

# Indices of Body Composition and Repeatability of Residual Feed Intake in Growing Columbia Ewes Fed the Same Diet

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## IMPACT STATEMENT

*This research is aimed at investigating the repeatability of RFI in consecutive years on Columbia ewe lambs and yearlings fed the same type of feed, and determining if body composition of yearling Columbia ewes is independent of RFI.*

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## SUMMARY

Residual feed intake (RFI), an efficiency measurement based upon the difference in expected and actual feed intake, is used to improve production efficiency of livestock. The purpose of this study was to evaluate the repeatability of ewe RFI measured for two consecutive years, and to investigate the relationship between indices of body composition in yearling ewes and RFI. Two trials, using the same Columbia ewe lambs ( $n = 17$ ) were conducted in consecutive years (2014, 2015) using the same diet. RFI was calculated for each ewe each year. RFI did not differ ( $P = 0.93$ ) between years. Each year, ewes were separated into RFI classes (LOW (efficient); MOD (average); HIGH (inefficient)). In 2014, ewe lamb performance did not differ among classes ( $P > 0.3$ ). In 2015, dry matter intake was greater for HIGH ewes ( $P < 0.0002$ ). Ribeye area (REA;  $\text{cm}^2$ ) and backfat thickness (BF; cm) were measured by ultrasound on day 0 (start of trial), 17, and 45 (end of trial) in 2015 and used to calculate estimates of final body composition. RFI classification did not affect REA or BF ( $P > 0.25$ ). There was a trend for whole-body muscle mass to differ among RFI classes ( $P = 0.09$ ), but no other body composition estimates were affected. Results suggest that RFI is repeatable; however, indices of body composition seem to be

independent of RFI in Columbia ewes fed the same diet under similar conditions.

## INTRODUCTION

Feed is the most costly resource for a livestock production system (Moore et al., 2009). Selecting for efficient animals that can produce more on less feed can have very positive economic impacts. One method of measuring feed efficiency, residual feed intake, has been recommended to be the optimal efficiency selection trait as it reflects physiological differences between animals, rather than differences in growth and maturity of animals (Carstens and Kerley, 2009).

However, 27% of the variation in RFI is due to unknown causes (Herd and Arthur, 2009). This means that it is possible to inadvertently select for undesirable traits when using RFI as a selection criterion for breeding females. The optimal age for measuring RFI in animals being retained in a herd has not been established, because it is possible that RFI can change throughout an individual's lifespan.

The objective of this study was to determine if Columbia ewes that underwent an RFI trial as ewe lambs would have a different RFI one year later as yearlings if fed the same feed and maintained in the same environment during the feeding trial. Also, the relationship between RFI and body composition in the yearling ewes was

investigated. Our hypotheses were that RFI values would be different in the yearling ewes, and that inefficient yearling ewes would have greater backfat thickness than efficient ewes.

## PROCEDURES

*Animals and Feeding Trials.* Two RFI feeding trials were conducted in consecutive years (2014, 2015) using the same Columbia ewes ( $n = 17$ ) as lambs and then yearlings. Ewes from the Montana State University flock were transported to the Fort Ellis Research Ranch in August, 2014 and 2015, where they underwent a 47-day (2014) and 45-day (2015) RFI trial. Ewes were brought into a barn twice daily, 12 h apart, and individually penned to allow unlimited access to an 80%:20% alfalfa:barley pelleted diet for 2 to 3 h. Feed was weighed prior to and after each feeding for calculating individual intake. Ewes were penned in a drylot with unlimited access to water, but no access to forage. In 2015, the feed fed was from the same batch as 2014, and the ewes were kept in the same pen as the previous year. Body weights were taken at weeks 1, 3, 4, 6, and 7 in 2014, and 1, 2, 3, 4, 6, and 7 in 2015. Ultrasound measurements of 12<sup>th</sup>- rib backfat (BF) and ribeye area (REA) were taken at the beginning, middle, and end of the 2015 trial by a trained technician. Backfat thickness and REA were used to model body composition estimates.

*RFI Calculation.* Daily intakes for each ewe were used to calculate ADG for both years. Statistical regression methods were used to calculate the initial and final BW, mid-test metabolic BW (MBW), and expected feed intake (EFI), and then to calculate RFI as actual dry matter intake (DMI) – EFI (Koch et al., 1963). Ewes were classified into categories of high RFI (inefficient), moderate RFI, and low RFI (efficient) for both years based upon how close their RFI value was to the average RFI value for each year.

## RESULTS AND DISCUSSION

Ewe RFI did not differ ( $P = 0.93$ ) between 2014 and 2015. RFI appears to be repeatable in consecutive years in young ewes allowed *ad libitum* access to the same type of feed and in the

same environment. Similarly, Redden et al. (2014) reported that the RFI of ewes fed a similar diet was repeatable in subsequent feeding trials; however, RFI was not repeatable when a different diet was fed (Redden et al., 2011).

Initial liveweight, final liveweight, and ADG did not differ ( $P > 0.05$ ) between efficiency classes in either year (Table 1). Dry matter intake did not differ ( $P = 0.32$ ) between classes in 2014, but low RFI (efficient) ewes consumed less feed than moderate and high RFI (inefficient) ewes in 2015 ( $P = 0.0002$ ). This corroborates previous reports of an increased difference in DMI intake between RFI classes in yearling ewes as compared to ewe lambs (Redden et al., 2011; 2014).

Backfat thickness and REA did not differ ( $P > 0.1$ ) between RFI classes of yearling ewes, which agrees with results of Redden et al. (2014). There were no differences ( $P > 0.05$ ) in body composition estimates between RFI classes, although there was a trend for greater muscling in the efficient ewes ( $P = 0.09$ ). Residual feed intake has been reported to be independent of body size and production (Herd and Arthur, 2009), thus, it was not surprising that there were no difference in BF, REA, and body composition estimates between RFI classes in yearling ewes.

Results indicate that RFI is repeatable in consecutive years in young Columbia ewes fed the same diet under similar environmental conditions. Furthermore, RFI class appears to be independent of both measured and modeled body composition in Columbia yearling ewes.

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#### ACKNOWLEDGEMENTS

This study was supported by the Montana Agric. Exp. Sta., and is a contributing project to Multistate Research Project, W2010, Integrated Approach to Enhance Efficiency of Feed Utilization in Beef Production Systems.

**Table 1.** Performance of Columbia ewe lambs and yearlings from different RFI classes in consecutive year RFI trials

Year	Item	RFI Classification			SEM	P-value
		Low	Moderate	High		
2014	Initial wt, lb	67.32	67.98	78.98	17.91	0.57
	Final wt, lb	105.38	102.96	111.54	21.89	0.81
	ADG, lb	0.66	0.62	0.57	0.11	0.56
	DMI, lb	3.76	4.16	4.73	0.84	0.32
	RFI	-0.19	0.03	0.14		
2015	Initial wt, lb	146.52	144.76	139.92	22.75	0.77
	Final wt, lb	170.5	168.74	165.44	22.62	0.87
	ADG, lb	0.55	0.55	0.59	0.18	0.84
	DMI, lb	5.54 <sup>a</sup>	6.47 <sup>b</sup>	7.06 <sup>b</sup>	0.79	0.0002
	RFI	-0.40	0.05	0.34		

<sup>a,b</sup> Means within a row with different superscripts differ ( $P \leq 0.05$ )