Effects of residual feed intake classification on carcass-value traits in finishing beef cattle

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I. INTRODUCTION

Adoption of technologies to enhance genetic merit for feed efficiency is arguably be one of the most cost-effective strategies to meet future demands for animal-protein foods in an environmentally sustainable manner. Residual feed intake (**RFI**) is a feed efficiency trait that quantifies inter-animal variation in feed intake beyond that expected to meet energy requirements for maintenance and production—efficient animals are those that eat less than expected for a given BW and level of production. McDonagh et al. (1) reported that steers from low-RFI parents had higher myofibril fragmentation indexes and calpastatin activity then steers from high-RFI parents. Likewise, Zorzi et al. (2) found that bulls with low-RFI phenotypes (more feed efficient) produced steaks that were less tender compared to steaks from high-RFI bulls. Furthermore, numerous studies have reported positive correlations between RFI, and backfat (**BF**) depth and marbling scores. Thus, favorable selection for RFI may have detrimental effects on carcass quality traits (tenderness, marbling) in feedlot progeny. The objectives of this study were to examine the effects of RFI classification on carcass-quality traits (Quality (**QG**) and yield grades (**YG**), tenderness), and grid-formula carcass values in feedlot cattle.

II. MATERIALS AND METHODS

This study was conducted utilizing data collected from 3 trials with Angus crossbred steers (N = 508, BW = 301 ± 32 kg), and 3 trials with Angus, Braford, Brangus, and Simbrah heifers (n = 415, BW = 276 ± 35 kg). For each trial, individual-animal performance (BW measured at 14-d intervals) and daily feed intake data (GrowSafe Sytems®) were measured for 70 d while fed a corn-based feedlot diet (3.09 Mcal ME/kg DM). Within trial, RFI was computed as actual minus expected DMI from regression of DMI on ADG and mid-test $BW^{0.75}$, with animals classified into low and high RFI phenotype groups based on ± 0.5 SD from trial-mean RFI. Cattle were harvested at an approximate BF depth of 1.2 cm, and carcass data collected to determine USDA YG and QG. Warner-Bratzler shear (**WBS**) force values were measured on top-loin steaks at 1- and 14-d post-mortem aging. Carcass values ($/kg HCW) were assessed using a marketing grid based on 3-year average price discounts and premiums for YG, QG and hot carcass weight (**HCW**). Carcass income ($/hd) was computed as the product of carcass value and HCW. Steer and heifer data were analyzed separately with a MIXED model that included RFI group as a fixed effect, and trial and pen within trial as random effects.

III. RESULTS AND DISCUSSION

For both steers and heifers, RFI classification did not affect initial age (data not shown), initial BW or ADG during the 70-d feedlot trials. Steers and heifers with low-RFI phenotypes consumed 16.3 and 19.8% less ($P < 0.001$) DMI, and had 19.7 and 24.3% greater G:F, respectively, than cohorts with high-RFI phenotypes. Low-RFI steers and heifers had lessor ($P < 0.001$) BF depth, and greater ($P < 0.001$) LMA then steers and heifers with high-RFI phenotypes, which resulted in steers and heifers with low-RFI phenotypes having 8.1 and 8.4% lower ($P < 0.05$) YG, respectively, than cohorts with high-RFI phenotypes. Reflecting the impact of RFI classification on BF depth, steers with low RFI tended ($P < 0.10$) to have lower QG then steers with high RFI, whereas, heifers with divergent RFI did not differ in QG. Tenderness, as assessed by WBS, was not affected by RFI classification at 1- or 14-d postmortem aging. Favorable YG for low-RFI phenotypes and favorable QG for high-RFI phentotypes resulted in similar carcass values ($/kg) for cattle with divergent phenotypes for RFI. Carcass income was greater ($P < 0.05$) for low- than high-RFI steers due to greater ($P < 0.05$) carcass weights for low-RFI steers. Reflecting

similar carcass weights and carcass values for heifers with divergent RFI, carcass income was not affected by RFI classification in heifers. Despite differences in both gender and breed type between the 2 feedlot-cattle populations examined in this study, differences within population due to RFI phenotype were remarkably similar.

Table 1. Effects of RFI classification on feed efficiency, carcass characteristics and carcass value in finishing steers and heifers.

	Steers (N = 504)			Heifers (N = 411)		
Item	Low RFI	High RFI	SE	Low RFI	High RFI	SE
Feedlot Performance:						
Initial BW, kg	301.2	302.1	2.3	275.6	274.8	3.0
ADG, kg/d	1.73	1.72	0.02	1.51	1.51	0.03
DMI, kg/d	9.17^{x}	10.95^{y}	0.06	8.00^{x}	9.98^{y}	0.12
G:F	0.188^{x}	0.157^{y}	0.001	0.189^{x}	0.152^{y}	0.002
RFI, kg/d	-0.897^{x}	0.878^{y}	0.032	-1.065^{x}	0.977^{y}	0.041
Carcass Characteristics:						
Hot carcass weight, kg	314.8^{e}	308.7^{f}	2.0	287.4	282.4	2.8
BF depth, cm	1.12^{x}	1.27^{y}	0.03	1.17^{e}	1.27^{f}	0.04
LMA, cm^2	77.2^{x}	74.5^{y}	0.6	74.4	72.9	0.8
USDA YG	2.82^{x}	3.07^{y}	0.04	2.82^{e}	2.97^{f}	0.06
USDA QG	385^{a}	396^{b}	3	398	400	4
WBS force (1d), kg	2.53	2.52	0.07	3.48	3.62	0.10
WBS force (14 d), kg	1.91	1.90	0.04	2.29	2.34	0.06
Carcass Value:						
Carcass value, $/kg	4.48	4.48	0.01	4.41	4.41	0.02
Carcass income, $/animal	1,411^{e}	1,382^{f}	10	1,272	1,249	16

^{a,b}Means within a row and gender with different subscripts differ at $P < 0.10$.
^{e,f}Means within a row and gender with different subscripts differ at $P < 0.05$.
^{x,y}Means within a row and gender with different subscripts differ at $P < 0.001$.

IV. CONCLUSION

Results from this study demonstrate that substantial phenotypic variation exists in feed intake unrelated to variances in body size and productivity in beef cattle, which can be quantified by RFI to identify cattle within gender and(or) breedtype that differ in efficiency of feed utilization. Steers and heifers with low-RFI phenotypes consumed 16 to 20% less feed compared to those with high RFI even though BW and ADG were similar. Steers and heifers with low-RFI phenotypes had numerically lower YG and QG compared to cohorts with high RFI. However, these differences did not affect grid-based carcass values ($/kg HCW) or income ($/animal) between cattle with divergent RFI phenotypes. Results supports the adoption of multi-trait selection indexes to identify cattle with superior genetic merit for RFI to improve life-cycle efficiency and profitability of beef cattle production systems through reductions in costs of feed inputs without compromising the value of carcass outputs.

REFERENCES

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