The relationship between feed efficiency & the expression of genes associated with appetite control in the hypothalamus & intestine of pigs

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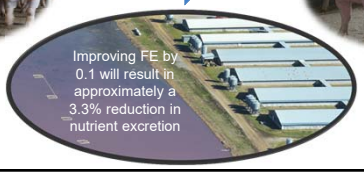
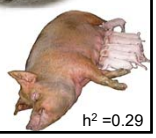
An Roinn Talmhaíochta, Bia agus Mara

What is feed efficiency & what is the impact of improving it?

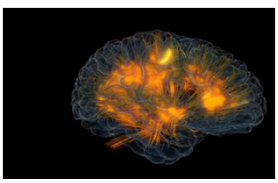
Feed consumed per kg of gain



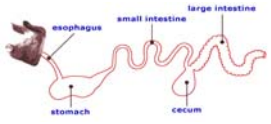


h^2 =0.29

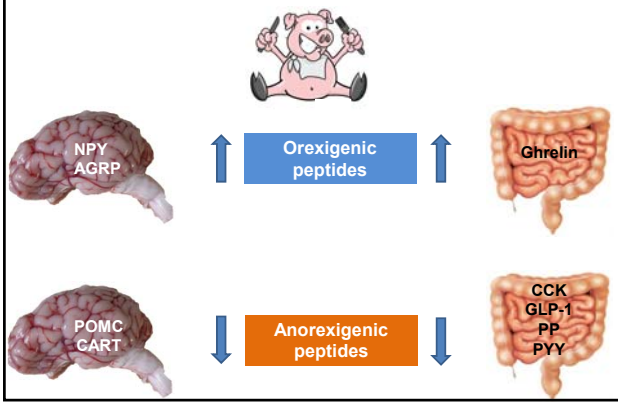
Residual feed intake as a measure of feed efficiency



What is driving the differences in feed intake and feeding behavior in pigs that differ in feed efficiency?



Neuropeptides & gut peptides in appetite control & feeding behavior



Neuropeptides & gut peptides in appetite control & feeding behavior

Are changes in neuropeptide and gut peptide gene expression responsible for differences in feed intake and feeding behavior in pigs divergent in feed efficiency?

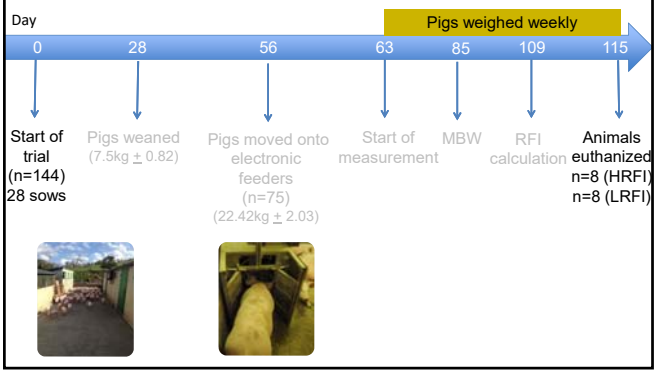
Objective

To examine the role of hypothalamic and gut peptide gene expression in the regulation of appetite and feeding behavior in pigs divergent in RFI

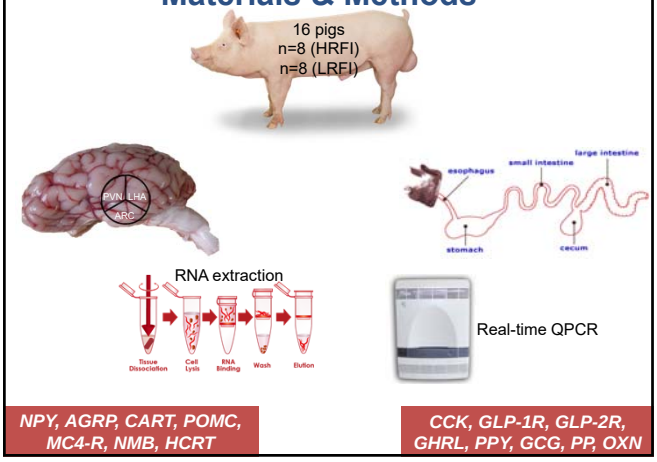
Hypothesis

The lower feed intake and lower feeding activity in LRFI pigs may be reflected in changes in the expression of genes involved in appetite control and feeding behavior when compared to HRFI pigs

