American Angus Association®
Teat Size (TEAT) and Udder Suspension (UDDR) Research Report
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Background

In the suite of traits to improve maternal function, good udder structure plays an important role in beef production. Even though milk is not the end product from a beef production system, good udder structure is related to cow longevity and health, as well as calf survival and growth from birth to weaning.

To characterize udder structure, the American Angus Association® (Association) has scoring guidelines to help producers evaluate their cow herd. The scores are taken within 24 hours of birth of the calf and can be taken for every calf a cow births. The visual assessment of teat size (TEAT) and udder suspension (UDDR) should be reported on the combined weakest quarter and one person should score all the females within the same management group.

Both scores (TEAT and UDDR) are scored on a scale from one to nine, where a score of one represents a very large and misshapen teat, or a very pendulous udder, while a nine indicates a very small teat size or a very tight udder.

The detailed scoring guideline as well as more data recording instructions can be found on the Angus.org teat and udder research page under the Angus Herd Improvement Records® (AHIR) program or by clicking here.

Given the relevance of TEAT and UDDR and the amount of data already submitted by Angus breeders to the Association, Angus Genetics Inc. (AGI) set out to research these traits and develop TEAT and UDDR research expected progeny differences (EPD) for the membership.

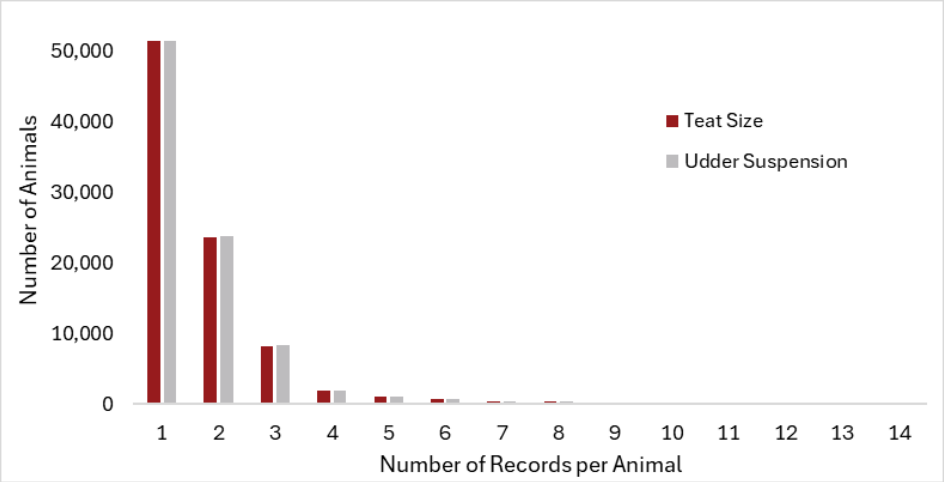
The research explored the data distribution within the Angus population, estimated genetic parameters, heritabilities, and genetic correlations as well as the development of the statistical model for a research genetic evaluation.

Data Dive

For the research and development of the research EPD for each of these traits, phenotypic records, alongside pedigrees and genotypes are incorporated in the single-step genetic evaluation model.

In the research development, there were over 148,000 records for each TEAT and UDDR, from more than 87,000 individual cows. The number of records is larger than the number of cows as females can have multiple records submitted over their lifetime. Many cows only had one record reported but there are some with up to 14 records submitted (Figure 1).

Figure 1: Distribution of the number of records per cow in theTEAT and UDDR research.



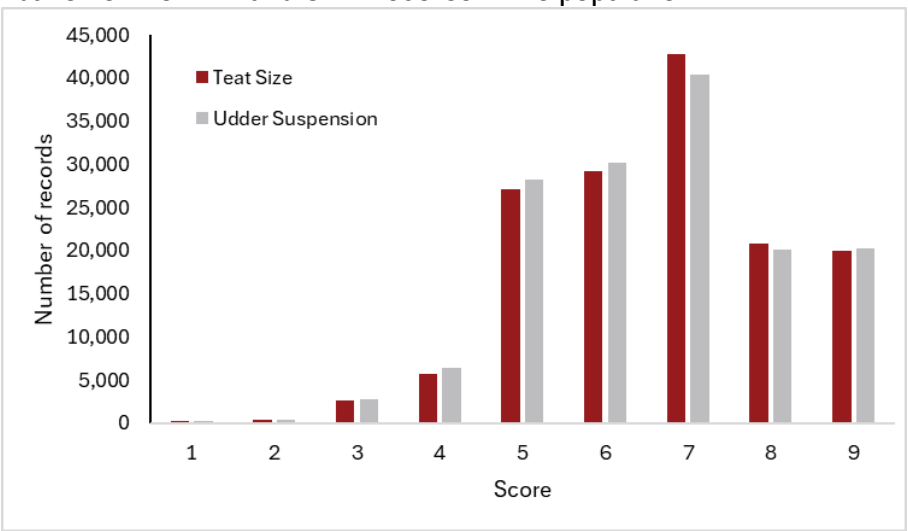
Overall, both teat and udder scores have an average score of 6.6 and submitted scores range from one to nine, representing the entire scoring scale. Table 1 shows the descriptive statistics of the phenotypic data.

