Relationship between feed efficiency and physiological stress parameters in Durox x Iberian pigs

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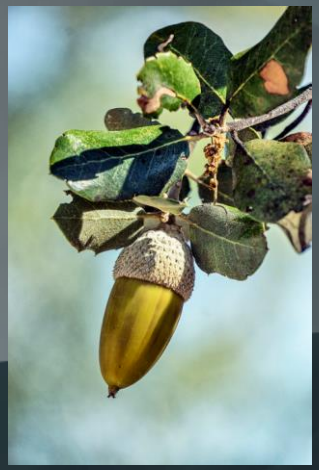
Gobierno de España · Ministerio de Economía, Industria y Competitividad · INIA Instituto Nacional de Investigación y Tecnología Agraria y Alimentaria · Instituto Tecnológico Agrario de Castilla y León · itacyl

Iberian pig production:

- 100% Iberian
- ♂ Duroc x ♀ Iberian
- Extensive “Montanera” (5%)
- Intensive fattening(69%)




OFERTA
Jamón de bellota 5 Jotas
189,00 €
Jamón de Salamanca Joselito
199,00 €
Jamón bellota de Guijuelo
135,00 €
Jamón de cebo
75,00 €

Introduction

A Hypothesis and Review of the Relationship between Selection for Improved Production Efficiency, Coping Behavior, and Domestication

Wendy M. Rauw[1,2], Anna K. Johnson[2], Luis Gomez-Raya[1,2] and Jack C. M. Dekkers[2]*

frontiers in Genetics

Resource allocation on a limited Budget:

Energy from food = Energy in product + Loss

↳ What comes out must be met by input

↳ Input used by one process is not available for another one

+ Maintenance

+ Activity

+ Welfare (stress)

+ Health (immune)

Improved Feed Efficiency

Maintenance

Activity

\+ Welfare (stress)

Health (immune)

⇩ ⇧

- Reduced ability to respond to stress, or
- Reduced stress response

Material & Methods

53 ♂ Duroc x ♀ Iberian pigs

January – June 2017 (124 days)

3 Diets: Growth – Fattening – Finishing ☞ Periods

Table 1. Composition of the three-phase diets.

	Growth	Fattening	Finishing
Netto Energy (kcal/kg)	2258	2498	2420
Crude Protein, %	13.7	13.5	12.75
Lys	0.76	0.68	0.55
Met	0.27	0.23	0.23
Crude Fat, %	4.1	7.5	5.1
Crude Fiber, %	4.6	4.2	4.5
Crude Ash, %	6	4.6	4.6
Calcium, %	0.77	0.48	0.51
Phosphorus, %	0.48	0.42	0.44
Sodium, %	0.24	0.23	0.25
Duration (wk)			
REP 1	8	5	4.7

Material & Methods

Every 6-8 days measurement of

body weight (BW) and feed intake (FI)

☞ weight gain (BWG), feed efficiency (FCE, RFI)

Within Period:

$$DFI_i = b_0 + (b_1 \times BW_i^{0.75}) + (b_2 \times DBWG_i) + (b_3 \times BFT_i) + RFI_i$$

$$FCE = BWG/FI$$

Blood samples during restraint ☞ Glucose, Lactate, Cortisol

Day 1 (growing), day 78 (fattening), day 125 (slaughter)

