Pork production with immunocastration: welfare and environment

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Challenge pork production

In the EU, about 75 % of male piglets are surgically castrated

Surgical castration serves to prevent off-odour in meat from male pigs, but causes strong public disapproval, as it is painful and considered a welfare problem

Pork production with entire males has long been regarded as an alternative, but problems with meat quality and welfare issues remain

→ Immunocastration (IC) could be a serious alternative with potential advantages on animal welfare, ecology and economy

Sustainable pork production with IC

1. No painful castration, no climate-relevant gases (isoflurane anesthesia)

2. Less animal welfare problems

3. Feed efficient & potentially environmentally friendly

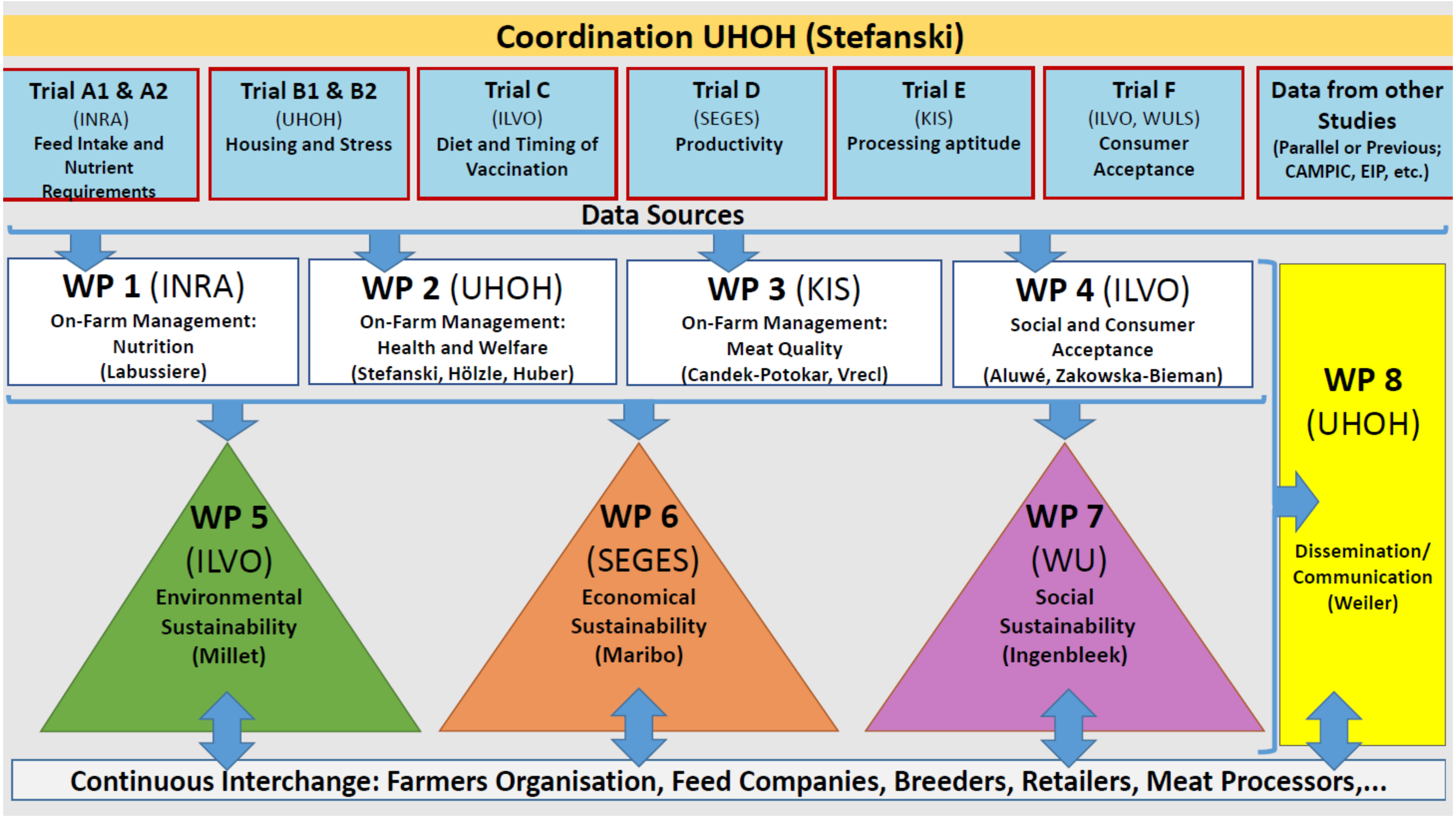
4. High meat quality, higher number of usable carcasses