Table 1: Descriptive statistics ofTEAT and UDDR phenotypic records.

Trait	N records	Average	Min	Max	SD
Teat Size	148,639	6.6	1.0	9.0	1.5
Udder Suspension	148,959	6.6	1.0	9.0	1.5

Even though the scores are distributed across the entire scoring scale, the number of records scored between 1 and 4 is small and most of the data lies between scores five through nine, as displayed in Figure 2.

Figure 2: Distribution of theTEAT and UDDR scores in the population.



The data distribution in Figure 2 shows that most cows were between scores 5 and 7 for both traits, which are between intermediate to small teats, and intermediate to tight udders.This would indicate that the Angus cow herd reported into the Association's database have good udder structure.

For teat size and udder suspension, extreme scores on either end of the scale are undesirable. Large teats can prevent a calf from suckling and proper intake of colostrum, and large/pendulous udders can cause problems like mastitis and are more prone to injury; on the other hand, very small teats can also result in a calf that cannot properly nurse and very tight udders may be associated with low milk production, resulting in poor calf development.

Modeling and genetic parameters estimation

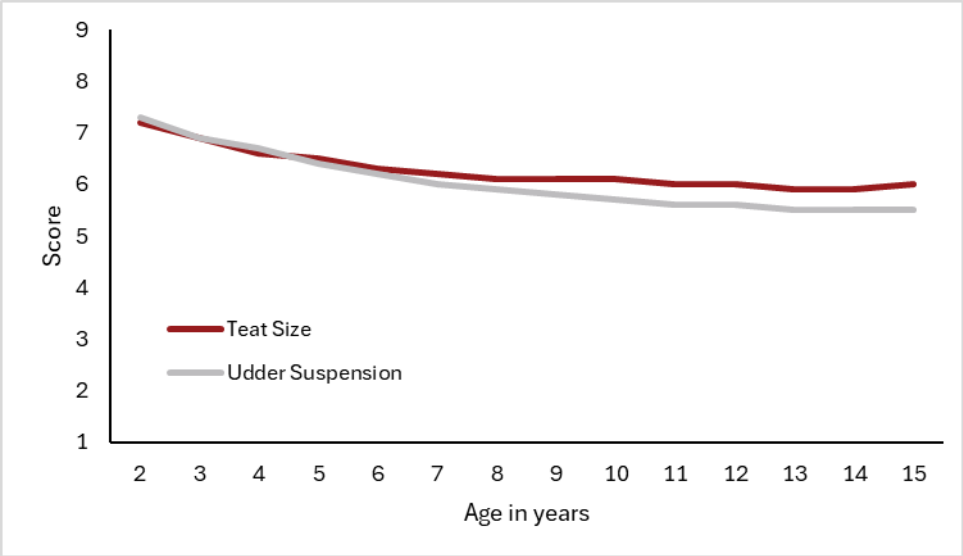
To estimate the heritabilities and genetic correlations, and to develop a research EPD, the first step is to identify the sources of non-genetic variation that affect a phenotype and develop the statistical model for the traits.

ForTEAT and UDDR, the contemporary group accounts for environmental and management differences and it was defined as calving events happening on an operation within a 90-day window and with the same birth management group.The birth management group is used to group cows that are managed and will calve together within an operation.

Note that both teat size and udder suspension scores should be measured within 24 hours of the calf's birth.

In addition to the contemporary group, our research shows that the age of the cow also plays an important role, and as cows get older, teat size tends to get larger (scores closer to 1), and udders tend to get more pendulous (scores closer to 1).This is illustrated in Figure 3.

Figure 3: Average score forTEAT and UDDR as a function of age in years



The relationship between udder structure and cow age makes it important to score females multiple times throughout their lifetime, as well as to account for the age of the cows in the model. Because age is accounted for in the model, females should be scored the same regardless of their age at time of calving.

Table 2 shows the heritability for TEAT and UDDR as well as the genetic correlation between the traits. Both teat size and udder suspension are moderately heritable (0.32 and 0.28, respectively) and have a genetic correlation of 0.77 which supports modeling them together in a multiple trait model.

Table 2: Heritability and genetic correlation for Teat and UDDR.

	Teat Size	Udder Suspension
Teat Size	**0.32**	0.77
Udder Suspension		**0.28**

Research EPDs

The TEAT and UDDR research EPDs are expressed in the units of teat and udder scores. These EPDs predict expected differences in teat size and udder suspension scores when comparing progeny of different individuals under similar mating and raised on the same conditions.