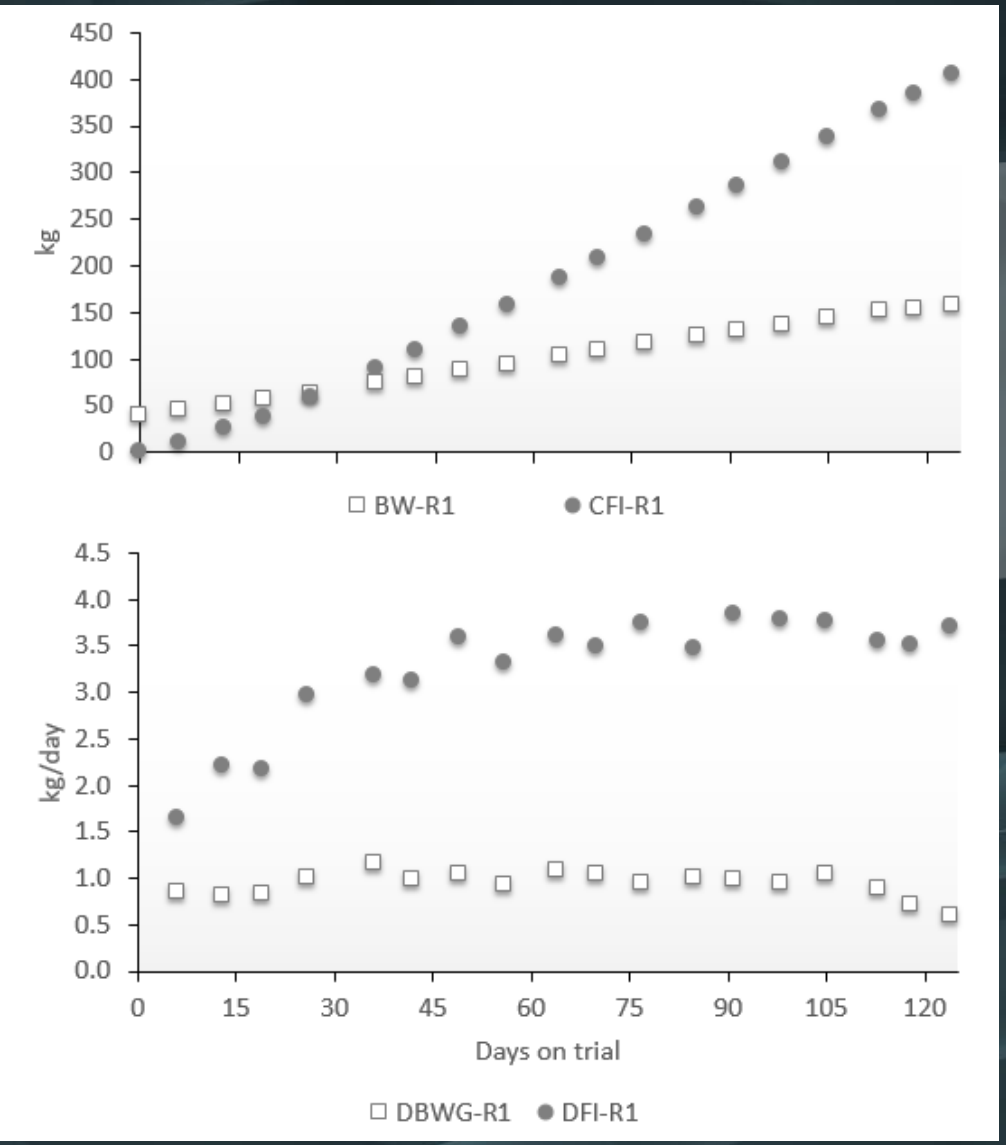
At Slaughter: fat thickness

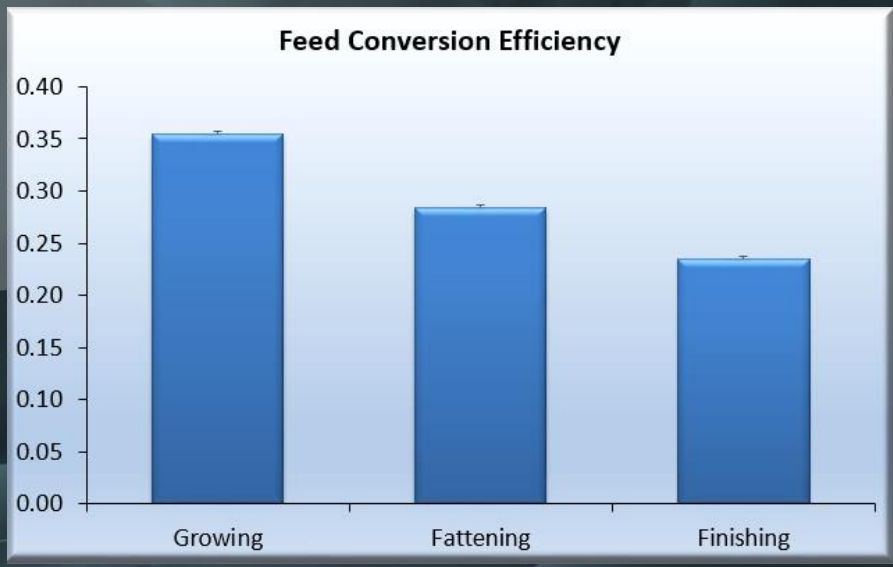
Material & Methods

Slaughter at 125 days:

