Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

Federal Department of Economic Affairs FDEA
Agroscope Liebefeld-Posieux ALP Research Station ALP
Milk and meat production

Berner Fachhochschule
Schweizerische Hochschule für Landwirtschaft

Session 14

giuseppe.bee@alp.admin.ch

Evaluation of growth performance, carcass characteristics, and meat quality of barrows, immunocastrated pigs and entire males

C. Pauly[2,1] and G. Bee*[1]

[1]*Agroscope Liebefeld-Posieux*, Research Station (ALP), *Switzerland*
[2]*Swiss College of Agriculture*, *Zollikofen, Switzerland*.

Rational behind the study

2 alternatives to surgical castration without anesthesia

- Entire males production
- Rearing immunocastrated pigs

Advantages of entire male production

Disadvantages of entire male production

- Improved animal welfare because surgical castration can be avoided
- Positive impact on growth performance and carcass characteristics
  - Greater feed efficiency
  - Greater lean meat percentage

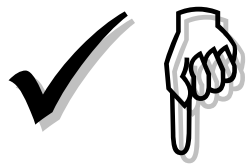
Pauly et al., 2008
Animal (in press)

- Aggressive behaviour when reaching maturity
  - Leg problems
  - Skin damage
- Low fat deposition may negatively affect fat quality

- Greater incidence of boar tainted meat in boars

Major substances responsible for **boar taint**

- **Androstenone** (5α-andorst-16-en-3-one)
  - Synthesized in the testis of sexually mature boars
  - Incorporated in the adipose tissue



- **Skatole** (3-methyl-indole)
  - Synthesized by intestinal bacteria from L-tryptophan
  - Incorporated in the adipose tissue

Boars

immunocastrated pigs

In Switzerland, castration of male piglets without anaesthesia will be banned **01/01/2009**.

Immuncastration or entire male production could be the alternatives!

Aims of the present trial

- Compare growth performance, carcass characteristics, meat quality traits and quality of the adipose tissue of grouped-penned barrows, immunocastrated pigs and boars.
- Determine the variation in the androstenone, skatole and indole levels in the adipose tissue of these pigs.
- Establish the incidence of boar taint in loin chops (10th rib level) by a trained sensory panel.

Experimental design

36 Swiss *Large White* male pigs blocked by BW into 12 blocks

B: 12 **b**arrows

IC: 12 **i**mmuno**c**astrated pigs

EM: 12 **e**ntire **m**ales

BW at start: 27.7 ± 0.5 kg
BW at slaughter: 107.0 ± 1.3 kg

ad libitum access to the diets, which were formulated according to the Swiss feeding recommendations for growing-finishing pigs (ALP, 2004).

Grower diet from 27 - 60 kg BW: 13.2 MJ DE/kg; 180.0 g CP/kg
Finisher diet from 60 - 107 kg BW: 13.6 MJ DE/kg; 150.0 g CP/kg

