

# Pork Production With Entire Male Pigs and Immunocastrates

## An Australian Perspective

**D.N. D'Souza, R.J.E. Hewitt, R.J. van Barneveld**

SunPork Group, Murarrie, Queensland, Australia



# This presentation

- Australian pig production
- Entire male pigs
  - Issues (boar taint incidence, welfare, eating quality)
- Immunocastration
  - Australian R&D
- Industry adoption and market acceptance
  - SunPork Group

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# Australian pork industry



Breeding herd size : ~275,000 sows  
Annual slaughter: 5.3M pigs



Conventional housed ~ 87%  
Outdoor housed ~13%



15 Producers ~50% of production  
400 producers ~90% of production  
1,800 producers ~ 10% of production



Pork consumption: ~ 27kg  
Fresh ~ 11kg  
Processed ~ 16kg  
(Imported processed ~70%)

## Pork Supply in Australia

Exposure to world export & import markets

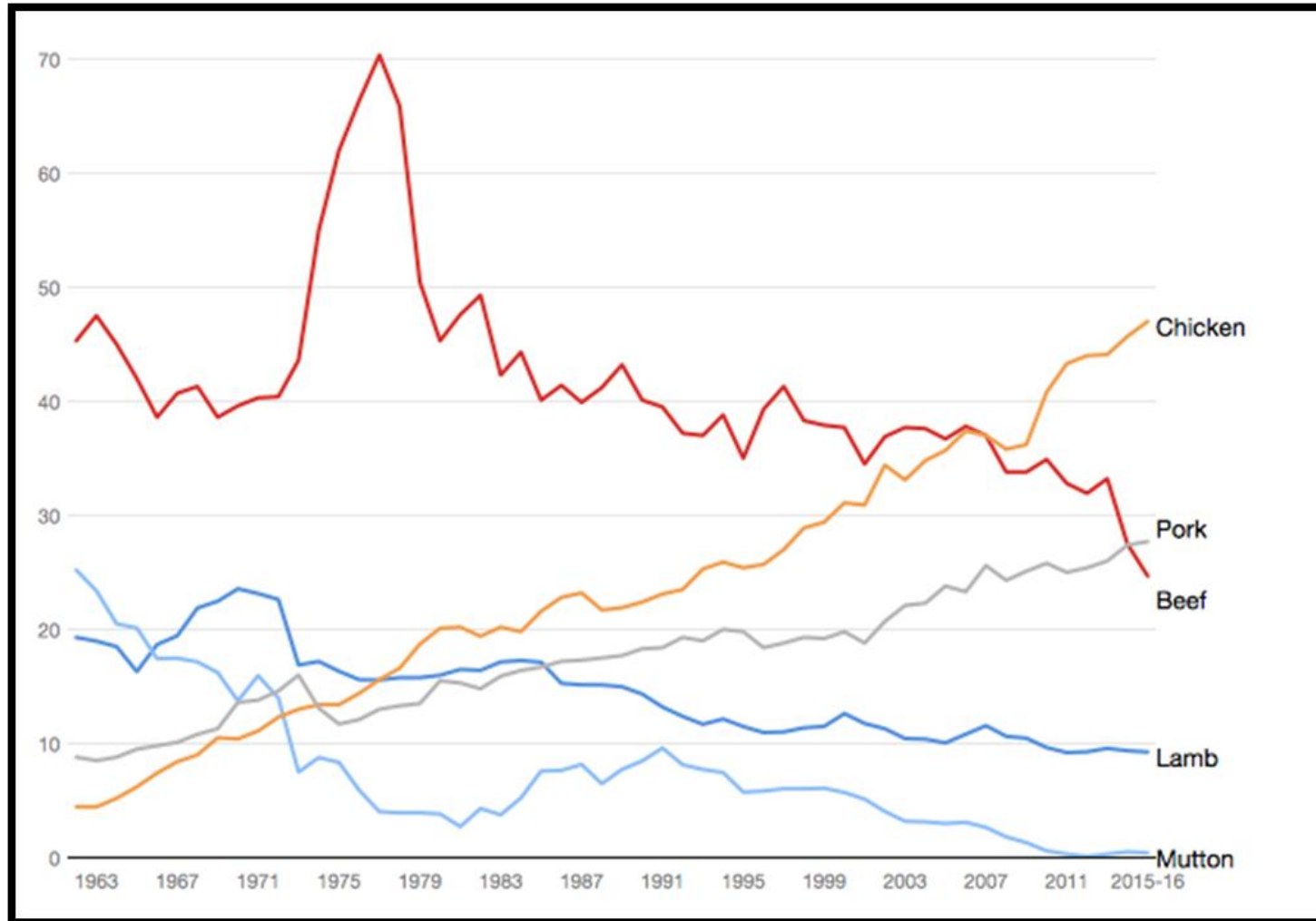


Pork Supply Flows – Australia

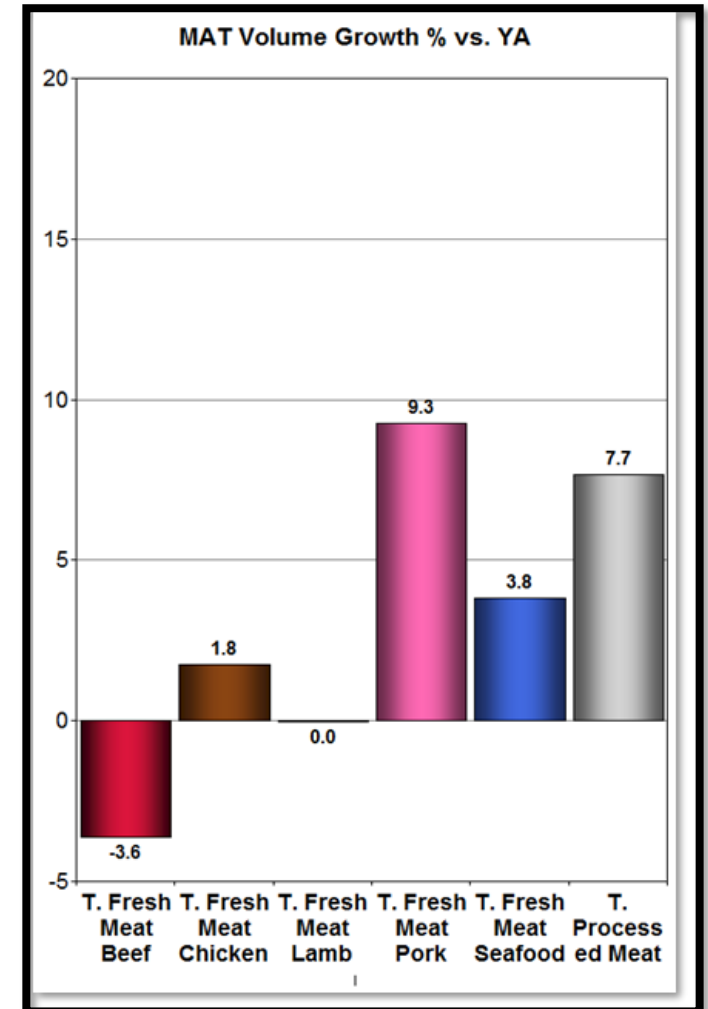
CWE – Moving total to May 2016

Sources: APL (Jan 2017)

