

Introduction

- Residual feed intake (RFI) is the difference between actual and predicted feed intakes (Pryce et al, 2012)
- Heifers consuming high-quality forage diets are more susceptible to excessive weight gains and over-conditioning (Coblentz et al, 2015)
- A high energy diet can impair mammary gland development causing harmful fattening of the udder (Pirlo et al., 1996)
- Potential differences in feed efficiency of growing dairy heifers due to predicted RFI as a lactating cow is not known.

Objective

- To determine growth, feed intake, and feed efficiency of pre-bred dairy heifers with different predicted genomic residual feed intake (RFI) as lactating predicted as a lactating cow and offered diets differing in energy density.

Materials and Methods

- Pre-bred Holstein heifers (128, ages 4-8 months) were stratified into 4 weight blocks
- Each block was randomly sorted by RFI (high and low) to obtain 2 pens of high and low predicted RFI for each block (8 heifers per pen)
- Two treatment diets differing in energy density, high energy (HiE) and low energy (LoE). Dry corn was removed and corn silage added to alter the energy density of the diet
- Each treatment was randomly allocated to blocks to obtain a 2x2 factorial treatment arrangement of 2 RFI levels and 2 dietary energy levels
- Diets were offered in a 120-d trial
- Measurements (weight, BCS, heart girth, body length, hip and wither height) and ultrasounds (rump and kidney fat) were taken at the beginning and end of the trial
- Whole pen manure collections were performed at week 9 and week 16 to obtain dry matter and NDF digestibility
- Statistical analysis was performed using a MIXED procedure in SAS 9.3 with pen as the experimental unit.

Results

Table 1. Ingredient composition and nutrient composition of TMR

Item	Diet	
	HiE	LoE
Ingredients, % of DM		
Alfalfa Haylage	52.0	55.0
Corn Silage	16.0	32.0
Dry Corn	29.0	10.0
Soybean Meal	4.0	4.0
Nutrients, % of DM		
Crude protein (CP), %	14.0	13.5
Neutral detergent fiber (NDF), %	36.3	41.2
Starch, %	25.3	18.0
Total digestible nutrients (TDN), %	66.6	63.8

Table 2. Nutrient intakes, growth and diet digestibility for heifers with different RFI and fed diets with different energy densities

RFI treatment	LoRFI		HiRFI		SEM	RFI	Diet	RFI x Diet
	HiE	LoE	HiE	LoE				
DM, kg/d	7.64	7.98	7.13	7.68	0.49	0.17	0.14	0.66
CP, kg/d	1.08	1.08	1.01	1.04	0.07	0.17	0.62	0.66
NDF, kg/d	2.76	3.28	2.50	3.16	0.24	0.19	0.01	0.59
TDN, kg/d	5.09	5.09	4.76	4.90	0.32	0.17	0.65	0.64
Daily gain, kg/d	1.19	1.00	1.10	0.94	0.04	0.03	<0.01	0.53
Feed Efficiency, kg intake, kg gain	6.43	7.91	6.47	8.13	0.16	0.48	<0.01	0.62
BCS Gain	0.85	0.56	0.80	0.34	0.13	0.36	0.06	0.58
DM Digestibility, % DM	59.5	60.3	59.3	63.2	1.98	0.53	0.28	0.46
NDF Digestibility, % DM	57.2	58.7	57.3	59.1	3.05	0.93	0.62	0.97

Table 3. Ultrasound rump and kidney fat gain (cm)

	RFI	LoRFI		HiRFI		SEM	RFI	Diet	RFI x Diet
		HiE	LoE	HiE	LoE				
Rump gain	0.47	0.34	0.43	0.37	0.04	0.82	0.08	0.61	
Kidney gain	2.4	2.0	2.4	2.0	0.17	0.92	0.10	0.88	

Summary

- Heifers on the LoE diet consumed numerically more DM, contrary to our hypothesis, but there was no effect of RFI ($P=0.17$), diet ($P=0.14$), or the interaction of RFI x Diet ($P=0.66$)
- Average daily gain was affected by RFI ($P=0.03$) with HiRFI heifers having more ideal gains, and by diet ($P<0.01$) with LoE heifers having lower gains, more ideal gains
- Feed efficiency was lower for heifers fed the HiE diet ($P<0.01$)
- Body condition score had a tendency to be greater ($P=0.06$) for HiE fed heifers

Conclusions

- Feed efficiency of pre-breeding heifers was not dependent on genomic RFI
- Heifers fed the HiE diet were most efficient, with HiRFI heifers fed this diet having greater gains, increased digestibility rates, and improved feed efficiency

References

- Coblentz, W.K., N. M. Esser, P.C. Hoffman, and M.S. Akins. 2015. Growth performance and sorting characteristics of corn silage-alfalfa haylage diets with or without forage dilution offered to replacement Holstein dairy heifers. *J. Dairy Sci.* 98:8018-8034.
- Pirlo, G., Capelletti, M., and Marchetto, G. 1996. Effects of energy and protein allowances in the diets of prepubertal heifers on growth and milk production. *J. Dairy Sci.* 8:730-739.
- Pryce J.E., Arias J., Bowman P.J., Davis S.R., Macdonald K.A., Waghorn G.C., Wales W.J., Williams Y.J., Spelman R.J., Hayes B.J. 2012. Accuracy of genomic predictions of residual feed intake and 250-day body weight in growing heifers using 625,000 single nucleotide polymorphism markers. *J. Dairy Sci.* 95:2108-2019.