Carcass, Dressing-%, Ham, shoulder, Loin yield, meat quality

Results


kg
450
400
350
300
250
200
150
100
50
0
BW-R1
CFI-R1
kg/day
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.0
0
15
30
45
60
75
90
105
120
Days on trial
DBWG-R1
DFI-R1


Feed Conversion Efficiency
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Growing
Fattening
Finishing

Results

Cortisol: hormone released by activation of HPA-axis

Activates glycogenolysis and gluconeogénesis

Glucose: Cortisol increases substrate levels of glucose to increase energy availability (less precise indicator of stress tan cortisol)

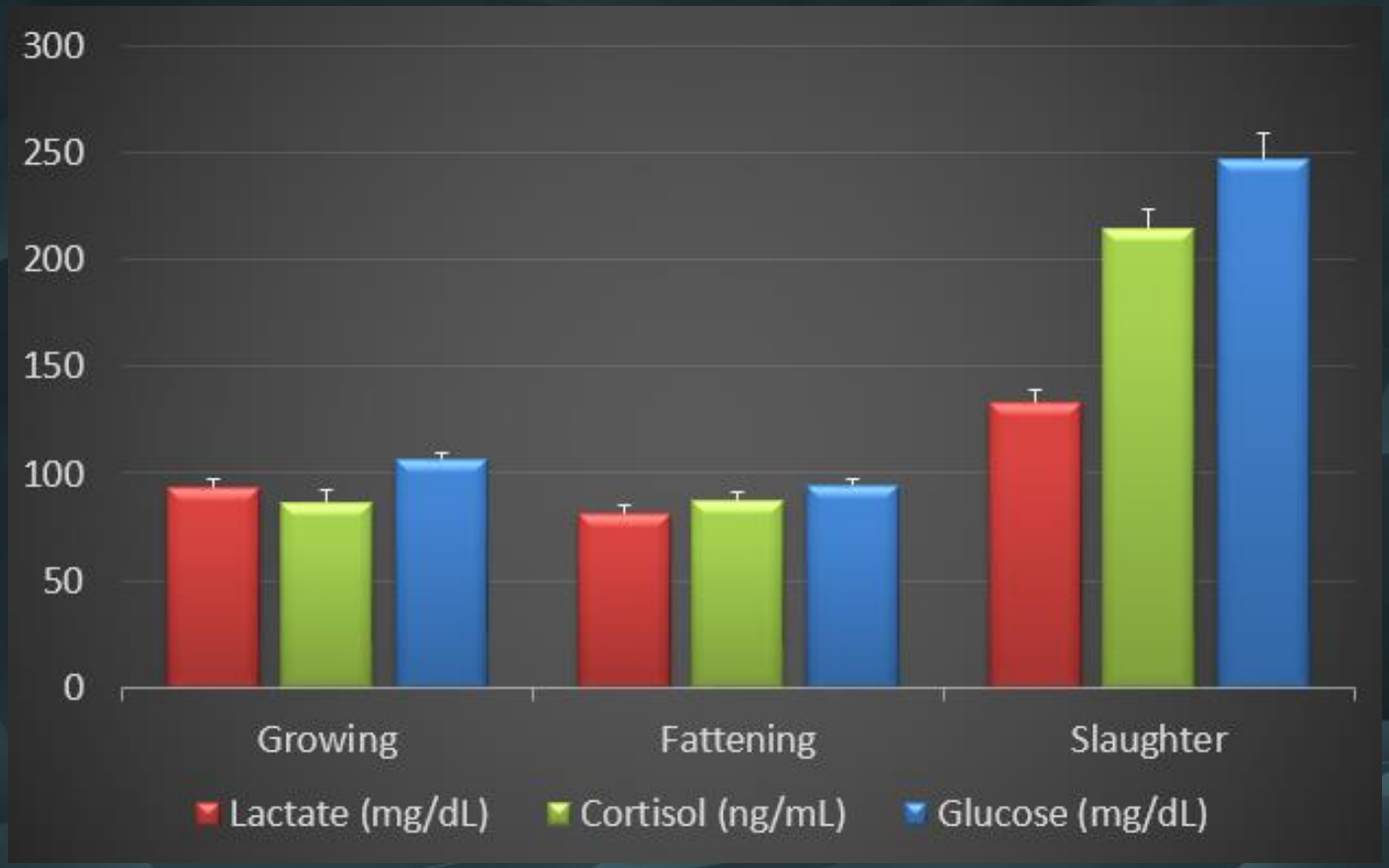
Glucose ☞ glycolysis (pyruvate) ☞ citric acid cycle (mitocondrial matrix)

