Abstract W38

Association between breed composition, phenotypic residual feed intake, temperament, ELISA scores for paratuberculosis, and ultrasound carcass traits in an Angus-Brahman multibreed herd

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SUMMARY

Associations between additive and nonadditive genetic effects, phenotypic residual feed intake (RFI), chute score (CS), exit velocity (EV), and dam ELISA scores for paratuberculosis (ES) and 4 ultrasound measurements were evaluated using 335 bulls, heifers, and steers ranging from 100% Angus (A) to 100% Brahman (B). Calves were born in 2006 and 2007, kept at the Beef Research Unit in Gainesville, FL, until weaning, then moved to a ***GrowSafe automated feeding facility*** in Marianna, FL. Calves were randomly allocated to pens by sire group (1 = A, 2 = ¾ A ¼ B, 3 = Brangus, 4 = ½ A ½ B, 5 = ¼ A ¾ B, and 6 = B) and sex (bull, heifer, and steer). Calves were fed concentrate during the 21-d adjustment and the ***70-d trial*** periods. Individual daily feed intake and byweekly weights, chute scores, and exit velocities were collected. Ultrasound measurements were taken at the end of the 70 d trial. Dam ES were obtained preweaning. Phenotypic RFI was computed as the difference between actual and expected feed intakes. Traits were analyzed using mixed linear models. Fixed effects were contemporary group (year-pen), RFI group, age of dam, sex of calf, age of calf, B fraction of calf nested within RFI group, heterozygosity of calf nested within RFI group, mean CS, mean EV, and ES. Random effects were sire and residual. The RFI groups were: high (RFI > mean + 0.5 SD), low (RFI < mean - 0.5 SD), and medium (RFI between mean ± 0.5 SD; SD = 5.4 kg). ***Ultrasound weight, ribeye area, backfat thickness, and intramuscular fat tended to decrease, whereas ultrasound tenderness tended to increase (tougher) as Brahman fraction increased. Higher ultrasound weights and lower ultrasound ribeye areas, backfat thicknesses, and intramuscular fat percentages were associated with higher levels of heterozygosity. Heavier animals and calves with larger ribeye areas had lower exit velocities, perhaps suggesting quieter temperaments. Neither chute score nor dam ELISA paratuberculosis scores were important for postweaning ultrasound traits.***

INTRODUCTION

Ultrasound carcass measurements are an important tool for preliminary assessment of carcass worth in beef cattle. Breed composition, feed efficiency, temperament, and subclinical paratuberculosis in dams may affect postweaning ultrasound traits in calves. Residual feed intake, measured as actual minus expected feed intake (Koch et al., 1963) is a preferred measurement of feed efficiency, where expected feed intake is computed as a function of average daily gain and metabolic mid-weight. Angus (A), Brahman (B), and crossbreds of various fractions of these two breed are commonly used in the Southern part of the US. ***The objective of this research was to evaluate the association between breed group (Angus (A), Brahman (B), Brangus, ¾ A ¼ B, ½ A ½ B, and ¼ A ¾ B), RFI, chute score (CS), exit velocity (EV), ELISA score for paratuberculosis (ES), and ultrasound longissimus muscle area (ULMA), subcutaneous fat thickness (UFT), percent intramuscular fat (UPIF), and tenderness score (UTS) in calves (n = 461) ranging from 100% Angus (A) to 100% Brahman (B).***

MATERIALS AND METHODS

Animals and preweaning management and nutrition. A total of 335 calves (bulls = 21, heifers = 149, steers = 165) born in 2006 and 2007 at the Angus-Brahman multibreed herd of the University of Florida (UF) were used in the study. Calves were from 6 breed groups (1 = Angus, 2 = ¾ A ¼ B, 3 = Brangus, 4 = ½ A ½ B, 5 = ¼ A ¾ B, and 6 = Brahman). The multibreed herd used a diallel mating involving 21 sires and 200 dams of all 6 breed groups per year. Table 1 shows numbers of calves generated per breed-group-of-sire x breed-group-of-dam combination from 2006 to 2007. Cows were synchronized with a progesterone-releasing device (CIDR®, Pfizer Animal Health) for 7 d (March), followed by an injection of $PGF_{2\alpha}$ (5 ml of LUTALYSE®, Pfizer Animal Health), received up to 2 artificial inseminations, then placed with a cleanup sire for 60 d (one cleanup sire per breed group; 6 breeding groups). Calves stayed at the UF Beef Research Unit (BRU) until weaning (August), then moved to a GrowSafe automated feeding facility in Marianna (September). Calves were pre-conditioned at the BRU for 3 wk using concentrate (1.6 kg to 3.6 kg; 488 Pellet, Medicated Weaning Ration, Lakeland Animal Nutrition, Lakeland, Florida; and soy hull pellets), hay, pasture, and free choice mineral (UF University Special Hi-Cu Mineral, University of Florida, Animal Science Department, Gainesville).

