Abstract W39

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

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SUMMARY

The objective of this research was to assess the relationship 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 7 carcass traits using 88 steers ranging in breed composition from 100% Angus (A) to 100% Brahman (B). Calves were born and raised until weaning at the Beef Research Unit in Gainesville, FL, 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 weekly weights, chute scores, and exit velocities were collected. Subsequently, steers were taken to a commercial feedlot in South Texas, and finally slaughtered at Sam Kane Beef Processors, Corpus Christi, TX. Phenotypic RFI was computed as actual minus expected feed intake. Traits were analyzed using mixed models. Fixed effects were pen, RFI group, age of dam, age of calf, B fraction of calf nested within RFI group, heterozygosity of calf, 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). ***Hot carcass weight, longissimus muscle area, marbling, and tenderness tended to decrease, whereas shear force tended to increase as Brahman fraction increased. Marbling and shear force tended to decrease as levels of heterozygosity increased. High kidney, pelvic, and fat percent was positively associated with exit velocity. Chute score and dam ELISA scores for paratuberculosis were not associated with carcass traits.***

INTRODUCTION

Identification of factors that permit animals to grow quickly and efficiently, and have desirable carcass characteristics remains a primary goal in beef production. Breed composition (additive and nonadditive genetic effects), residual feed intake, (RFI; actual minus expected feed intake), temperament (chute score, CS; exit velocity, EV), and dam ELISA scores for paratuberculosis (ES) are factors that may have an impact on carcass traits. Purebred Brahman (B) and B crosses with *Bos taurus* breeds such as Angus (A) represent a large fraction of the commercial cattle population in the Southern region of the US. ***The objective was to evaluate the relationship between 7 carcass traits and additive and nonadditive genetic effects, residual feed intake (RFI) group (high: RFI > mean + 0.5 SD; medium: RFI between mean ± 0.5 SD; low: RFI < mean - 0.5 SD), chute temperament score (CS), exit velocity (EV), and dam ELISA score for paratuberculosis (ES) in 84 steers with breed compositions ranging from 100% A to 100% B.***

MATERIALS AND METHODS

Steers and preweaning management and nutrition. Steers (n = 88) were from the Angus-Brahman multibreed herd of the University of Florida (UF). Calves were generated using a diallel mating of 21 sires and 200 dams of 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). Table 1 shows the numbers of steers per breed-group-of-sire x breed-group-of-dam combination. Reproductive management used a combination of artificial insemination and natural service. Cows were synchronized in March of 2005 with a progesterone-releasing device (CIDR®, Pfizer Animal Health) for 7 d, followed by an injection of $PGF_{2\alpha}$ (5 ml of LUTALYSE®, Pfizer Animal Health), artificially inseminated twice, then placed with a natural service sire for 60 d (6 breeding groups with one sire per breed group). Calves were born in the Spring of 2006, kept at the UF Beef Research Unit (BRU) until weaning (August 2006), and moved to the Marianna GrowSafe automated feeding facility in September 2006. Calves were pre-conditioned at the BRU for 4 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 steers by breed group of sire x breed group of dam combination

Breed group of dam	Breed group of sire						
	Angus	¼ A ¼ B	Brangus	½ A ½ B	¼ A ¾ B	Brahman	All
Angus	7	2	1	1	3	3	17
¾ A ¼ B	4	1	4	3	1	2	15
Brangus	1	0	11	0	0	0	12
½ A ½ B	0	4	7	3	4	2	20
¼ A ¾ B	1	2	1	4	1	2	11
Brahman	0	0	0	0	0	13	13
All	13	9	24	11	9	22	88

Postweaning management, nutrition, and data collection. Upon arrival at the UF-IFAS Feed Efficiency Facility (FEF), calves were randomly placed in 10 pens of 20 animals each 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). Pens are 108 m^2, and have 2 GrowSafe feed nodes. A feed adjustment period of 21 d was followed by a feeding trial of 70 d. Calves received a concentrate diet (DM = 91.2%, CP = 17.3%, DIP = 11.3%, NEm = 1.7 mcal/kg, and NEg = 1.2 mcal/kg) composed of whole corn (38%), soybean hulls (18%), corn gluten feed (18%), cottonseed hulls (13.6%), and a protein, vitamin, and mineral supplement (14.3%). Individual feed intake was recorded in real-time. Individual animal weights, chute scores and exit velocities were obtained weekly. After the feed efficiency trial, steers were sent to a South Texas feedlot (King Ranch Feedyard, Kingsville, TX), and commercially slaughtered at about 14 mm of fat over the ribeye (Sam Kane Beef Processors, Corpus Christy, TX).