Phenotypic identification of pigs divergent in feed efficiency



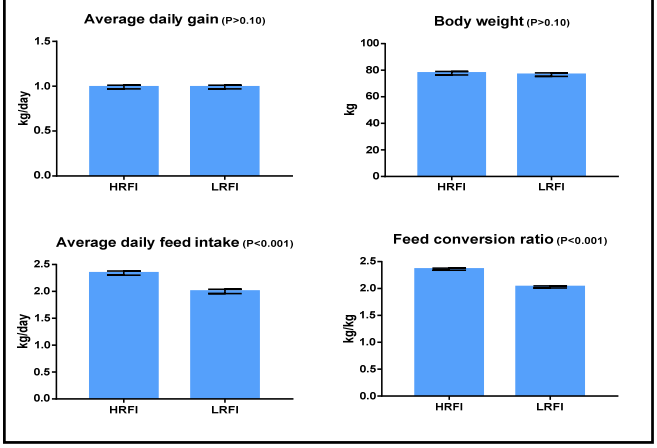
Materials & Methods



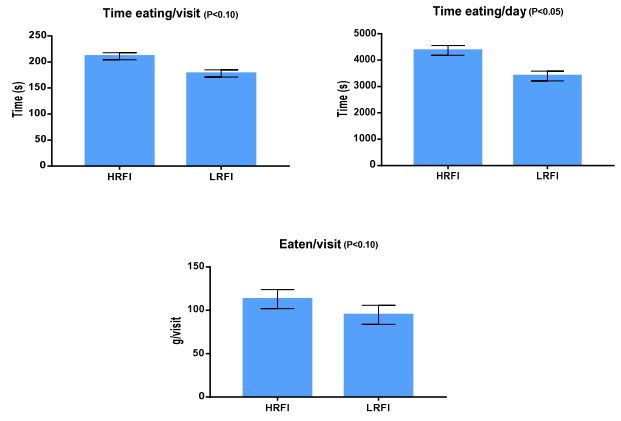
NPY, AGRP, CART, POMC, MC4-R, NMB, HCRT

CCK, GLP-1R, GLP-2R, GHRL, PPY, GCG, PP, OXN

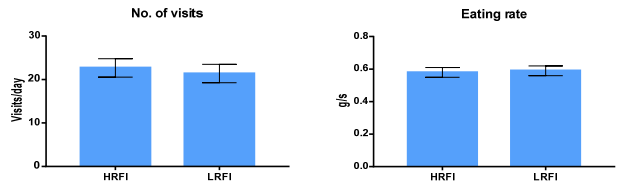
Animal performance



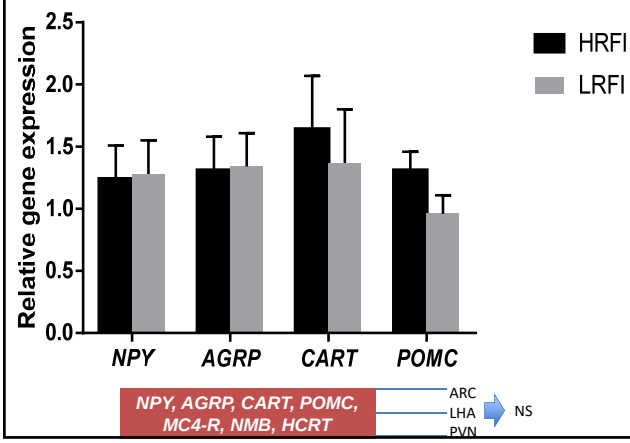
Feeding behavior



Feeding behavior



Neuropeptides in the ARC

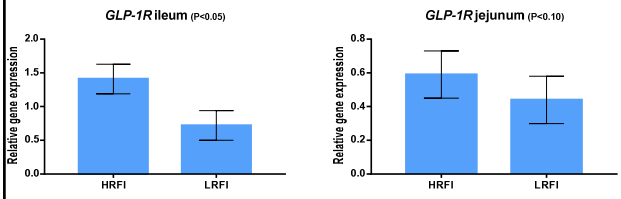


Gut peptide gene expression

CCK, GLP-2R, GHRL, PPY, GCG, PP, OXN

Duodenum
Jejunum
Ileum

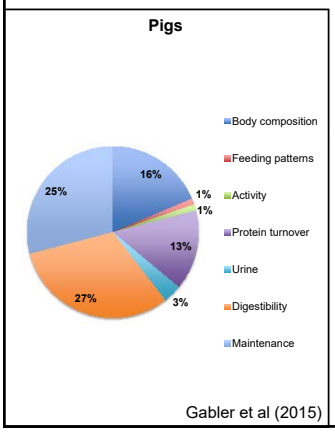
→ NS



Summary

- LRFI pigs had lower feed intake than the HRFI pigs
- LRFI pigs had reduced feeding behavior activity
- Pigs divergent in RFI did not differ in the gene expression of the main hypothalamic neuropeptides
- LRFI pigs had lower gene expression of *GLP-1R* in both the jejunum and ileum

Conclusions



Gabler et al (2015)


animal

Pigs that are divergent in feed efficiency, differ in intestinal enzyme and nutrient transporter gene expression, nutrient digestibility and microbial activity

S. Vigors, T. Sweeney, C. J. O'Shea, A. K. Kelly and J. V. O'Doherty

PLOS ONE

RESEARCH ARTICLE

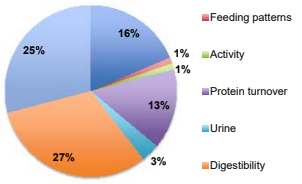
The Effect of Divergence in Feed Efficiency on the Intestinal Microbiota and the Intestinal Immune Response in Both Unchallenged and Lipopolysaccharide Challenged Ileal and Colonic Explants

Thank you for listening!

