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Abstract
Ultrasound measures for 12-13th rib fat thickness, rump fat thickness, ribeye area and % intramuscular fat have been collected on more than 27,000 yearling Angus bulls and more than 7,000 developing heifers as part of a two-year research program with the American Angus Association. The effects of the age of the cow producing the calf and the age of the calf at scanning time are significant and must be accounted for through adjustments to the actual ultrasound measures before breeders can use the information to compare animals within contemporary groups.

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Adjustment Factors for Ultrasound Measures in Yearling Angus Bulls and Developing Heifers

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Summary

Ultrasound measures for 12-13th rib fat thickness, rump fat thickness, ribeye area and % intramuscular fat have been collected on more than 27,000 yearling Angus bulls and more than 7,000 developing heifers as part of a two-year research program with the American Angus Association. The effects of the age of the cow producing the calf and the age of the calf at scanning time are significant and must be accounted for through adjustments to the actual ultrasound measures before breeders can use the information to compare animals within contemporary groups.

Introduction

Ultrasound measures for 12-13th rib fat thickness, rump fat thickness, ribeye area and % intramuscular fat (IMF) have been collected on yearling Angus bulls and developing heifers as part of a two-year research program with the American Angus Association (AAA). Adjustment factors for such things as animal age, age of dam and animal sex are required in order to make fair comparisons between animals within contemporary groups and for development of ultrasound expected progeny differences. The purpose of this paper is to report the adjustment factors that have been developed as a part of this research project.

Method and Materials

Real-time ultrasound (RTU) images on purebred yearling Angus bulls and developing heifers were collected by field technicians working with the Iowa State University Centralized Ultrasound Processing (CUP) laboratory (Kildee Hall, Ames, IA 50011). Images collected include a rump fat image, a cross-sectional image between the 12-13th ribs and 4 longitudinal images taken across the 11-13th ribs. The images are stored on ZIP™ diskettes chute-side and sent to the CUP laboratory for interpretation of fat thickness measures, ribeye area and % IMF (a measure of marbling). The images were collected on animals from Angus herds throughout the United States during 1998-9. Scanning weight on each animal must be recorded within seven days of when the ultrasound images are collected. Phenotypic means for the traits measured and for each of the two sexes are presented in Table 1.

The data were edited to remove records that probably were incorrectly recorded in some way or that involved an animal that may have suffered from some health problem. For example, all records for animals with negative gain from weaning to yearling were deleted, as were records for animals gaining in excess of 6.0 lbs. per day. Bull records outside the range of 320 to 440 days of age were deleted, as were heifer records outside the range of 320 to 440 days of age. Animals with inconsistencies between the recorded scanning sex and sex recorded in the AAA database were deleted from the analysis.

All statistical analyses were preformed using PROC MEANS and GLM procedures of SAS. Contemporary group effects were defined as herd code, scanning lot date and animal sex. These effects were absorbed in the GLM analyses. Independent covariates considered singly and together in various combinations in the GLM analyses included: animal age, age of dam (AOD), animal scanning weight, and animal gain from weaning to scanning. Because no serial ultrasound measures on individual animals were available, all regression analyses were within sex classes and used pooled records.

Results and Discussion

Animal age and weight regression models for each of the ultrasound measures are given in Table 2. R^2 values are significantly higher for the external fat and ribeye traits using a weight regression model, whereas, age and weight model R^2 values for the % IMF trait are essentially the same. When both age and weight were used in the same regression model, age was always the least significant effect, and the R^2 values never improved significantly over those for the weight alone model. Therefore, ultrasound adjustment factors used by the AAA will be those using the weight regressions for the external fat and ribeye traits and the age regression adjustment for % IMF.

For example,

Animal gain, lbs/day = (scanning weight – actual weaning weight)/(animal age at scanning).

365-day scanning weight, lbs = scanning weight + (365 – animal age)*animal gain.

AOD, 365 day scanning weight, lbs = 365-day scanning weight + (adjustment factor from Table 2)

365-day % IMF (bulls), % = Actual % IMF + (365 – animal age) * .003591.

AOD, 365-day % IMF, % = 365-day % IMF + (factor from Table 2).

AOD, 365-day ribeye area (bulls), in^2 = Actual ribeye measure + (AOD, 365-day scanning weight – scanning weight) * .006197.