5. Preconditions
   - optimization of the production process
   - confirmation of reliability ("non-responder")
   - consumer acceptance

ERA-Net SuSI addresses research gaps

Sustainability in pork production with immunocastration

→ Evaluation and optimization of pork production with immunocastration as an environmentally, economically and socially sustainable alternative



Aim of the talk

Impact of immunocastration (IC) on

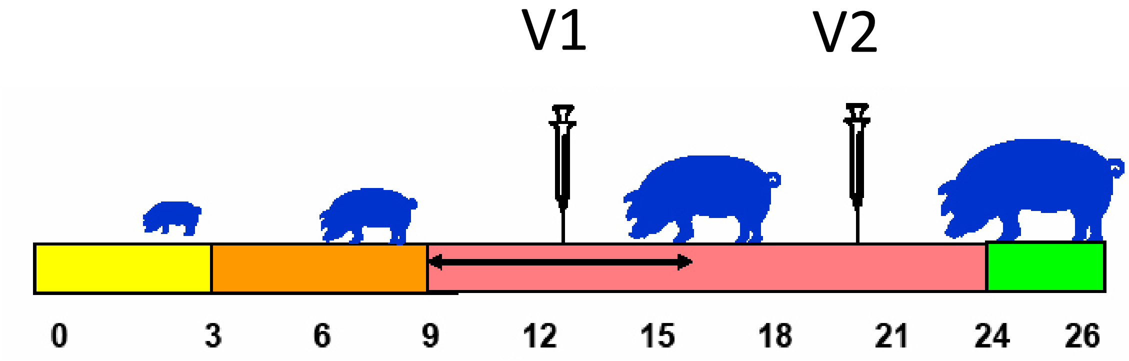
(1) welfare (behavior & health)

(2) nutritional efficiency & environmental footprint

How does immunocastration work?

Vaccination with anti-GnRH vaccine (Improvac©)

Injection at two time points (V1 & V2)



Age in weeks

Effect of IC on welfare → behavior & health

State of the art

- IC show less aggressive and sexual behavior than EM,

  e.g. Rydmer et al. 2010 (Sweden), Karaconji et al. 2015 (Australia) , Puls et al. 2017 (USA)

- Penile injuries in entire males are abundant, e.g. Weiler et al. 2016

Research gaps

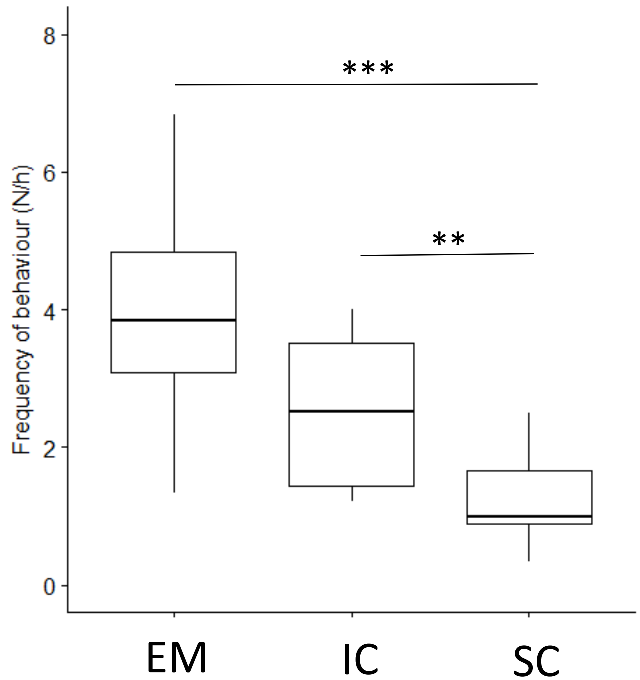
- IC behavior: Stability under varying / stressful housing conditions

