Abstract # 915
Poster # W047

Pregnant beef heifers categorized by residual feed intake measured in adolescence exhibit differential intake and feeding behaviors when fed a restricted diet.

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Abstract:

Selection for residual feed intake (RFI) in cattle will bring about changes in metabolism and physiology that are not explicitly known. We appraised feed intake and feeding behaviour in heifers, characterized by a range of RFI, when fed two different planes of nutrition from day 30 to 150 of pregnancy. Sixty-nine purebred Angus heifers, with RFIF (RFI corrected for fat, ave=0.047, SD=0.7678) measured in adolescence, entered a GrowSafe® automated feed intake recording system after confirmation of pregnancy at 30-days post artificial insemination (AI). Heifers were divided randomly, yet equally in terms of RFIF, weight at start of test (SOT), and SOT rib and rump fat, into 2 diet-groups. Heifers received a ration formulated to allow gain of either 0.5 kg/d (L-diet), or 0.7 kg/d (H-diet). Rations were fed until 150 d of pregnancy, and were adjusted periodically to account for heifer and fetal growth plus decreasing fall temperatures. Heifer weight, as well as rib and rump fat were measured approximately once every 4 weeks, and individual feed intake and feeding behaviour was continuously measured by GrowSafe®. All weight and fat measurements, feed intake and behaviour were analyzed using PROC GLM in SAS 9.0, with RFIF, diet (H- or L-diet), RFIF*diet, and AI (1st or 2nd) included in the model. There were no significant differences due to RFIF, diet, or their interaction on SOT weight, or SOT rib and rump fat. By end of test (EOT), significant diet effects were seen upon EOT weight, both EOT rib and rump fat, and ADG during the feed trial ($P<0.01$), with heifers consuming H-diet displaying higher weights and fat measurements, but no effect of RFIF was detected. However, significant diet and RFIF effects were detected in average daily intake, feeding duration and head-down time ($P<0.05$), where heifers with lower RFIF ate less, had a lower average daily feeding duration and head-down time, than those with higher RFIF. Therefore, regardless of diet consumed and under limiting nutritional conditions, low RFIF pregnant heifers ate less, yet maintained the same growth and body condition when compared to high RFIF pregnant heifers. This result is important as RFIF is typically measured on virgin animals and under ad-libitum conditions. If selection for RFI is to become mainstream in the cattle industry, investigating the performance of high and low RFI animals in different nutritional environments and physiological conditions is important.

RFI (residual feed intake): is a measurement of how much an animal eats either above or below what is estimated from its weight and stage of growth.

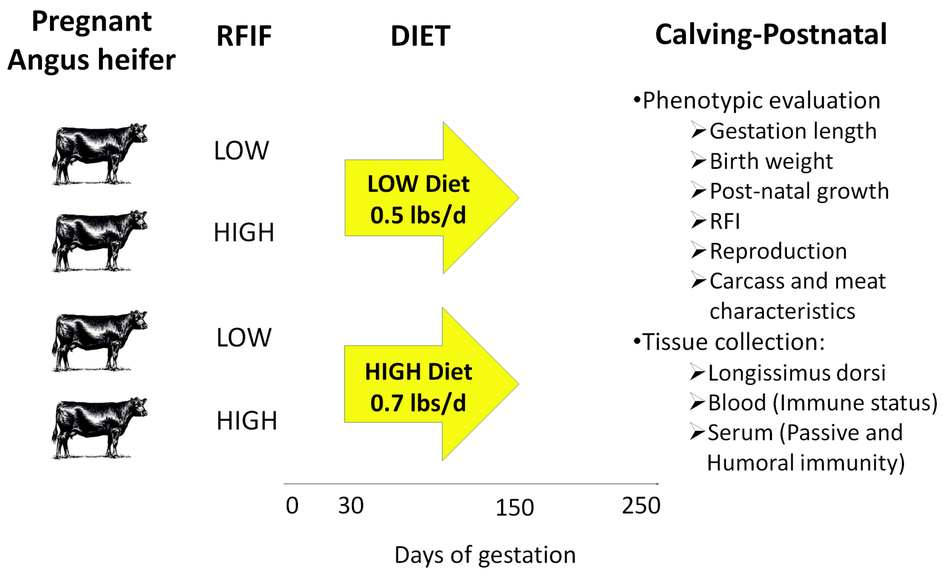
Cattle with divergent RFI **process and store** the energy they receive from feedstuffs **differently**.