# Per capita consumption, demand for pork increasing



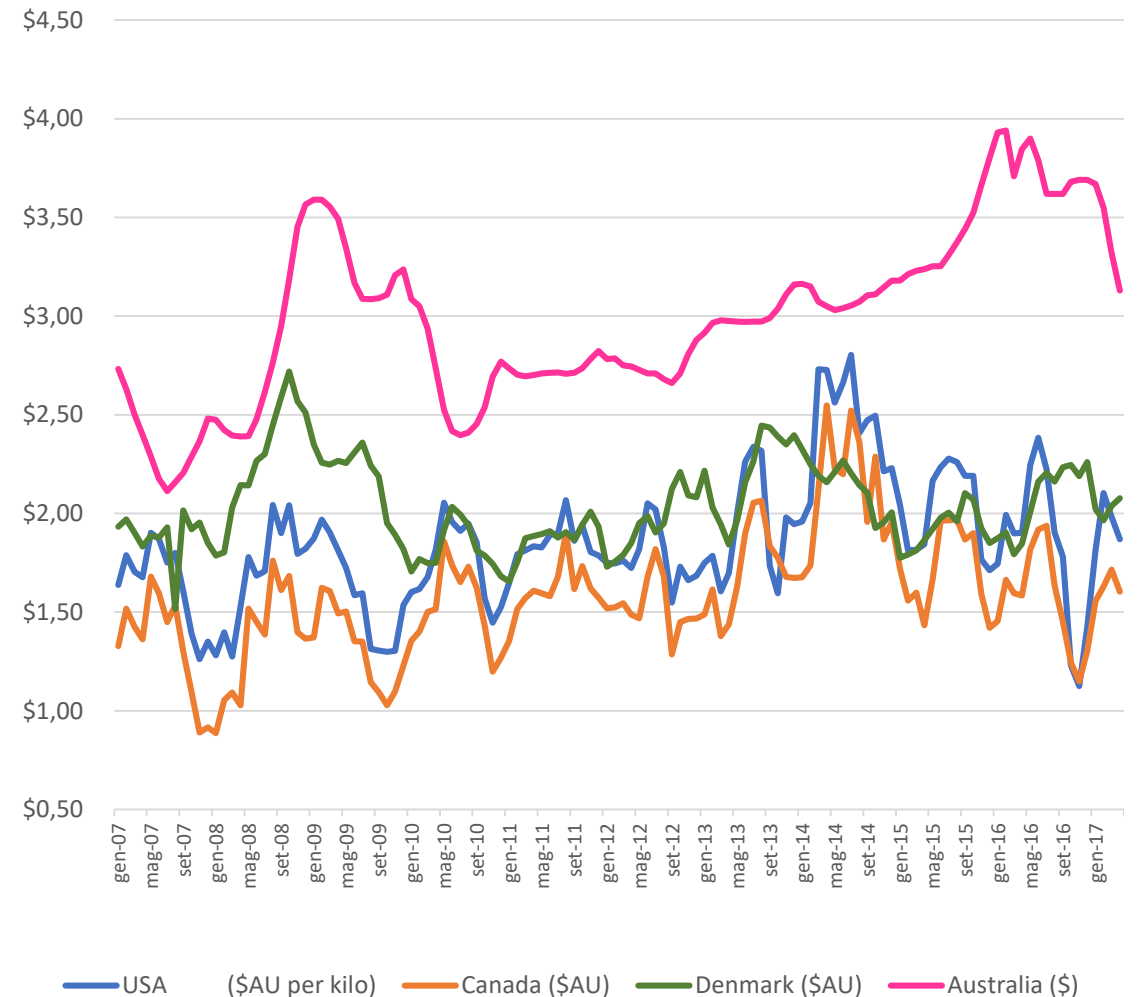
ABARES, 2017



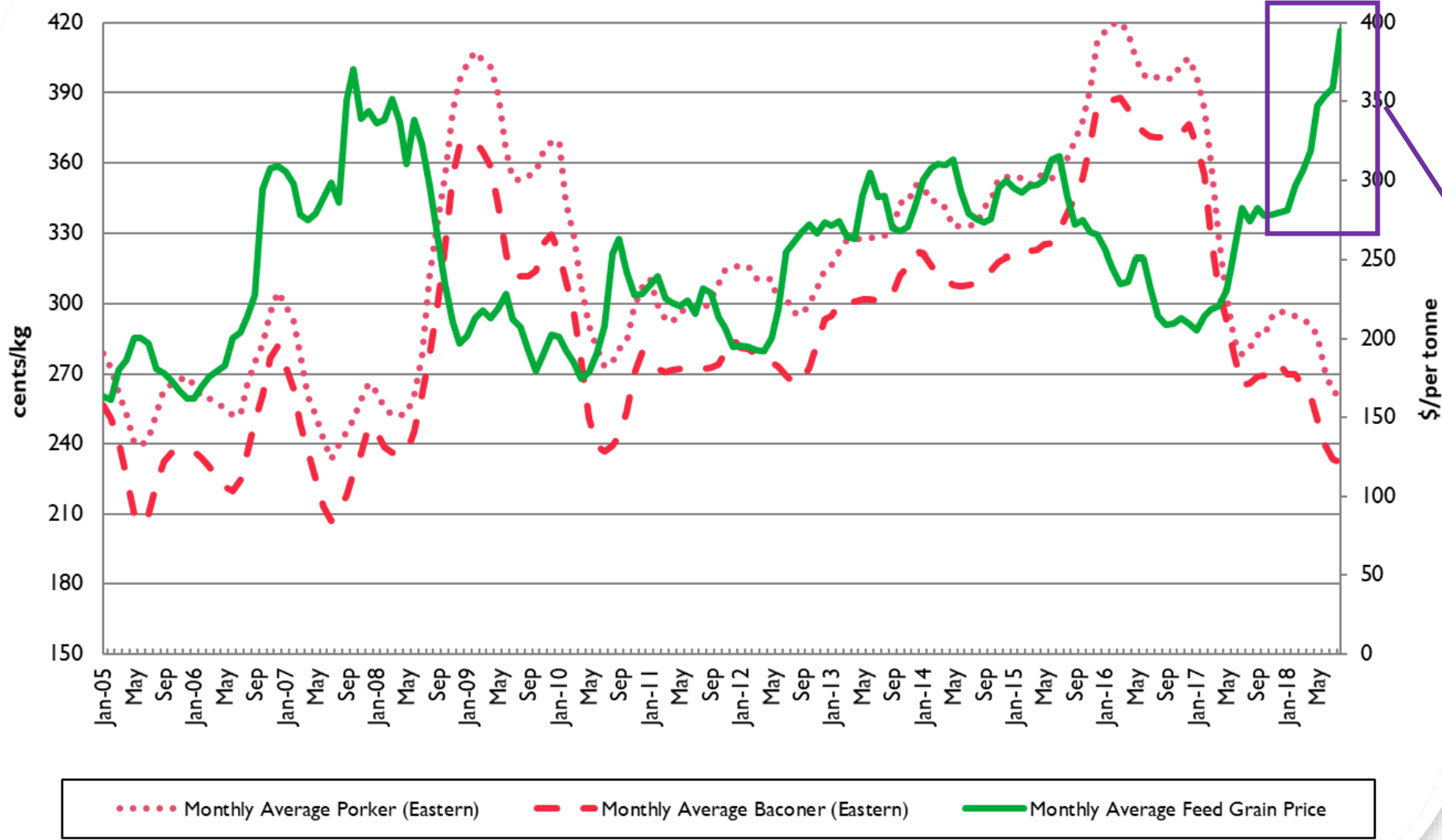
Nielsen Homescan Data 2017

# Cost of production (cost/kg HSCW, 75kg carcase)

Cost Area	Low Range	High Range	Average	Average (€)
Freight	\$0.09	\$0.14	\$0.12	0.08
Feed costs	\$1.50 3.70:1 and \$405/t	\$1.70 3.95:1 and \$430/t	\$1.60	1.02
Labour	\$0.40	\$0.45	\$0.42	0.27
Utilities	\$0.08	\$0.12	\$0.09	0.06
Repair and maintenance	\$0.06	\$0.12	\$0.09	0.06
Genetics	\$0.07	\$0.10	\$0.08	0.05
Pharmaceuticals	\$0.12	\$0.25	\$0.20	0.13
Facility	\$0.06	\$0.12	\$0.08	0.05
Technical services	\$0.06	\$0.08	\$0.07	0.05
Consumables	\$0.04	\$0.12	\$0.06	0.04
Corporate and administration	\$0.04	\$0.06	\$0.05	0.03
Finance	\$0.02	\$0.05	\$0.03	0.02
Cull sow value	\$0.10	\$0.12	\$0.11	0.07
<b>TOTAL COSTS</b>	<b>\$2.64</b> <b>(€1.67)</b>	<b>\$3.43</b> <b>(€2.19)</b>	<b>\$3.00</b>	<b>€1.93</b>