- Effect on IC on penile injuries (and other health-related problems such as ulcers, leg problems)

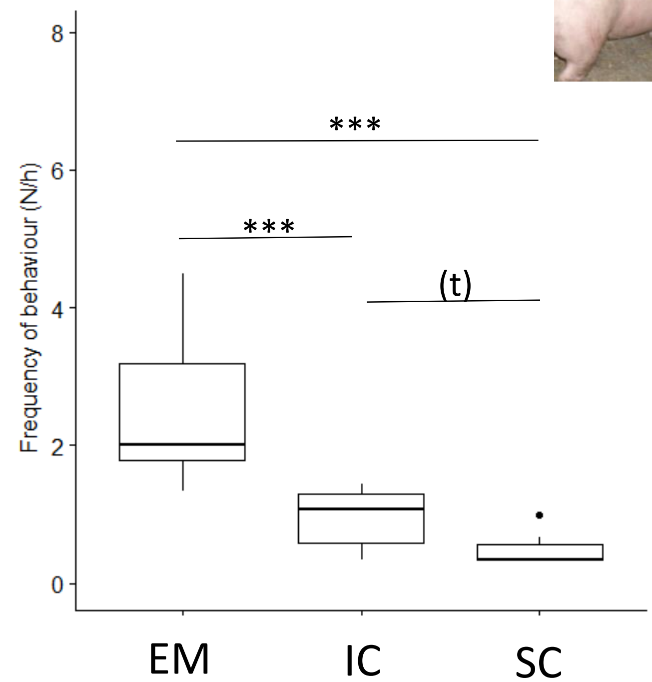
Behavior of IC (SuSI project)

Social mixing

Aggressive



Sexual



Preliminary data from SuSI project showing 50 % of the final data set

H-test with pairwise comparison (Bonferroni-corrected)