Lactate: Anaerobic metabolism: pyruvate ☞ lactate

Acute stress: increase in cortisol, glucose, and lactate

But at *slaughter*: exhaustion of glycolytic stores

Results



Cortisol	slaughter
growing	0.25 †
fattening	0.33 *

	Growing	Fattening	Slaughter
Glucose - Lactate	0.23 †	0.53 ***	0.13

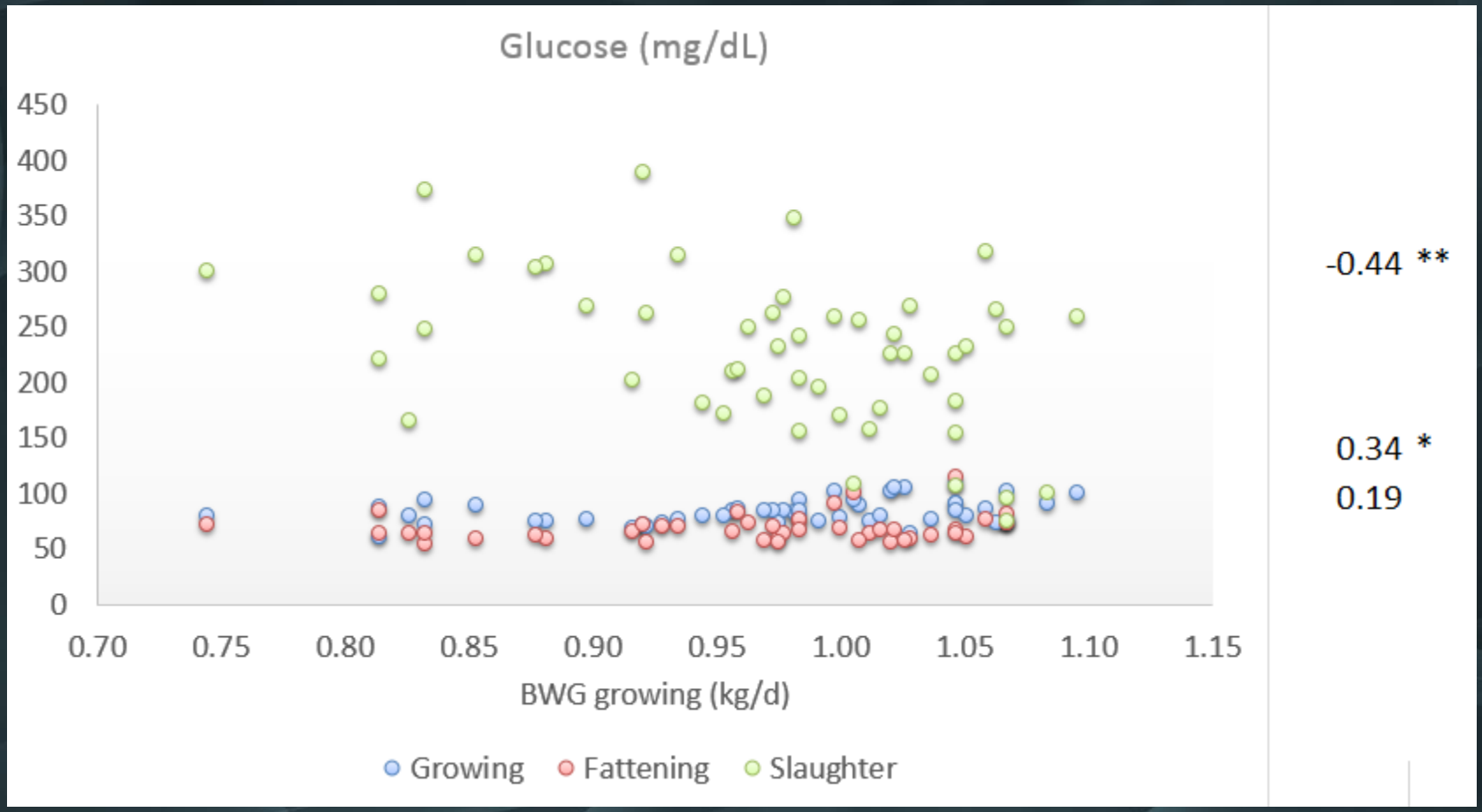
Slaughter	Glucose	Lactate
Cortisol	-0.35 *	0.48 ***