### Average Porker.Baconer vs Feed Grain Prices (Eastern Seaboard)



Feed cost extremely high due to drought

Data Source Pro Farmer  
Produced by APL

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# Entire male pig production – focus on efficiency

- Ceased surgical castration late 1970s
- Relatively low slaughter weight (HSCW) ~55kg ( $\pm 10$ kg)
- Enhance growth performance and efficiency
- Carcase trade
- Domestic markets only
- Payment on backfat and weight

## Now:

- Growth and efficiency focus continue
- Slaughter weights have increased marginally ~76kg (up to 100kg)
- Domestic and export markets (and value-add products)
- Mainly boxed sub-primal and cuts trade, with some carcase trade
- Payment still on backfat and weight (rather than LMY or SLMY)

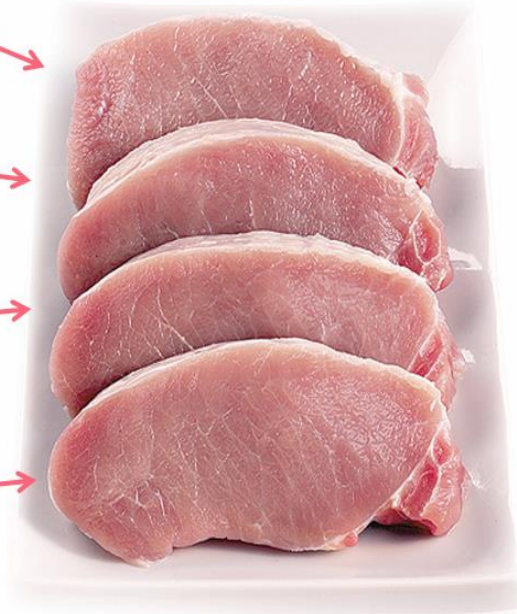
# But we have created a few issues!