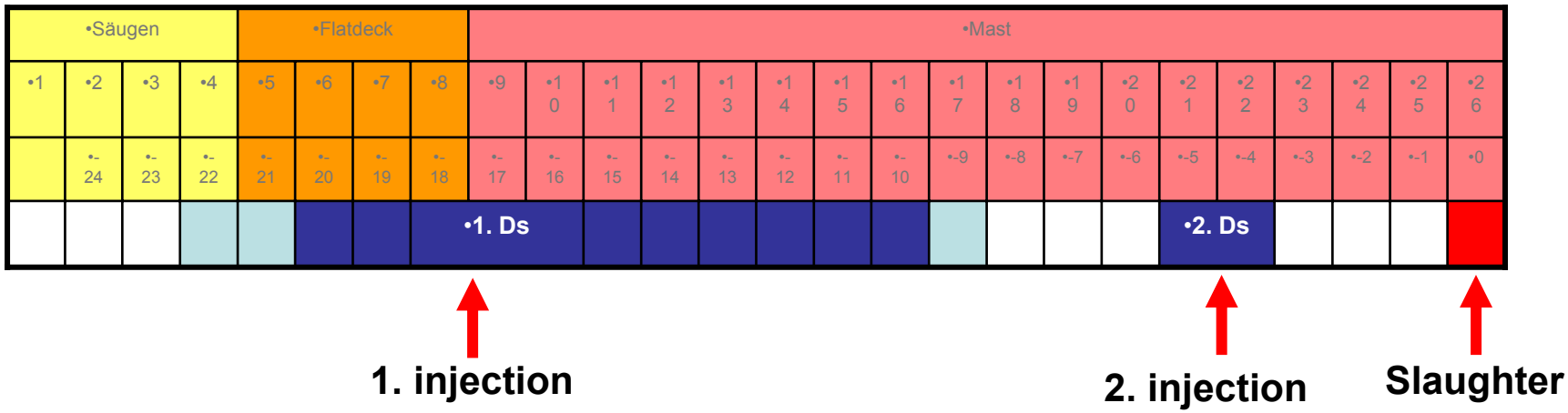
Time point of the vaccinations

What: 2 ml Improvac®/per injection

Where: subcutaneous at the neck level

When: 1. injection at 22.2 kg BW

2. Injection at 74.3 kg BW (*22 - 44 d prior to slaughter*)



Source: Pfizer

Evaluated traits

Growth performance
- ADWG
- ADFI
- Feed efficiency

Carcass characteristic
- Hot carcass weight
- Carcass yield
- Lean meat percentage
- Back fat percentage
- Organ weights

Meat quality traits in the LM (10th rib level)
- pH 30 min and 24 h (postmortem)
- Drip loss (after 48h)
- Shear force

Fatty acid composition of the adipose tissue

HPLC analysis of
(method described by Dehnhard et al. (1993)
Hansen-Møller (1994).
- Androstenone
- Skatole
- Indole

Sensory analysis
(loin chops from the 10th rib level)
- Boar odor
- Boar flavor
- Tenderness
- Juiciness

Growth performance

			Experimental groups		
			B	IC	EM
27 - 60 kg BW	ADG	g/d	834^{b}	774^{a}	784^{a}
	ADFI	kg/d	1.80^{b}	1.63^{a}	1.65^{a}
	G:F	g/g	0.46	0.47	0.47
60 - 107 kg BW	ADG	g/d	1029^{ab}	1079^{b}	988^{a}
	ADFI	kg/d	2.93^{b}	2.85^{b}	2.49^{a}
	G:F	g/g	0.35^{a}	0.38^{b}	0.40^{c}
27 - 107 kg BW	ADG	g/d	931^{e}	920de	883^{d}
	ADFI	kg/d	2.36^{c}	2.22^{b}	2.06^{a}
	G:F	g/g	0.39^{a}	0.41^{b}	0.43^{c}

^{a,b} Within a row, means for experimental treatments without a common superscript differ ($P < 0.001$)

B: barrows; IC: immunocastrated pigs; EM: entire males

Growth performance after second injection

			Experimental groups		
			B	IC	EM
23 - 44 d prior to slaughter	ADG	g/d	1007[a]	1136[b]	1030[a]
	ADFI	kg/d	3.09[b]	3.10[b]	2.62[a]
	G:F	g/g	0.33[a]	0.37[b]	0.39[b]

[a,b] Within a row, means for experimental treatments without a common superscript differ ($P < 0.001$)

B: barrows; IC: immunocastrated pigs; EM: entire males

Carcass characteristics

		Experimental groups		
		B	IC	EM
Carcass yield[1]	%	79.5[a]	**78.3**[b]	**78.6**[b]
Lean meat[2]	%	53.2[a]	**55.3**[b]	**56.7**[c]
Loin	%	24.3[a]	**24.6**[a]	**25.4**[b]
Ham	%	18.0[a]	**18.9**[b]	**19.0**[b]
Shoulder	%	12.2[a]	**12.9**[b]	**13.1**[b]
Belly	%	18.6[b]	**17.9**[a]	**17.8**[a]
Subcutaneous fat	%	15.3[c]	13.8[b]	12.8[a]
Testis	g		299[a]	584[b]
Bulbourethral gland	g	7[a]	47[b]	68[c]
Salivary gland	g	40[a]	46[b]	68[c]

[a,b] Within a row, means for experimental treatments without a common superscript differ ($P < 0.05$)

B: barrows; IC: immunocastrated pigs; EM: entire males

[1]Hot carcass weight as percentage of the BW at slaughter.