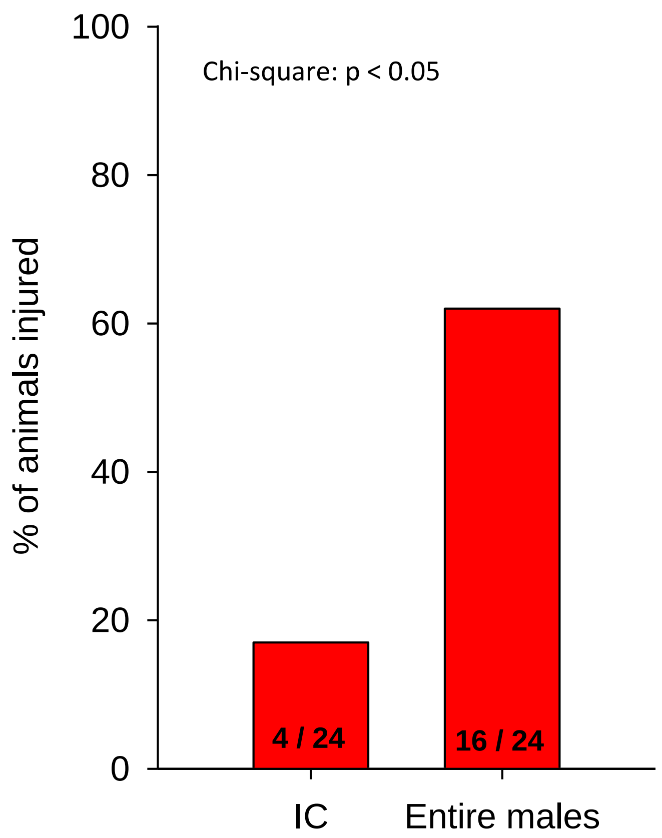
Immunocastrates vs. entire males

- Less sexual behavior

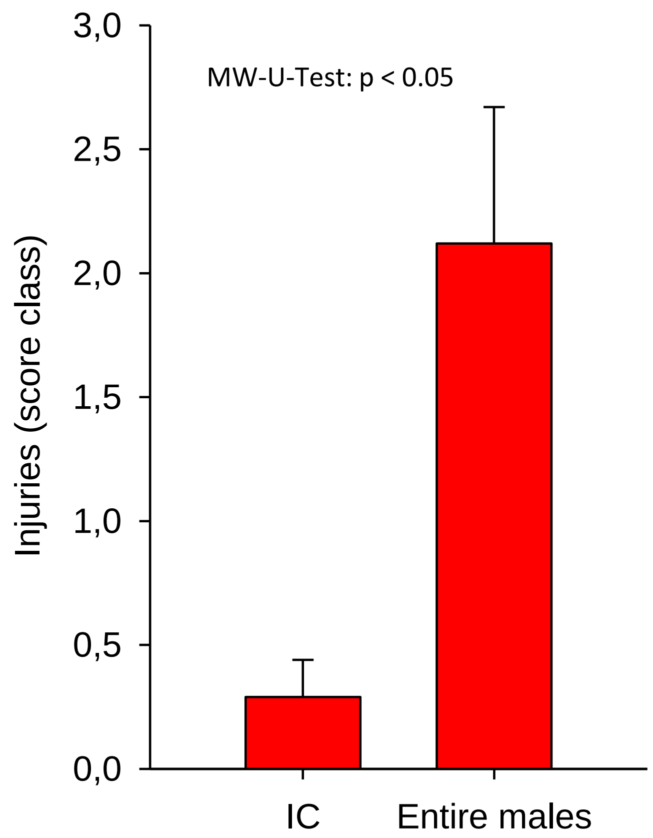
- Effect on aggressive behavior may depend on the housing environment
- ➢ Final analysis with full SuSI data set; further research

Health - Penile injuries in IC (SuSI project)

Prevalence



Severity



Data from SuSI project showing 50 % of the final data set

Kress et al. 2018

IC vs. entire males

- Less frequent and less severe penile injuries

Nutritional efficiency & environmental footprint

State of the art

"In terms of feed consumption, immunocastrates can be considered boars until the second vaccination, after which their feed intake increases drastically" (Millet et al . 2018)

Research gaps

- Innovative feeding concepts
- Optimized feeding strategies to minimize environmental impact

Nutritional efficiency of IC

	Barrow	IC	Boar	r.s.d.	P-value
Daily gain, kg	0.72	0.72	0.72	0.07	0.987
Daily feed intake, kg	2.00^{b}	1.84^{a}	1.83^{a}	0.24	0.005
Gain: feed, g/g	0.36^{a}	0.40^{b}	0.41^{b}	0.21	0.005
Carcass yield, %	78.9^{b}	77.2^{a}	77.9^{a}	1.2	<0.001
Lean meat, %	60.5^{a}	61.1^{b}	62.4^{c}	3.7	<0.001
Meat thickness, mm	66.7^{b}	66.6^{b}	64.9^{a}	7.5	<0.001
Fat thickness, mm	14.7^{c}	13.8^{b}	12.1^{a}	3.4	<0.001

^{abc} Within a row, means without a common superscript differ ($P < 0.05$).