Repeatable response

glucose ⇧ = lactate ⇧

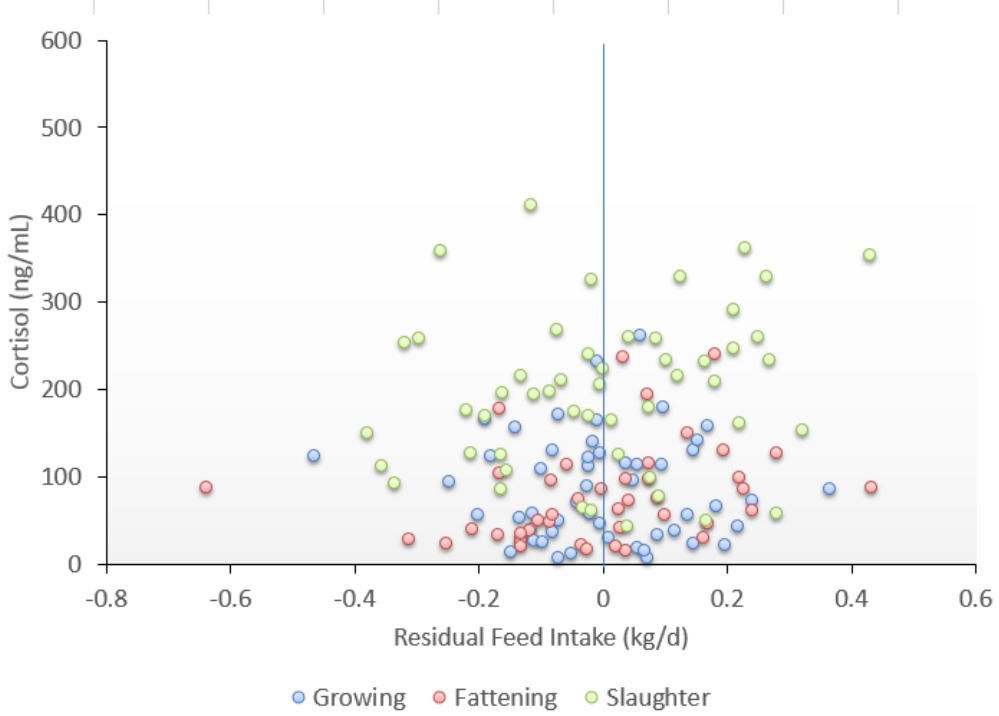
Exhaustion of glycolytic stores

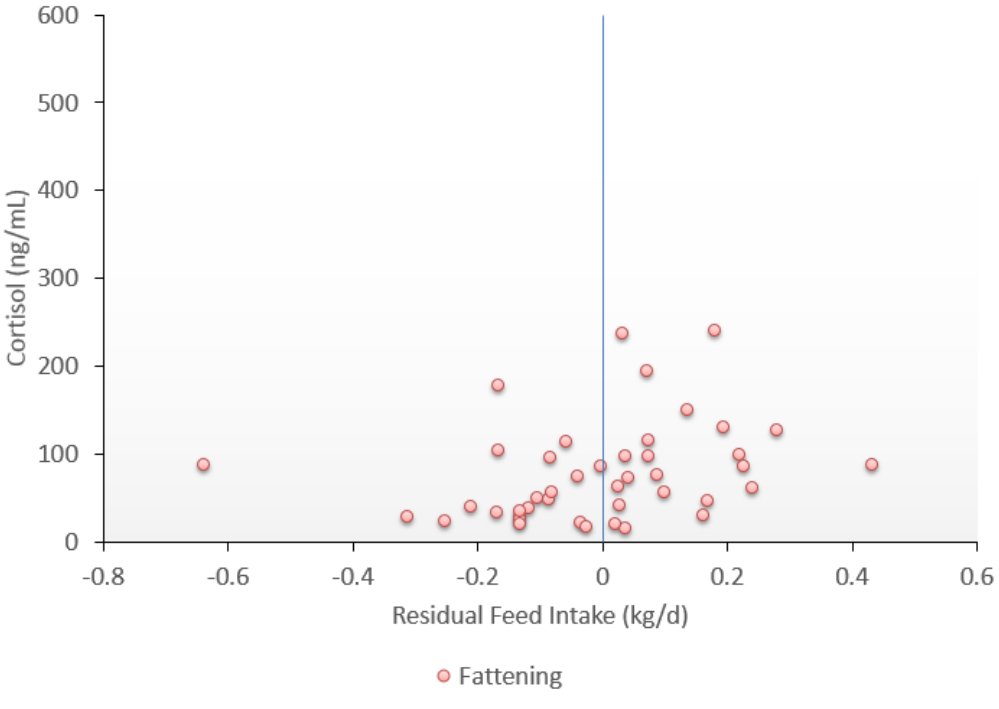
Results



Faster growth = higher stress response & faster depletion of glycolytic stores at slaughter