Nutrition : Maternal nutrition during pregnancy has been shown to have **permanent** effects on post-natal growth and development of offspring.

Depending upon the time and type of nutritional treatment, these effects may target different biological pathways, and possibly become **multi-generational**.

What are the implications of selection for low RFI (more efficient) cattle and the amount of energy left to support the development of the unborn calf? How does this interact with the nutritional environment?

Experimental design



Results of feed trial during gestation:

- Regardless of diet fed during pregnancy, low RFIF heifers exhibited different feeding behaviors and continued to eat less than high RFIF heifers (Table 1, Figure 1), although no differences were seen in weight gain or ultrasound rib and rump fat (Table 2).

Table 1. Significance (P) values for the influence of residual feed intake as measured as a heifer (RFIF), and level of diet restriction (Diet), on feeding behaviour characteristics measured by GrowSafe.

Trait	RFIF[1]	Diet[2]	RFIF*Diet
Intake AVE	**<.0001**	**<.0001**	0.0776
Duration AVE	**0.0239**	**<.0001**	0.9105
Head-down AVE[3]	**0.0004**	**<.0001**	0.7534
Event AVE	0.6334	**0.0402**	0.2815

[1]Residual feed intake corrected for backfat.
[2]Two diets: High (formulated to gain 0.7 kg/day), and Low (0.5 kg/day).
[3]Square-root of Head-down AVE.

Table 2. Significance (P) values for the influence of residual feed intake as measured as a heifer (RFIF), and level of diet restriction (Diet), on growth and fat characteristics of heifers during the feed trial.

Trait	RFIF[1]	Diet[2]	RFIF*Diet	AI[3]
SOTweight	0.1568	0.2229	0.4634	<.0001
EOTweight	**0.2656**	**0.0028**	0.2407	0.0021
ADGFeedTrial	**0.8757**	**<.0001**	0.2211	0.032
SOTribfat	0.9066	0.9288	0.2238	0.784
EOTribfat	**0.3781**	**<.0001**	0.4117	0.0176
SOTrumpfat	0.6926	0.7868	0.1765	0.5426
EOTrumpfat	**0.9207**	**<.0001**	0.9069	0.0381

[1]Residual feed intake corrected for backfat.
[2]Two diets: High (formulated to gain 0.7 kg/day), and Low (0.5 kg/day).
[3]Pregnant at 1st or 2nd AI.

- As RFI of the heifer became positive (less efficient), average daily intake (Intake AVE), feeding event duration average (Duration AVE), and average time the animal spent detected by GrowSafe (Head-down AVE), increased (Figure 1-3).

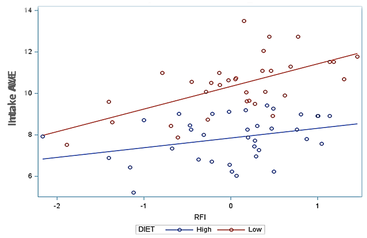


Figure 1. Intake AVE increases as RFI becomes positive, regardless of diet fed.

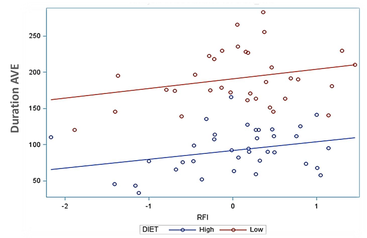


Figure 2. Duration AVE increases as RFI becomes positive, regardless of diet fed.

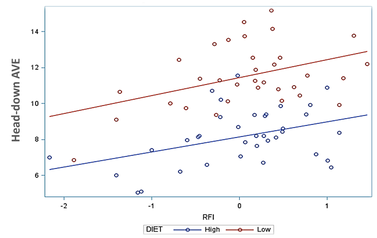


Figure 3. Head-down AVE increases as RFI becomes positive, regardless of diet fed.

Significance: Usually RFI is measured in the feedlot under ad-libitum conditions. In this experiment we have seen that heifers with a lower RFI (more efficient) as initially measured while virgin and under ad-libitum conditions, still eat less while pregnant and on a restricted diet while maintaining similar growth and body condition, as compared to heifers with a more positive RFI (less efficient).