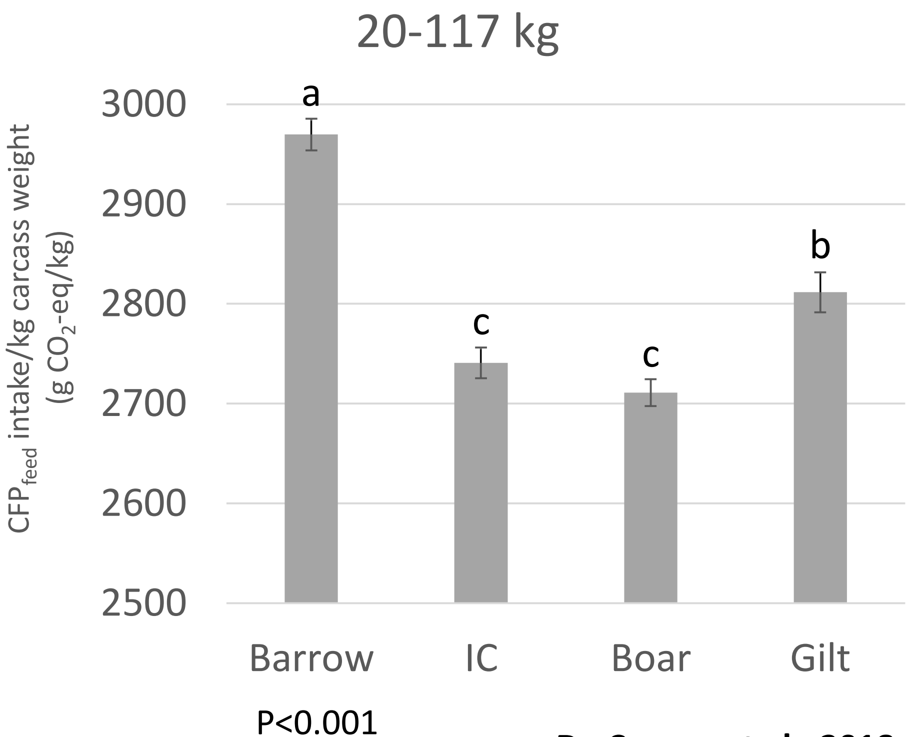
Aluwé et al., 2015

IC vs. barrows

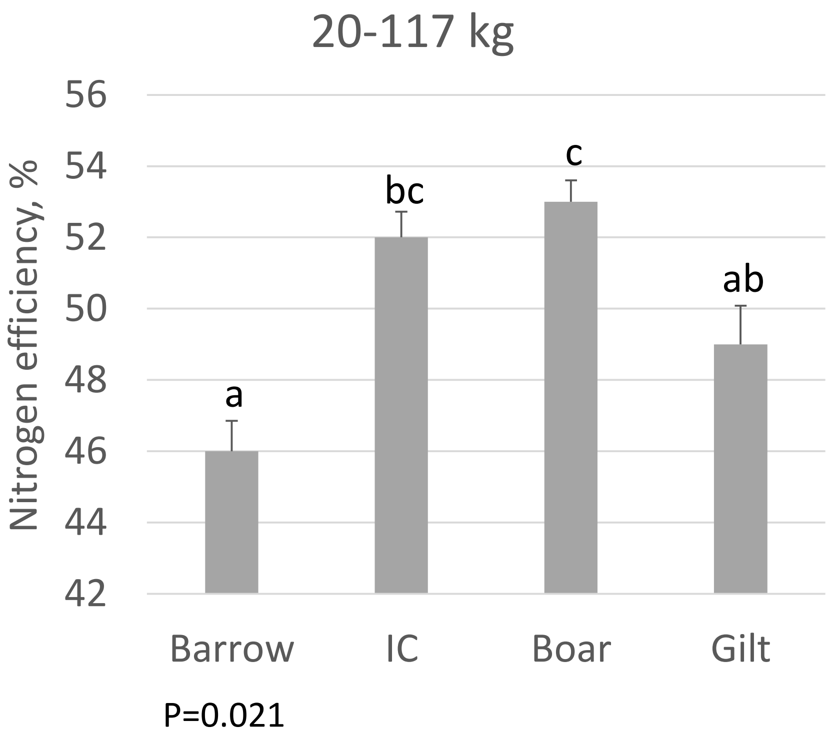
- Better feed conversion ratio
- Higher lean meat in %
- Lower carcass yield = less feed per kg meat ?