Results

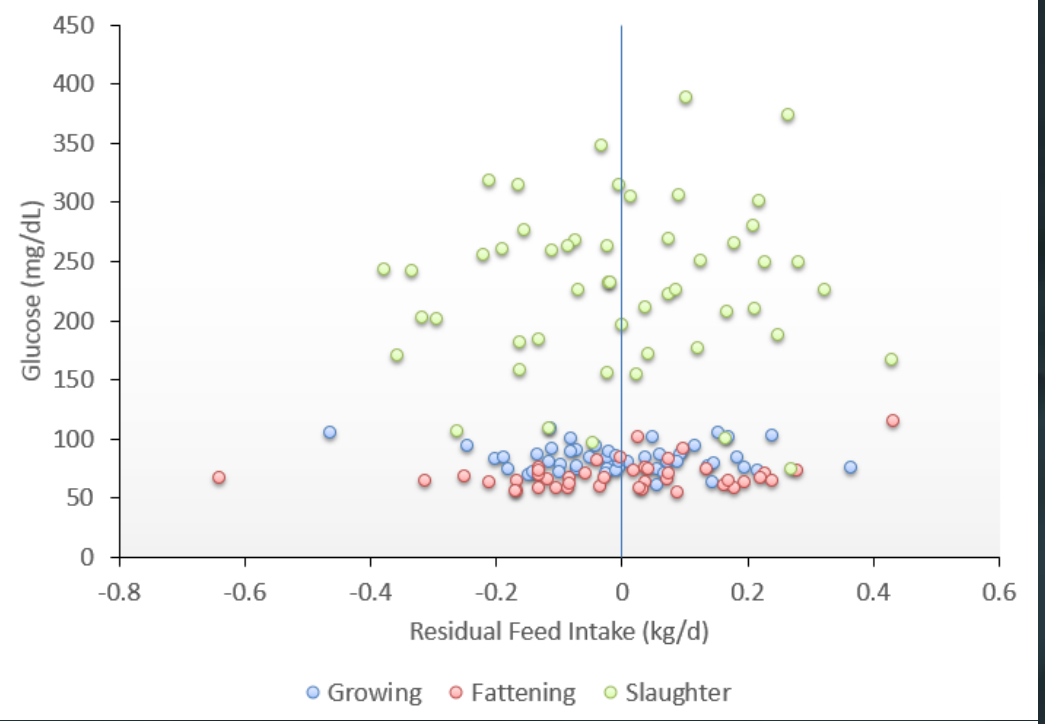


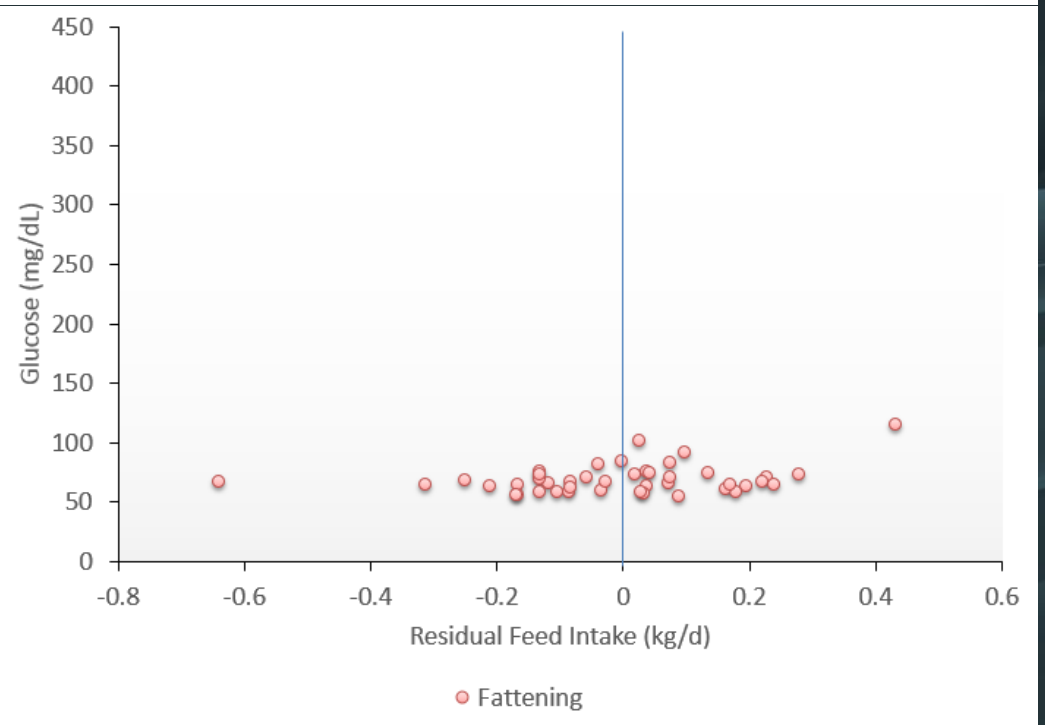


		Glucose	Lactate	Cortisol
RFI	Growing	-0.13	0.07	-0.05
	Fattening	0.32 *	0.25	0.29 †
