

Residual feed intake, feed conversion ratio, growth and body composition traits in pedigree beef bulls

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Introduction

As maintenance energy and feed costs are a considerable proportion of the total costs of beef production, accordingly beef breeding selection strategies need to focus on improving feed efficiency without negatively altering performance or carcass traits. Traditionally feed efficiency was expressed as the ratio of weight gain to feed intake (FCR) but selection for this measure can lead to an increase in mature size and thus maintenance requirements (Okine et al., 2004). An alternative measure of feed efficiency proposed is residual feed intake (RFI) or net feed efficiency, which is the difference between actual energy intake (EI) and calculated EI required for bodyweight maintenance and liveweight gain (negative or lower values desirable). This measure is largely independent of growth and maturity patterns (Okine et al., 2004). As heritability estimates range from 0.16 to 0.43 (Herd et al., 2003) the concept of RFI can be used to identify efficient bulls. The objective of this study was to characterise RFI in Irish pedigree performance tested bulls and evaluate the relationship between RFI and growth and carcass traits.

Materials and Methods

Data were obtained on a total of 255 Charolais (CH) and 432 Limousin (LM) pedigree bulls that completed a performance test at the Irish bull testing station in Tully between January 1998 and June 2004. There were 28 batches of bulls tested in total. Expected EI (UFV/day) was calculated by regressing average daily EI (intake period min. 98 to max. 168 days) on average daily liveweight gain (ADG) and mid-test liveweight^{0.75} (Carstens et al., 2002) with a model which included batch using the GLM procedure of SAS (2001). The RFI for each bull was calculated as actual EI minus the expected EI predicted from the regression model generated for each batch. FCR was calculated as average daily EI divided by ADG. Relationships between RFI and FCR and between performance and ultrasound measures of eye muscle area and fat cover were determined using partial correlation coefficients (corrected for batch) using the CORR procedure of SAS. Within breed, bulls were then ranked by RFI and separated into low, medium and high groups that were < 0.5 SD, \pm 0.5 SD and > 0.5 SD respectively, from the mean RFI SD. These data were analysed using GLM with a model that included RFI group, and batch as a covariate. Final test-weight per day of age was used as an indicator of mature weight.

Results and Discussion

Unlike FCR, there was no significant relationship between RFI and weight per day of age or ADG but RFI and EI was significantly correlated (Table 1).

Table 1. Partial correlations of RFI and FCR and, performance and carcass traits for Limousin and Charolais bulls

Parameter	Breed	RFI	FCR
Wt. per day of age (kg)	LM	0.03 (ns)	-0.17 (***)
	CH	-0.05 (ns)	0.12 (*)
ADG (kg/day)	LM	-0.00 (ns)	-0.62 (***)
	CH	0.00 (ns)	-0.68 (***)
EI (UFV/day)	LM	0.49 (***)	0.16 (**)
	CH	0.49 (***)	0.24 (***)
FCR (UFV / kg gain)	LM	0.43 (***)	-
	CH	0.41 (***)	-
Fat area (cm ²)	LM	0.10 (*)	-0.00 (ns)
	CH	0.19 (**)	0.09 (ns)
Muscle area (cm ²)	LM	0.05 (ns)	0.05 (ns)
	CH	-0.07 (ns)	0.08 (ns)

While growth rates and weight per day of age were similar, high RFI bulls consumed more feed per day and had a higher FCR (P<0.001) than low RFI bulls (Table 2). There was no effect of RFI on ultrasound estimates (not presented) for LM but fat area was lower (P<0.01) in CH for the low RFI than the high RFI.

Table 2. Comparison of low, medium and high RFI

Parameter	Breed	RFI			s.e.	Sig
		Low	Med.	High		
RFI (kg)	LM	-0.48	0.00	0.55	0.020	***
	CH	-0.62	0.00	0.57	0.026	***
Wt per day of age (kg)	LM	1.46	1.47	1.48	0.012	ns
	CH	1.66	1.62	1.62	0.018	ns
ADG (kg)	LM	1.58	1.62	1.61	0.022	ns
	CH	1.80	1.80	1.77	0.030	ns
EI (UFV /day)	LM	8.2	8.7	9.3	0.08	***
	CH	9.1	9.6	10.1	0.11	***
FCR (UFV /kg gain)	LM	5.28	5.48	5.95	0.080	***
	CH	5.10	5.40	5.79	0.076	***

Conclusion

Results suggest that RFI is an alternative measure of feed efficiency, which is independent of growth traits and mature weight.

References

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