➢ Opportunities for optimisation, adjustment of diet after V2

Environmental footprint of IC



De Cuyper et al., 2018



Van den Broeke et al., 2017

IC vs. barrows

- Lower carbon food print of the feed intake/ kg carcass weight
- Higher nitrogen efficiency

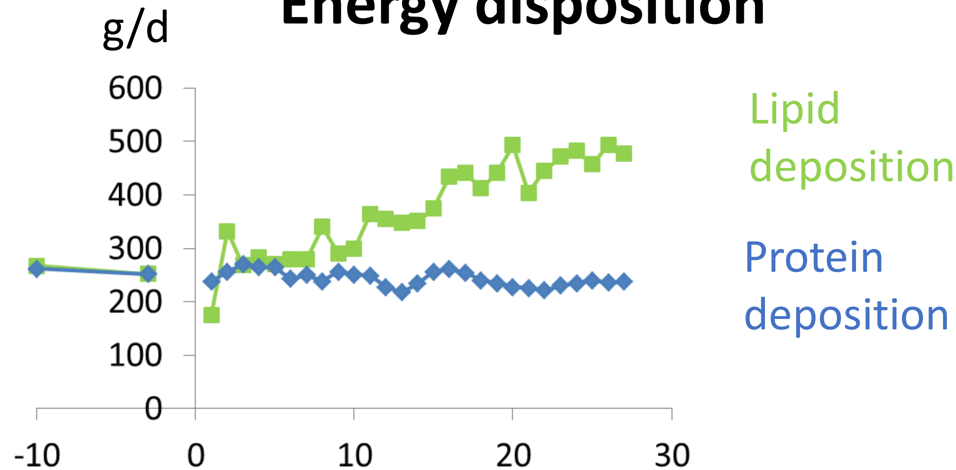
➢ IC are ecologically more efficient than barrows