Any questions?

Conclusions

Pigs



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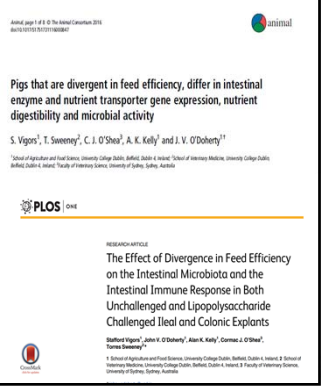

animal

Pigs that are divergent in feed efficiency, differ in intestinal enzyme and nutrient transporter gene expression, nutrient digestibility and microbial activity

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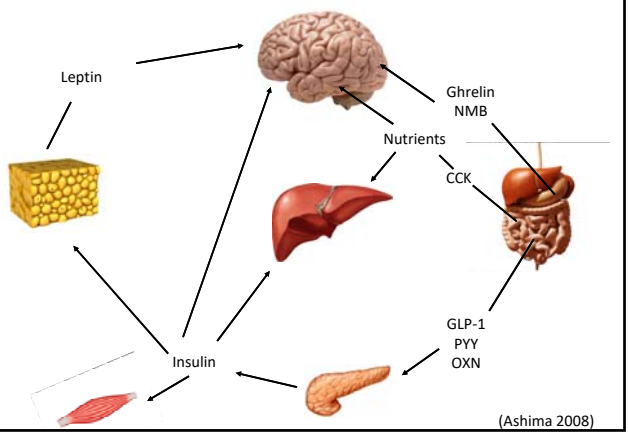
Organs involved in appetite control



(Ashima 2008)

Correlations between feeding behavior & hypothalamic neuropeptides

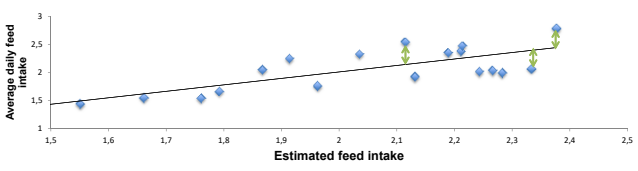
	Time/visit	Time eating per day	Eaten per visit	Eating rate	Total eaten per day	No. of visits
Paraventricular nucleus						
AGRP	-0.3	-0.05	-0.22	0.03	0.12	0.34
CART	0.41	0.05	**0.63***	0.03	0.12	0.34
NPY	-0.31	-0.05	-0.13	0.21	0.26	0.38
POMC	0.19	0.32	0.07	-0.3	0.38	0.15

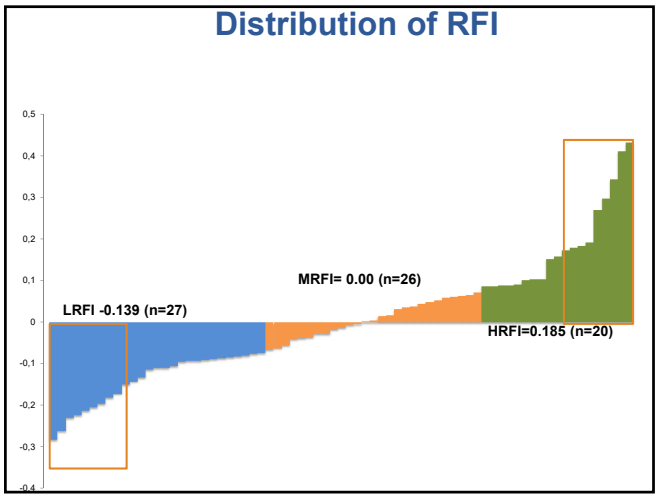
Correlations between feeding behavior & gut peptides

	Time/visit	Time eating per day	Eaten per visit	Eating rate	Total eaten per day	No. of visits
Duodenum						
CCK	-0.02	0	0.03	0	0.12	-0.03
GLP-1R	-0.17	0.01	-0.06	0.1	0.19	0.11
GLP-2R	-0.27	0.27	-0.39	-0.16	0.22	**0.67***
PPY	-0.26	0.15	***-0.52**	-0.24	-0.11	**0.60***

Residual feed intake (RFI)

- RFI partitions feed intake into intake for body weight and body weight gain and a residual portion that is unrelated to growth and maintenance
- RFI allows evaluation of variation in feed efficiency that cant be accounted for when using FCR or GTF




Distribution of RFI
0,5
0,4
0,3
0,2
0,1
0
-0,1
-0,2
-0,3
-0,4
LRFI -0.139 (n=27)
MRFI= 0.00 (n=26)
HRFI=0.185 (n=20)