AOD, 365-day 12-13th rib fat thickness, in. = Actual 12-13th rib fat thickness + (AOD, 365-day - scanning weight) * .0002952.

After adjusting scanning weight for AOD effects, there is no need to additionally adjust the external fat and ribeye measures for the AOD effects. This was verified by running a GLM and testing the significance of AOD effects for external fat and ribeye traits after adjusting them to the AOD, 365-day endpoint for bulls (or AOD, 390-day endpoint for heifers) using the appropriate equations (see previous sample formulas). The AOD effects are either extremely small or statistically non-significant when this is done.

AOD effects on % IMF in both yearling Angus bulls and developing heifers, although small, are still significant and show definite trends as cows mature (see Table 3) . The results are slightly erratic for females 7 years and older. The results indicate that calves from first-calf heifers (2-year-old cows) have higher % IMF than 3-year-old and older cows; 3-year-old cows have higher % IMF values than 4-year-old and older cows up to about age 6. The trend tends to reverse past the 6 year age of dam category. The reason for this AOD phenomenon is not known at this time. The AOD adjustment factors to be used for the Angus records will be to subtract .09% and .13% from bull and heifer % IMF measures, respectively, out of 2-year-old cows, and to subtract .04 and .07% from bull and heifer % IMF measures, respectively, out of 3-year-old cows. At this time, no AOD % IMF adjustments will be made to records from calves out of 4-year and older cows.

Implications

Actual ultrasound measures on seedstock animals should never be used to compare animals for body composition traits. The effects of the age of the cow producing the calf and the age of the calf at scanning time are just too significant and must be accounted for through adjustment of the records. After the adjustments are made, then breeders can fairly compare differences between animals within the same contemporary group.

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Table 1. Phenotypic means for scanning weights and ultrasound measures in yearling Angus bulls and developing heifers.

	Bulls		Heifers	
Trait	Mean	SD	Mean	SD
Age, days	368	34	395	31
Weight, lbs	1076	128	847	118
Gain, lbs/day	2.90	.59	1.56	.49
12-13th rib fat thickness, in.	.24	.10	.22	.11
Rump fat thickness, in.	.29	.10	.30	.12
Ribeye area, $in.^2$	11.74	1.50	9.16	1.39
% IMF, %	3.51	.83	4.10	.95
No. of animals	27,699		7,735	

Table 2. Age and weight regressions that can be used to adjust ultrasound measures in yearling Angus bulls and developing heifers.

	Bulls				Heifers			
	Age		Weight		Age		Weight	
Trait	b	R^2	b	R^2	b	R^2	b	R^2
12-13th rib fat, in.	.000516	.47	.000295	.53	.00087	.59	.00038	.63
Rump fat, in.	.000517	.39	.000285	.44	.00130	.53	.00049	.59
Ribeye area, $in.^2$	.01262	.51	.00620	.61	.01666	.54	.00684	.63
% IMF, %	.00359	.44	.00033	.43	.00504	.36	.00061	.35

Table 3. Age of dam effects for scanning weight and % IMF in yearling Angus bulls and developing heifers.

	Bulls			Heifers		
Age of Dam[1], Yrs	No. of Bull Progeny	%IMF, %	Scanning Weight, lbs	No. of Heifer Progeny	% IMF, %	Scanning Weight, lbs
≤ 2	5237	.094	73.24	1746	.13	46.82
3	4246	.034	33.66	1305	.12	25.62
4	3562	.00	12.23	1198	.02	9.98
5	3175	-.02	.72	887	.03	.64
6	2544	0	0	682	0	0
7	2067	.02	1.70	570	-.03	2.28
8	1599	-.03	5.86	418	.06	8.10
9	1044	-.01	14.29 (11.0)[2]	328	-.02	13.85 (13.0)
10	671	-.08	18.40	183	.11	15.49
11	534	-.07	22.80 (28.0)	143	-.10	28.52 (26.0)
12+	696	-.06	40.59	237	-.07	34.23

[1]Age of dam at progeny scanning time.

[2]Numbers in parentheses are curve fitting numbers. That is, numbers to keep the adjustments following a smooth curve as age increases. Low numbers cause some of the older age of dam categories and their resulting adjustment factors to be slightly erratic in nature.