	Finishing	0.05	0.37 **	0.19

⇧ Cortisol = ⇧ RFI = ⇩ Feed Efficiency

Results





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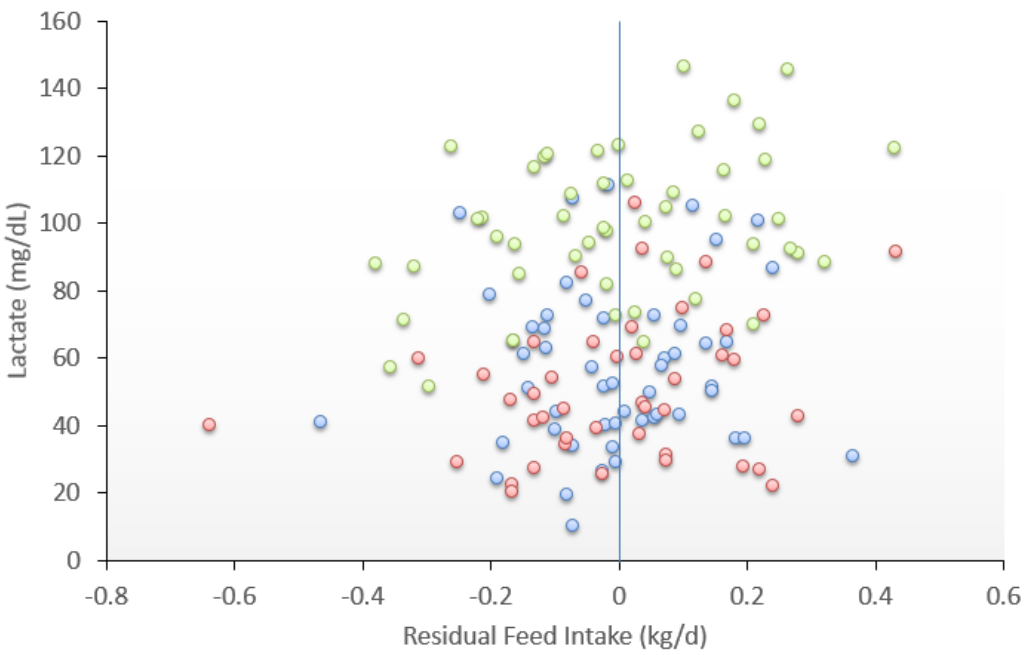