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

Carcass traits. The 7 carcass traits were: hot carcass weight (HCW), longissimus muscle area (REA), fat thickness between the 12th and 13th rib (FOE), kidney, pelvic, and heart fat as percentage of carcass weight (KPH), marbling score (MARB; USDA scores: 200 = traces, 300 = slight, 400 = small, 500 = modest, 600 = moderate), Warner-Bratzler shear force (WBSF), and tenderness score (TEND; 1 = extremely tough, 2 = very tough, 3 = slightly tough, 4 = slightly tender, 5 = moderately tender, 6 = very tender, 7 = extremely tender).
Statistical analysis. Carcass traits were analyzed using mixed models (SAS Proc Mixed). Fixed effects were pen (1 to 20), RFI group (1 = high = RFI > mean + 0.5 SD, 2 = medium = RFI between mean ± 0.5 SD, 3 = low = RFI < mean - 0.5 SD; SD = 5.4 kg; Nkrumah et al., 2004), age of dam (1 = 3 yr, 2 = 4 yr, and 3 = 5 yr and older), age of calf, Brahman fraction of calf within RFI group, heterozygosity of calf, mean CS, mean EV, and ES. Random effects were sire and residual assumed to have mean zero, common variance, and uncorrelated. Least squares means by RFI group were plotted against breed group of calf using SAS Proc GPLOT.

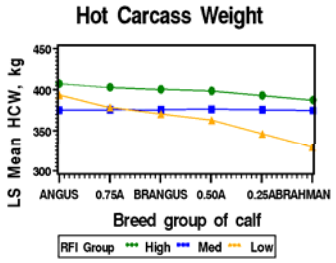
RESULTS AND DISCUSSION

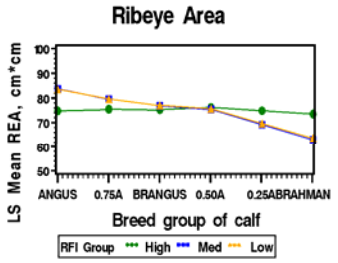
Breed composition and residual feed intake. Differences between RFI groups were non-significant for all carcass traits. For ***additive genetic effects***, the regression of HCW on B fraction of calves showed a decreasing slope from Angus to Brahman within RFI group (significant for low RFI = -64.1 ± 23.9 kg; P < 0.009). Similar decreasing trends also existed for REA (med RFI = -20.7 ± 6.7 cm^2, P < 0.003; low RFI = = -19.7 ± 6.7 cm^2, P < 0.005), MARB (high RFI = -252.7 ± 96.7, P < 0.01; med RFI = -123.7 ± 57.8, P < 0.04), and TEND (high RFI = -1.4 ± 0.7, P < 0.04; med RFI = -1.0 ± 0.4, P < 0.02; low RFI = -1.2 ± 0.4, P < 0.004). Contrarily, WBSF showed an increasing trend as B fraction increased (high RFI = 1.4 ± 07, P < 0.01; med RFI = -123.7 ± 57.8, P < 0.04). ***Nonadditive genetic effects*** indicated that MARB increased (87.8 ± 49.9; P < 0.08), and that WBSF decreased (-0.6 ± 0.4 kg; P < 0.08) as the level of heterozygosity increased.

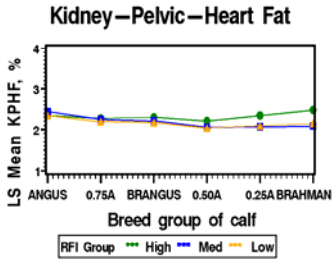
Temperament and ELISA score for paratuberculosis. Mean chute score and dam ELISA scores for paratuberculosis were not associated with any carcass trait. The regression of carcass traits on mean exit velocity was significant only for KPH (0.2 ± 0.1 %*(m/sec)$^{-1}$; P < 0.03), indicating that animals with higher KPH appeared to have exited faster from the chute.

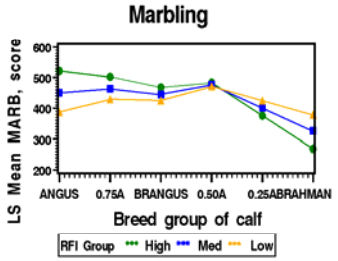
Table 2. Significance (P > F) of Regression of Brahman fraction and Heterozygosity of calf on traits

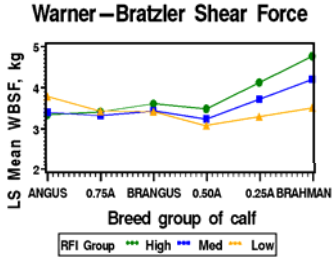
Trait	Brahman Fraction	Heterozygosity
Hot Carcass Weight	0.05	0.95
Longissimus Muscle (Ribeye) Area	0.0004	0.72
Fat Thickness Over the Ribeye	0.76	0.59
Kidney, Pelvic, and Heart Fat	0.56	0.43
Marbling	0.01	0.08
Warner-Bratzler Shear Force	0.03	0.08
Tenderness	0.0002	0.41

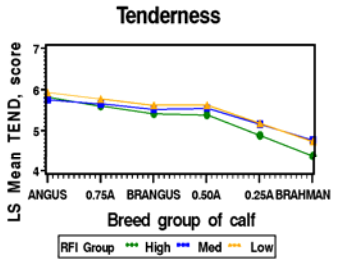












FINAL REMARKS

Hot carcass weight, ribeye area, marbling, and tenderness tended to decrease, whereas shear force tended to increase as Brahman fraction increased.
Marbling tended to increase and shear force tended to decrease as levels of heterozygosity increased.
High kidney, pelvic, and fat percent was positively associated with exit velocity.
Chute score was unrelated to carcass traits.
Dam ELISA scores for paratuberculosis were not associated with carcass traits.

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