[2]Sum of denuded shoulder, back, and ham weights as a percentage of cold carcass weight

Meat quality traits

		Experimental groups		
		B	IC	EM
Initial pH		6.2	6.2	6.3
Ultimate pH		5.5	5.5	5.5
L*		50.1	51.0	50.3
a*		6.5	6.1	6.5
b*		2.8	2.7	2.7
Drip loss (after 48 h)	%	4.1	4.2	4.6
Shear force	kg	3.70[b]	3.45[a]	3.77[b]

[a,b] Within a row, means for experimental treatments without a common superscript differ ($P < 0.05$)

B: barrows; IC: immunocastrated pigs; EM: entire males

[1] Sum of denuded shoulder, back, and ham weights as a percentage of cold carcass weight

Fatty acid profile of the adipose tissue

	Experimental groups		
	B	IC	EM
C16:0 (palmitic acid)	26.2^{c}	25.5^{b}	24.1^{a}
C18:0 (stearic acid)	15.2^{c}	14.3^{b}	13.2^{a}
C18:1 (oleic acid)	38.8	39.1	39.0
C18:2 (linoleic acid)	11.5^{a}	12.8^{a}	15.0^{b}
C18:3 (linolenic acid)	1.0^{a}	1.1^{a}	1.3^{b}
SFA	43.8^{c}	42.0^{b}	39.5^{a}
MUFA	42.6	42.9	42.8
PUFA	13.6^{a}	15.2^{b}	17.7^{c}

^{a,b} Within a row, means for experimental treatments without a common superscript differ ($P < 0.05$)

B: barrows; IC: immunocastrated pigs; EM: entire males

The sums of the main fatty acid series are represented as SFA = saturated fatty acids, MUFA = monounsaturated fatty acids, PUFA = polyunsaturated fatty acids

"Boar taint"
concentrations of ANDROSTENONE, SKATOLE, INDOLE

		Experimental treatments		
μg/g AT		B	IC	EM
Androstenone;	mean	≤ 0.12[a]	0.12[a]	0.71[b]
	min. - max.		≤ 0.12 – 0.29	≤ 0.12 – 1.94
Skatole;	mean	0.03[a]	0.05[a]	0.19[b]
	min. – max.	≤ 0.02 – 0.06	≤ 0.02 – 0.09	≤ 0.02 – 1.23
Indole;	mean	≤ 0.02	≤ 0.02	0.03
	min. – max.			≤ 0.02 - 0.07

[a,b] Within a row, means for experimental treatments without a common superscript differ ($P < 0.05$)