Teat Size EPD (TEAT), expressed in units of teat size score with a higher EPD indicating smaller teats. The teat size scores range from 9 (very small) to 1 (very large, balloon shaped). Longer, thicker teats inhibit calf suckling which could decrease the intake of colostrum and increase the risk of preweaning mortality.

Udder Suspension EPD (UDDR), expressed in units of udder suspension score with a higher EPD indicating tighter udder suspension. The udder suspension scores range from 9 (very tight) to 1 (very pendulous). Weak suspension (low scores) indicates lack of support to the ligament that ties the udder to the cow's body all allowing the udder to hang low subjecting the udder to increased injury or other issues.

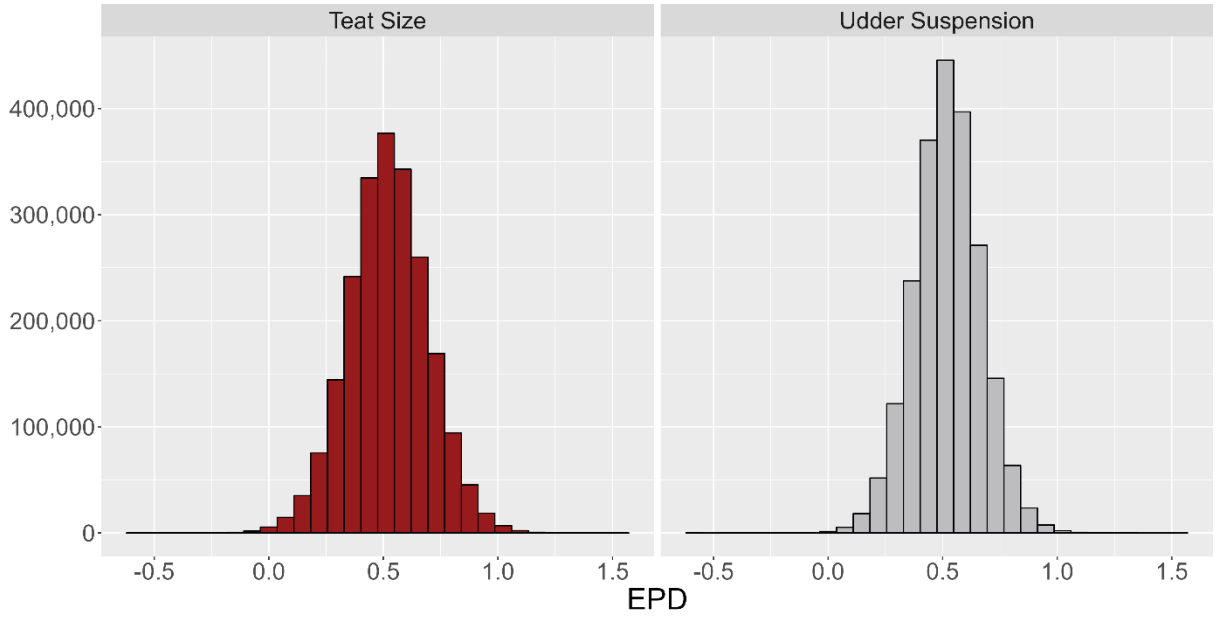
While overall smaller teats and tighter udders tend to result in fewer problems, breeders need to consider making breeding decisions to avoid extremes. In this context, while a higher EPD would lead to smaller teats and tighter udders over generations, caution is needed not to push the herd towards an undesirable extreme. A negative correlation exists between teat size and weaning weight direct (-0.14), and maternal (-0.17); this relationship is similar between udder suspension and weaning weight direct (-0.11), and maternal (-0.24). Weaning weight maternal is often referred to as the milk EPD and it is expressed as pounds of weaning weight.

Table 3 shows the EPD distribution of the entire population for TEAT and UDDR. The average EPD for both traits is 0.52 ranging from about -0.6 to 1.51. From largest to smallest there is a range of over two scores, which shows the variation within the population allowing breeders to make selection decisions that fit their breeding programs. Figure 4 shows the histogram distribution of the EPD that displays a bell-shaped distribution centered around the mean.

Table 3: Descriptive statistics of the overall population ofTeat and UDDR EPD.

Trait	Average	Min	Max	SD
Teat Size	0.52	-0.57	1.51	0.17
Udder Suspension	0.52	-0.60	1.33	0.15

Figure 4: Teat and UDDR EPD distribution.



Conclusion

The current research conducted by the AGI research team supports the release of research EPDs for teat size and udder suspension. These two new research EPDs will expand the American Angus breeder's toolbox to improve maternal function. Continued data reporting is encouraged as these new EPDs develop and the database expands. The development of the TEAT and UDDR research EPDs includes phenotypic data alongside pedigrees and genotypes in the single-step model. The TEAT and UDDR research EPDs were released on August 22, 2024. We will continue to monitor and research these traits until a final production release as well as their incorporation into the appropriate $Value indexes.