

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)
- Straw and other low-energy forage can be used to dilute diets, reducing the caloric density and dry matter intake (Coblentz et al, 2015)
- 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 dairy heifers with different genomic residual feed intake (RFI) predicted as a lactating cow and offered diets differing in energy density.

Materials and Methods

- Post-bred Holstein heifers (128, ages 14-20 months) were blocked by initial weight into 4 weight blocks
- Each block was 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 content were offered. The high energy control diet (CON) contained corn silage and alfalfa silage. The lower energy diet (STR) was similar to CON but included wheat straw.
- 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	
	CON	STR
Ingredients, % of DM		
Corn Silage	48.0	26.8
Alfalfa Haylage	52.0	59.1
Straw	-	14.1
Nutrients, % of DM		
Crude protein (CP), %	11.8	11.7
Neutral detergent fiber (NDF), %	45.6	50.1
Starch, %	15.5	11.0
Total digestible nutrients (TDN), %	62.5	58.0

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

RFI treatment	Low		High		SEM	RFI	P=	RFI x Diet	
	Diet treatment	CON	STR	CON					STR
DM, kg/d		11.05	10.0	11.0	10.0	0.063	0.43	<0.01	1.00
DM, % of BW		2.09	1.95	2.09	1.99	0.01	0.11	<0.01	0.14
CP, kg/d		1.31	1.17	1.3	1.16	0.007	0.42	<0.01	1.00
NDF, kg/d		5.05	5.00	5.00	5.00	0.035	0.57	0.41	0.77
NDF, % of BW		0.95	0.97	0.95	0.99	0.011	0.25	0.04	0.25
TDN, kg/d		6.95	5.59	6.91	5.55	0.032	0.31	<0.01	0.87
Daily gain, kg/d		1.16	0.94	1.19	0.85	0.013	0.08	<0.01	0.02
Feed Efficiency, kg intake, kg gain		9.5	10.7	9.4	11.9	0.11	0.02	<0.01	<0.01
Height gain, cm		3.5	3.6	3.7	2.8	0.33	0.41	0.34	0.23
Ending BCS		3.87	3.47	3.79	3.52	0.074	0.85	0.02	0.46
DM Digestibility, % DM		58.9	50.0	57.9	51.6	1.47	0.83	0.01	0.44
NDF Digestibility, % DM		48.9	42.1	47.8	44.2	1.71	0.79	0.06	0.40

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

	RFI	Low		High		SEM	RFI	P=	RFI x
		Diet	CON	STR	CON				
Rump gain	0.59	0.2	0.56	0.4	0.19	0.02	<0.01	0.01	
Kidney gain	1.39	1.5	1.7	1.12	0.52	0.95	0.68	0.55	

Summary

- Dry matter intake (DMI) was affected by diet (11.0 vs 10.0 kg/d for CON and STR, respectively; P<0.01), but not by RFI (P>0.10)
- Average daily gain was affected by the interaction of RFI and diet with low RFI heifers having higher gains than high RFI when fed STR (P=0.02), but no difference when fed CON (P=0.25)
- Feed efficiency was better for low RFI than high RFI heifers when fed STR (P<0.01), but no effect on RFI when fed CON (P>0.10)
- Body condition score increased when fed CON
- Diet digestibility was greater for CON, which likely caused greater intake and gains for heifers fed CON.

Conclusions

- Feed efficiency of heifers having different RFI is dependent on diet energy level with heifers having low RFI using the moderate energy (STR) diet more efficiently.
- Straw diet reduced intake and maintained more desirable heifer weight gains

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.
- 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.