AT: adipose tissue

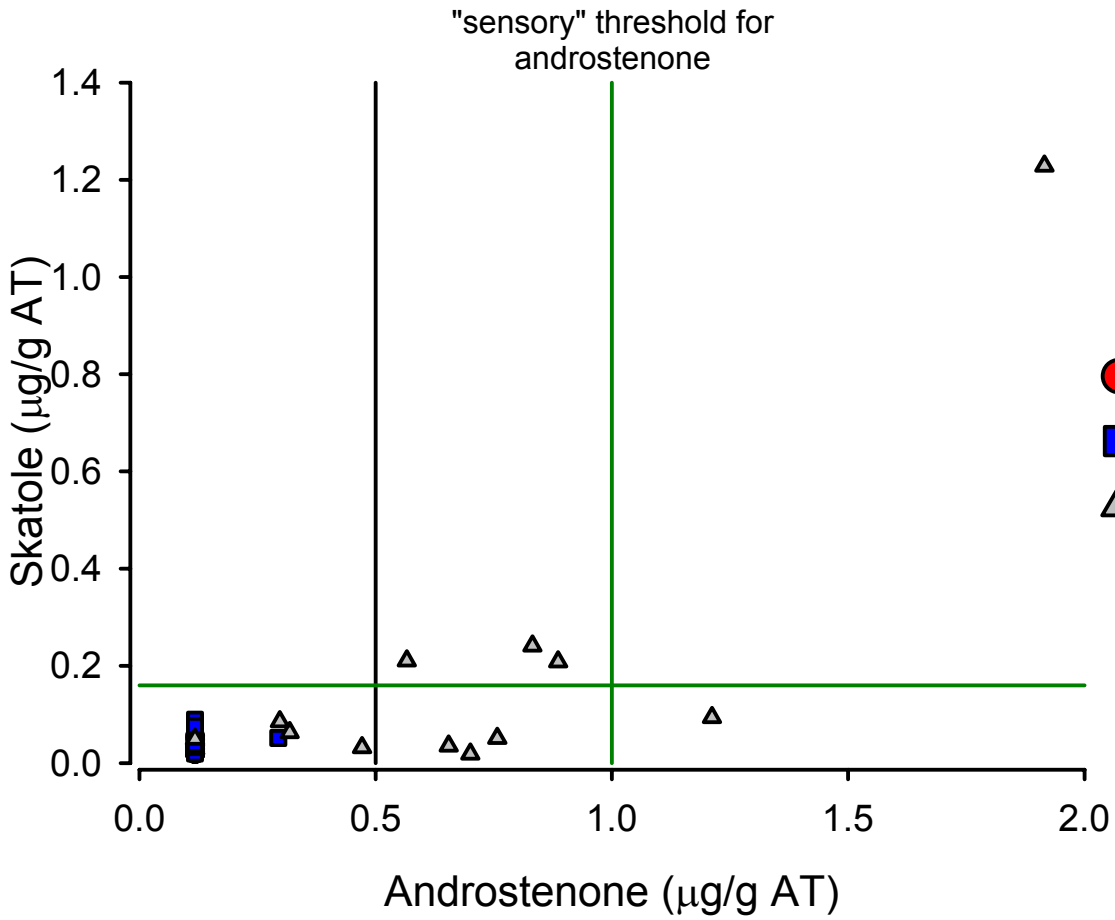
B: barrows; IC: immunocastrated pigs; EM: entire males

Attempt to define boar taint

	boar taint			
µg/g AT	**no**	**mild**	**strong**	
Androstenone	**≤ 0.5**	**> 0.5 - ≤ 1.0**	≤ 1.0	**> 1.0**
Skatole	**≤ 0.16**	**≤ 0.16**	**> 0.16**	**≤ or > 0.16**
Indole	**≤ 0.16**	**≤ 0.16**	**> 0.16**	**≤ or > 0.16**

Thresholds based on sensory evaluation studies performed in Switzerland
AT: adipose tissue

Incidence of “boar taint” among the experimental groups



	boar taint		
	no	mild	strong
C	12	-	-
IC	12	-	-
EM	4	3	5

C
IC
EM

"sensory" threshold for skatole

Sensory evaluation

Traits	Experimental treatments C	IC	EM
Boar odor	3.5	3.5	4.3
Boar flavor	3.4[a]	3.5[a]	4.6[b]
Tenderness	5.5	5.2	5.1
Juiciness	5.9[a]	5.3[b]	5.4[b]

Sensory scale: 1 weak: 9 strong; 5: neither weak nor strong; the number of analyzed samples was 18 (6 litters)

Conclusions

IC vs. B

= similar growth rate

+ more efficient

- lower carcass yield

+ leaner carcasses

= similar androstenone, skatole and indole concentrations

IC vs. EM

= similar growth rate

- less efficient

= similar carcass yield

- less leaner carcasses

+ MARKEDLY lower androstenone and skatole concentrations

THANK YOU FOR YOUR ATTENTION