures suggesting that body size (usually represented by weight) also could be represented by any of the calf measures that we recorded. In the Angus-sired calves there were differences among calves due to their sire (sire effects) for birthweight, head and cannon bone circumferences and body length. Thus, calves were of different body sizes in part due to their sire.

The pertinent question, however, was whether sire effects were present in body measures at the same (independent of) birthweight. Each measure was adjusted

Figure 1. **Seven body shape measures and weight were recorded within 24 hours after birth. Calves were held in the posture they assume during birth for each measurement.**

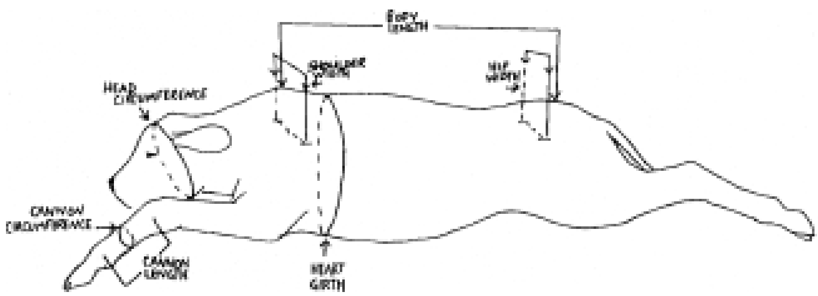


Table 1. Average calf size and difference in body measures between calves born assisted and unassisted before and after adjustment of measures for birthweight.

		Difference (assisted — unassisted)	
Body measure	**Average**	**Observed**	**After adjustment for birthweight**
Birthweight	82.1	6.8	
Head circumference	18.9	.4	.0
Hip width	7.7	.3	.1
Shoulder width	7.1	.3	.1
Body length	20.4	.4	-.1
Cannon bone circumference	4.7	.2	.0
Cannon bone length	6.1	.0	-.1
Heart girth	28.5	.6	-.2

Note: All measures are reported in inches except birthweight (pounds).
[+] Source: Virginia Tech

for birthweight by linear regression and again tested for sire effects. Calf cannon bone circumference still differed among sires.

Similar results were seen with the Polled Hereford-sired calves: hip width, body length, cannon bone circumference and heart girth differed among sire groups after removal of differences due to birthweight alone. Thus, differences in body measures of calves at the same birthweight existed and could be attributed in part to sire.

To confirm this result three indices were constructed that described independent aspects of calf shape using the body measures adjusted for birthweight.

The first index for the Angus-sired calves described independent aspects of calf shape using the body measures adjusted for birthweight. The first index for the Angus-sired calves described skeletal width, the second index described skeletal thickness, and the third described skeletal length (remember, these are independent of birthweight). Just as was observed with the individual measures, sire effects were present for calf shape (indicated by the indices).

The presence of sire effects for the individual body measures indicated that the traits should be heritable. Birthweight was highly heritable (.52), while the heritability of the other measures before they were adjusted for birthweight was low to moderate (range from .14 to .34). After adjustment for birthweight, the heritability of the measures was near zero except for cannon bone circumference (.16) This meant that bone thicknesses in newborn calves could be altered by selection without a correlated change in birthweight.

As indicated above, the real key was to assess whether shape in addition to birthweight was related to dystocia. The Angus and Polled Hereford bulls were bred to mature cows so the actual incidence of calving difficulty was low. However, the Simmental bulls were bred to young females and subsequently 42 percent of the calvings were assisted (use of mechanical calf puller or Caesarean).

Because many calves were born with assistance it was possible to compare the calves born unassisted with those born with assistance. The assisted calves were almost seven pounds heavier and were larger in all other body measures (by .2 to .6 inch) except cannon bone length (Table 1). Yet when the data were adjusted for birthweight there was no significant difference between the body measures of calves born assisted and unassisted. Thus, calves that were born with assistance did have big heads and wide hips (for example), but only because they were large calves and not because they were shaped any differently than calves born unassisted!

One problem with a trait like dystocia score is its subjectiveness. One producer may pull a calf when another producer may wait and see if the cow can deliver the calf by herself. This leads to differences in recorded calving score data due only to human decision. To avoid using only subjective calving scores in the analysis, the weight adjusted-shape of the Simmental- and Polled Hereford-sired calves was. also compared to the EPDs of their sire for birthweight and first-calf calving ease.

The EPD for birthweight was an accurate estimate of the sire's genetic potential for birthweight, while calving ease EPD indicated a sire's genetic predisposition to produce calves born with difficulty.

When body measures or the shape indices were adjusted for birthweight and EPD for birthweight there was no relationship between calf shape and EPD for calving ease. Any relationship between calf shape and genetic potential for dystocia independent of actual birthweight was mediated only through genetic potential or heavier birthweights.

If you still think calf shape influences dystocia and should be selected for, consider the following: repeatability of cow effects on her calve's body measures independent of birthweight was low (.22 or less) suggesting that the shape of previous calves does not help to predict the shape of the next calf of a given cow. The correlation of body measures on a calf (independent of weight) and the same measures on the calf's dam at her birth was low (range in coefficients -.17 to .10).

Finally, the same body measures on a calf at birth and at weaning independent of weight are also lowly correlated (.03 to .09). Thus, body shape of a newborn calf independent of general size (weight) cannot be accurately predicted from the body shape of its parents at their birth and further, there is little relationship between newborn body shape and shape in the older animal. Thus, looking at a prospective herd sire's body shape gives you little if any information on how his calves will be shaped.

Editor's Note: Russ Nugent is currently a research animal scientist at the Roman L. Hruska U.S. Meat Animal Research Center, ARS, USDA, PO. Box 166, Clay Center, NE 68933-0166. The research on calf shape was conducted by Russ Nugent, Dave Notter and Bill Beal in the animal science department at Virginia Polytechnic Institute and State University, Blacksburg. Technical details of this project can be found in the June 1991 issue of the *Journal of Animal Science* 69(6):2413-2433. AJ