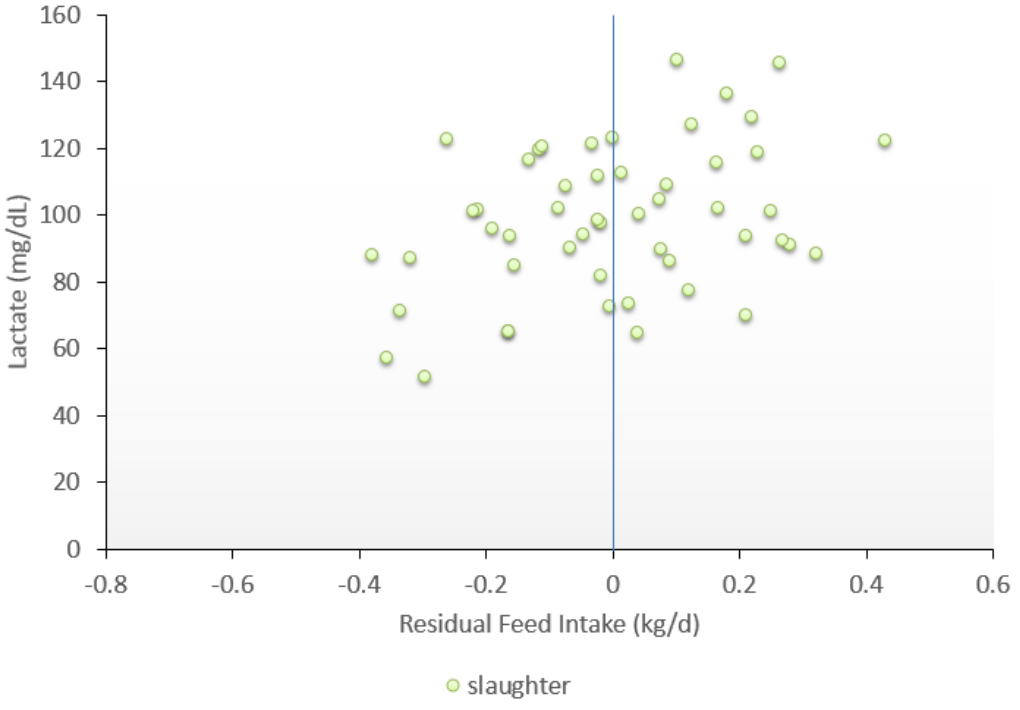

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⇧ Lactate = ⇧ RFI = ⇩ Feed Efficiency

Conclusions

- Repeatable response cortisol
- Positive relationship between glucose and lactate
- Slaughter: increase in glucose, lactate, cortisol
- Slaughter: stress ⇧ = cortisol ⇧, lactate ⇧, glucose ⇩
  - Exhaustion of glycogenic stores
- Faster initial growth: glucose = ⇧ (Growth), ⇩ (Slaughter)
- More efficient animals (RFI-):

  Glucose ⇩ (fattening), Cortisol ⇩ & Lactate ⇩ (Slaughter)

Improved Feed Efficiency

Maintenance

Activity

\+

Welfare (stress)

Health (immune)

⇩ ⇧

Reduced ability to respond to stress, or

Reduced stress response

ERA-NETSUSAN

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ERA-NET SusAn 35: SusPig www.suspig-era.net

Sustainability of Pig production through improved feed efficiency - 2017–2020

AGL2016-75942-R: IBERFIRE (Iberian, RFI, Reproduction)

Molecular Characterization of feed efficiency and reproduction traits in Iberian pigs - 2017–2021

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