Table 1. Number of calves by breed group of sire x breed group of dam combination

Breed group of dam	Breed group of sire						
	Angus	¾ A ¼ B	Brangus	½ A ½ B	¼ A ¾ B	Brahman	All
Angus	29	7	9	7	8	14	74
¾ A ¼ B	18	5	13	9	9	9	63
Brangus	2	2	28	2	3	2	39
½ A ½ B	16	16	15	11	15	17	90
¼ A ¾ B	4	3	6	8	4	5	30
Brahman	0	0	0	0	0	39	39
All	69	33	71	37	39	86	335

Management, nutrition, and data collection at the feed efficiency facility. Calves were randomly allocated to 10 pens in 2006 (20 calves/pen) and to 14 pens in 2007 (14 calves/pen) in the UF-IFAS Feed Efficiency Facility (FEF; NFREC, Marianna, FL) by sire group (1 = A, 2 = ¾ A ¼ B, 3 = Brangus, 4 = ½ A ½ B, 5 = ¼ A ¾ B, and 6 = B) and sex (bull, heifer, and steer).The FEF had 24 pens (108 m^2/pen) equipped with 2 GrowSafe feed nodes. Calves were fed a concentrate diet. The 2006 diet had whole corn, soybean hulls, corn gluten feed, cottonseed hulls, and a protein, vitamin, and mineral supplement in 2006. The 2007 diet had higher fiber content (chopped bermudagrass, no soybean hulls) The concentrate had a DM, CP, NEm, and NEg of 91.2%,17.3%, 1.7 mcal/kg, and 1.2 mcal/kg in 2006, and 90.0%,14.1%, 1.5 mcal/kg, and 0.9 mcal/kg in 2007. The adjustment period lasted 21 d, and the trial period was 70 d. Individual feed intake was measured in real-time, and weights and temperament recorded byweekly.

Temperament, Feed Efficiency, and Subclinical Paratuberculosis. ***Temperament*** measurements were: 1) ***chute score*** (BIF, 2002; CS = 1 = docile; 2 = restless; 3 = nervous; 4 = flighty; 5 = aggressive; 6 = very aggressive); and 2) ***exit velocity*** (EV) out of the chute (m/sec). ***Residual feed intake*** was computed as actual feed intake minus expected feed intake (Koch et al., 1963; Arthur et al., 2001; Archer et al., 2007) during the 70-d trial. Expected feed intake was a function of average daily gain and metabolic mid-weight. Average daily gain was computed as the regression of weight on days on test. Metabolic mid-weight was equal to estimated mid-weight (estimated initial weight plus average daily gain times 35 d) to the power of 0.75. ***Subclinical paratuberculosis*** was evaluated using ELISA scores (ES) obtained from dams of calves: 1 = negative, 2 = suspect, 3 = weak positive, and 4 = positive.

Ultrasound Measurements. Taken at the end of the feed efficiency trial (certified technician,Tallgrass Beef Co., Sedan, KS). Traits: Weight (UW) and ultrasound measurements of area of longissimus muscle (UREA), subcutaneous fat thickness (UFT), percent intramuscular fat (UPIF), and tenderness score (UTS; 10 = very tender, 20 = tender, 30 = slightly tender, 40 = slightly tough, and 50 = tough).
Statistical analysis. Traits (UW, UREA, UFT, UPIF, and UTS) were analyzed with mixed models (SAS Proc Mixed). Fixed effects were contemporary group (year*pen; year = 2006, 2007; pen = 1 to 14), RFI group, age of dam (1 = 3 yr, 2 = 4 yr, and 3 = 5 yr and older), sex of calf (1 = bull, 2 = heifer, and 3 = steer), age of calf, Brahman fraction of calf within RFI group, heterozygosity of calf within RFI group, mean CS, mean EV, and ES. Three ***RFI groups*** (Nkrumah et al., 2004) were defined: high (calf RFI > mean + 0.5 SD), low (calf RFI < mean - 0.5 SD), and medium (calf RFI between mean ± 0.5 SD; SD = 5.4 kg). Random effects were sire and residual, both assumed to have mean zero and to be uncorrelated. Least squares means by RFI group for UW, UREA, UFT, UPIF, and UTS were plotted against breed group of calf with SAS Proc GPLOT.