But this may depend on the feeding startegy

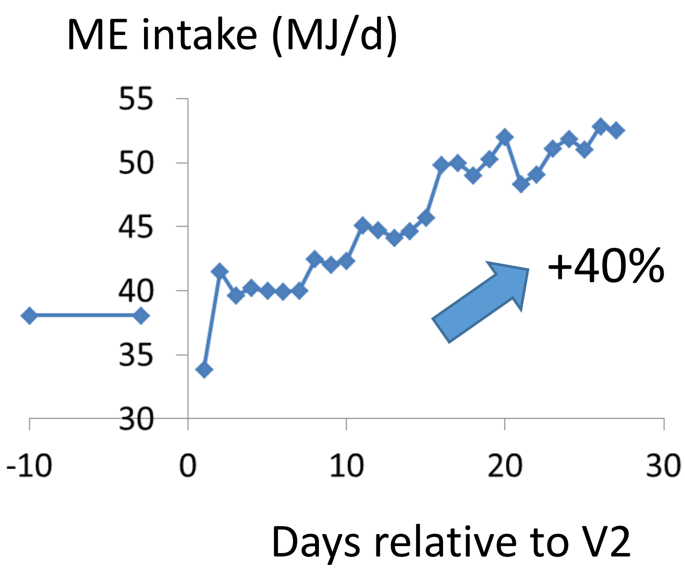
➢ Opportunities for optimisation

Effect of IC on energy intake and nutrient deposition

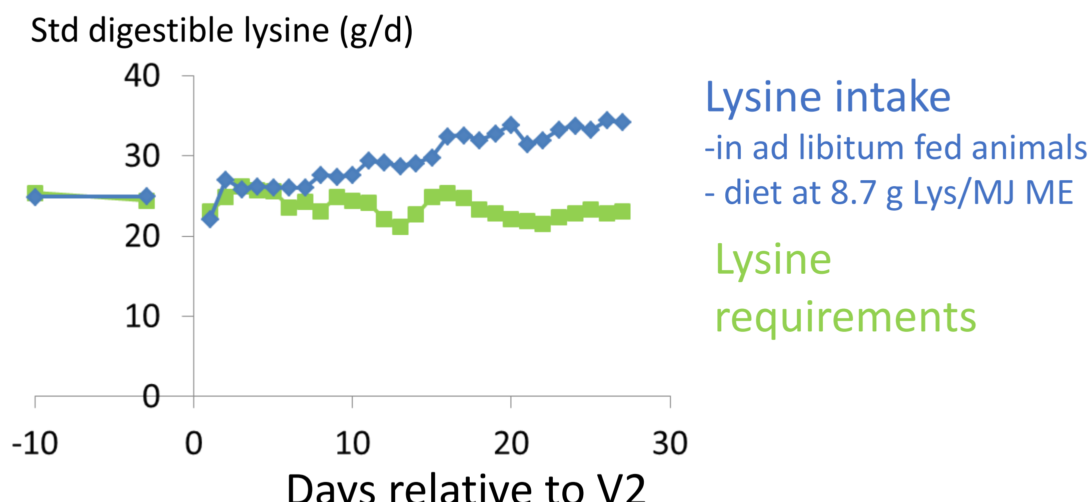
Energy disposition



Energy intake



Utilization of dietary amino acids



INRA, unpublished; Labussière et al., 2014 ; Batorek et al., 2016

Effect of IC on energy intake and nutrient deposition

Optimized feeding of IC <u>until</u> second week after V2

Standard finishing diet for boars is adequate

- High protein deposition capacity (compared to castrates)
- Better feed conversion ratio (compared to castrates)

Optimized feeding of IC <u>after</u> second week after V2

- Protein content should be reduced to limit protein catabolism and spillage
- Reduces nitrogen excretion

<u>Research gap</u>

Possible interaction between feeding level and protein utilization

Opportunities in pork production with IC

Opportunities

- Welfare advantages of IC for animal-friendly pork production
- Exploit the ecological advantages of IC
- Exploit the economical advantages of IC

Current drawbacks

- Research gaps with respect to optimized management (e.g. housing, feeding, reliability and time point of vaccination)
- Consumer and market reservations in some countries

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ERA-NET SUSAN

ILVO
Flanders research institute for agriculture, fisheries and food

INRA
SCIENCE & IMPACT

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SuSI
Sustainability in Pork Production with Immunocastration

SEGES
Danish Pig Research Centre

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SGGW

WAGENINGEN
UNIVERSITY & RESEARCH
100 years 1918 — 2018

Univerza v Ljubljani
Veterinarska fakulteta

De Cuyper et al., 2018

Experimental design

- Two rounds: 384 experimental animals (96/sex)
- Danish sow x Belgian Piétrain sire
- **4 sexes**: entire males (Em), barrows (Ba), immunocastrates (Ic) and gilts (Gi)
- Grouphousing: 4 animals (same sex) per pen
- *Ad libitum* feeding
- **3 phase feeding strategy**, phase 3 adapted for barrows
- Desk study: hypothetical soybean-free feed for phase 3
- Start weight: 25kg
- **Slaughter weight**: 99kg - 138kg

De Cuyper et al., 2018

$$CFP_{feed}/\text{KG FEED} \times \text{FEED INTAKE} = \mathbf{CFP_{feed\ intake}}$$

$$CFP_{feed\ intake}/\text{kg carcass weight}$$

Van den Broeke et al., 2017

Experimental design

Start trial

72 pens of 4 piglets
Same sex /pen
- EM
- Barrows
- IC
- Gilts

25 kg at start trial

During trial

Pigs fed *ad libitum*
Multiphase feeding regime

Weekly weighing:
Growth
Feed intake
Gain to feed ratio

Slaughter

3 slaughter weights

Van den Broeke et al., 2017

Nutrient content pig

6 pigs/ treatment
(sex × slaughter weight)
euthanized
=1 pig per pen

Carcass grinded
Representative
subsample of 10 kg
collected

Subsample autoclaved,
mixed, lyophilized and
analysed

Body composition:
Water, crude protein, crude fat,
crude ash, total phosphorus
concentration

Van den Broeke et al., 2017

Calculation of N- and P- efficiency

Nutrient efficiency = nutrient accretion / nutrient intake

Nutrient intake = feed ingested × nutrient content feed

Nutrient accretion = [mean bodyweight pen at slaughter × nutrient content pig]-[mean bodyweight pen at start × nutrient content piglet]