RELATIONSHIP BETWEEN FEED EFFICIENCY AND PHYSIOLOGICAL STRESS PARAMETERS IN DUROX X IBERIAN PIGS

Wendy Rauw, Eduardo de Mercado, Luis Alberto García, Luis Gómez Raya, Luis Silió, Carmen Rodríguez, Emilio Gómez Izquierdo
Iberian pig production:
- 100% Iberian
- ♂ Duroc x ♀ Iberian
- Extensive “Montanera” (5%)
- Intensive fattening (69%)
INTRODUCTION

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**

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

Maintenance + Activity + Welfare (stress) + Health (immune)
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.

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

Graph showing the weight gain over days on trial for different groups, with one graph for weight in kg and another for weight gain in kg/day.

Bar chart indicating feed conversion efficiency across different phases: Growing, Fattening, and Finishing.
Cortisol: hormone released by activation of HPA-axis
Activates glycogenolysis and gluconeogénésis

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

Glucose ↝ glycolysis (pyruvate) ↝ citric acid cycle (mitochondrial matrix)

Lactate: Anaerobic metabolism: pyruvate ↝ lactate

Acute stress: increase in cortisol, glucose, and lactate
But at slaughter: exhaustion of glycolytic stores
RESULTS

Repeatable response

Glucose $\uparrow$ = lactate $\uparrow$

Exhaustion of glycolytic stores

Cortisol

- Slaughter: 0.25 †
- Growing: 0.33 *
- Fattening: 0.33 *

Glucose - Lactate

- Growing: 0.23 †
- Fattening: 0.53 ***
- Slaughter: 0.13

Slaughter

- Glucose: -0.35 *
- Lactate: 0.48 ***
Faster growth = higher stress response & faster depletion of glycolytic stores at slaughter
RESULTS

↑ Cortisol = ↑ RFI = ↓ Feed Efficiency
RESULTS

Glucose $= \text{RFI} = \text{Feed Efficiency}$

\[ \uparrow \text{Glucose} = \uparrow \text{RFI} = \downarrow \text{Feed Efficiency} \]
RESULTS

Lactate = RFI = Feed Efficiency
Conclusions

- Repeatable response cortisol
- Positive relationship between glucose and lactate
- Slaughter: increase in glucose, lactate, cortisol
- Slaughter: stress $\uparrow = \text{cortisol} \uparrow$, lactate $\uparrow$, glucose $\downarrow$
  - Exhaustion of glycogenic stores
- Faster initial growth: glucose $= \uparrow$ (Growth), $\downarrow$ (Slaughter)
- More efficient animals (RFI-):
  - Glucose $\downarrow$ (fattening), Cortisol $\downarrow$ & Lactate $\downarrow$ (Slaughter)
IMPROVED FEED EFFICIENCY

Reduced ability to respond to stress, or
Reduced stress response

Maintenance Activity
Welfare (stress)
Health (immune)
ACKNOWLEDGEMENTS

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
ACKNOWLEDGEMENTS

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ERA-NET SusAn: SusPig [www.suspig-era.net](http://www.suspig-era.net)

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Gracias