RESULTS AND DISCUSSION

Breed composition and residual feed intake. Differences between RFI groups were important only for UIMF (P < 0.006). There was a decreasing trend for UW for ***additive genetic effects*** from Angus to Brahman within RFI group (high = -58.2 ± 17.3 kg, P < 0.0009; med = -39.4 ± 13.2 kg, P < 0.003; low = -46.6 ± 11.8 kg; P < 0.0001). Similar decreasing trends existed for UREA (low = -7.9 ± 2.8 cm^2, P < 0.004), UFT (med = -0.2 ± 0.1 cm, P < 0.03), and low = -0.35 ± 0.09 cm, P < 0.0001) and UIMF (med = -1.3 ± 0.2 %, P < 0.0001; low = -0.8 ± 0.2 %, P < 0.0001), whereas an increasing trend existed for UTEND (high = 8.7 ± 1.3, P < 0.0001; med = 6.0 ± 1.0, P < 0.0001; low = 5.4 ± 0.9 %, P < 0.0001). ***Nonadditive genetic effects*** within RFI group tended to increase UW (high = 44.5 ± 19.3 kg, P < 0.02), decrease UFT (high = -0.34 ± 0.15 cm, P < 0.02; low = -0.22 ± 0.11 cm, P < 0.05), decrease UIMF (low = -0.48 ± 0.23 , P < 0.04), and increase UTEND (med = 3.0 ± 1.2, P < 0.01).
Temperament and ELISA score for paratuberculosis. ***Neither chute score nor ELISA score for paratuberculosis were significantly associated to any of the ultrasound traits.*** The regressions of UW and UREA on exit velocity were negative (-12.5 ± 3.5 kg*(m/sec)$^{-1}$ for UW, and -1.7 ± 0.8 cm^2*(m/sec)$^{-1}$) indicating that heavier animals and animals with bigger longissimus muscle areas were slower in exiting the chute, thus suggesting a more docile temperament.

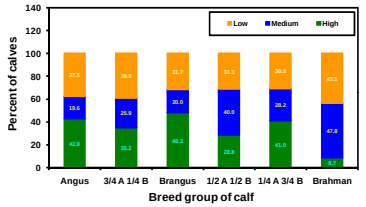
Table 2. Significance (P > F) of Regression of Brahman fraction and Heterozygosity of calf on traits

Trait	Brahman fraction	Heterozygosity
Ultrasound Weight	< 0.0001	0.03
Ultrasound Ribeye Area	0.02	0.87
Ultrasound Fat Thickness	0.0001	0.006
Ultrasound Intramuscular Fat	< 0.0001	0.05
Ultrasound Tenderness	< 0.0001	0.04

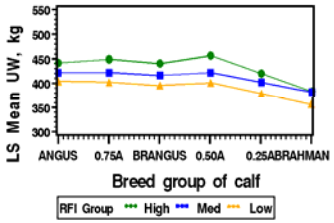
Table 3. Significance (P > F) of Temperament and ELISA scores for paraTBC

Trait	Chute Score	Exit Velocity	ELISA Score
Ultrasound Weight	0.46	0.0004	0.20
Ultrasound Ribeye Area	0.83	0.05	0.61
Ultrasound Fat Thickness	0.69	0.43	0.39
Ultrasound Intramuscular Fat	0.87	0.63	0.92
Ultrasound Tenderness	0.54	0.80	0.20

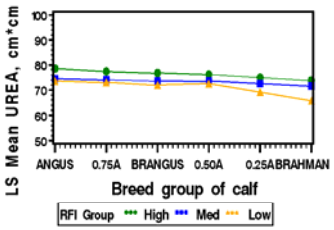
Residual Feed Intake



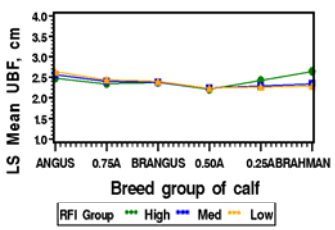
Ultrasound Weight



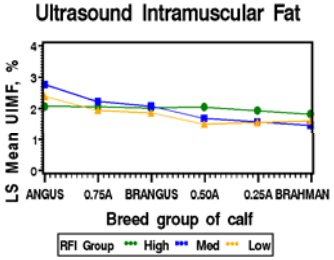
Ultrasound Ribeye Area



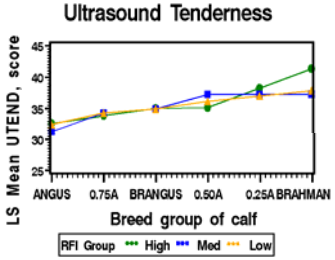
Ultrasound Backfat



Ultrasound Intramuscular Fat



Ultrasound Tenderness



FINAL REMARKS

Ultrasound weight, ribeye area, backfat thickness, and intramuscular fat tended to decrease, whereas ultrasound tenderness tended to increase (tougher) as Brahman fraction increased.
Higher ultrasound weights and lower ultrasound ribeye areas, backfat thicknesses, and intramuscular fat percentages were associated with higher levels of heterozygosity.
Heavier animals and calves with larger ribeye areas had lower exit velocities perhaps suggesting quieter temperaments.
Chute score was not important for postweaning ultrasound traits.
Dam ELISA scores for paratuberculosis were unrelated to postweaning ultrasound traits.

LITERATURE CITED

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