Entire male pig  
(boar taint)

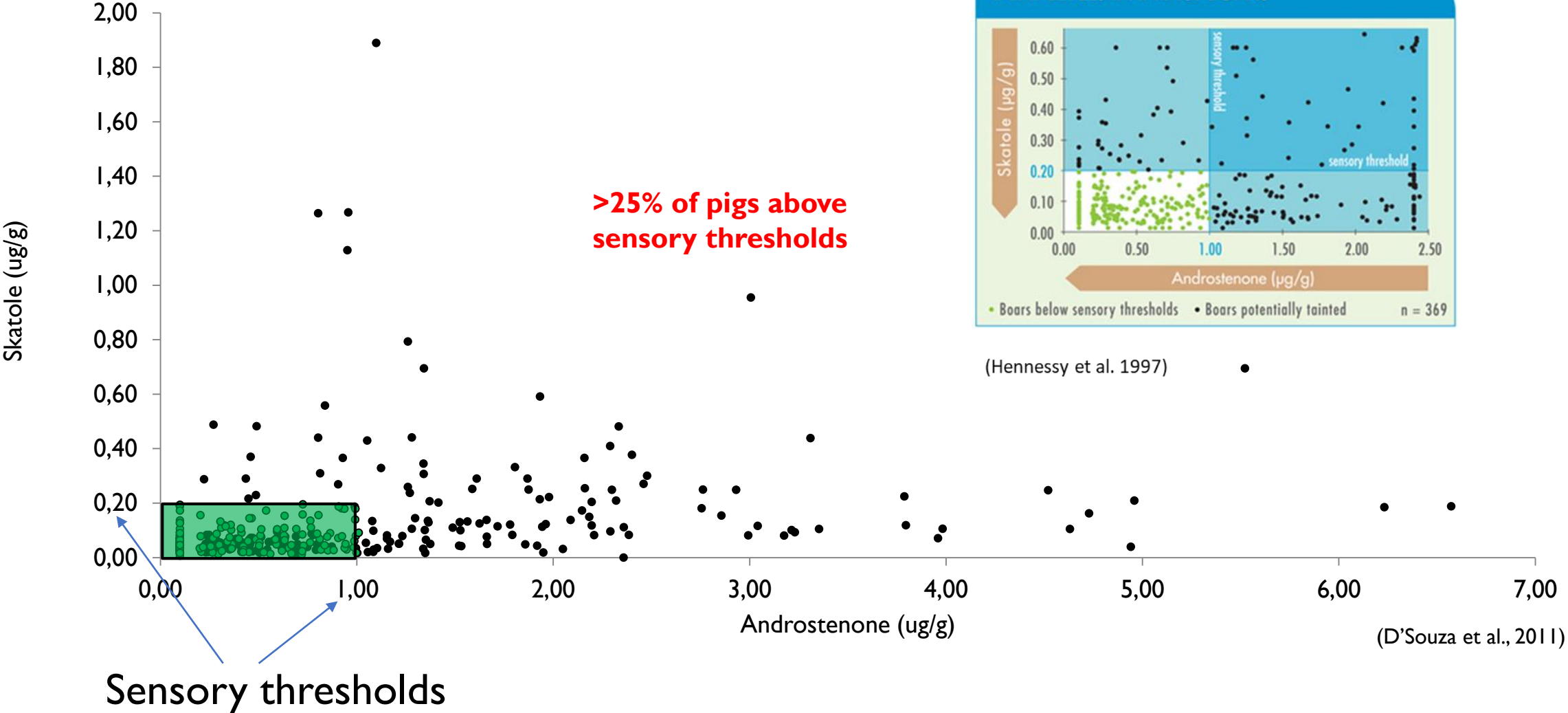
<1% IM fat

Inconsistent ageing  
period  
(2-5 days)

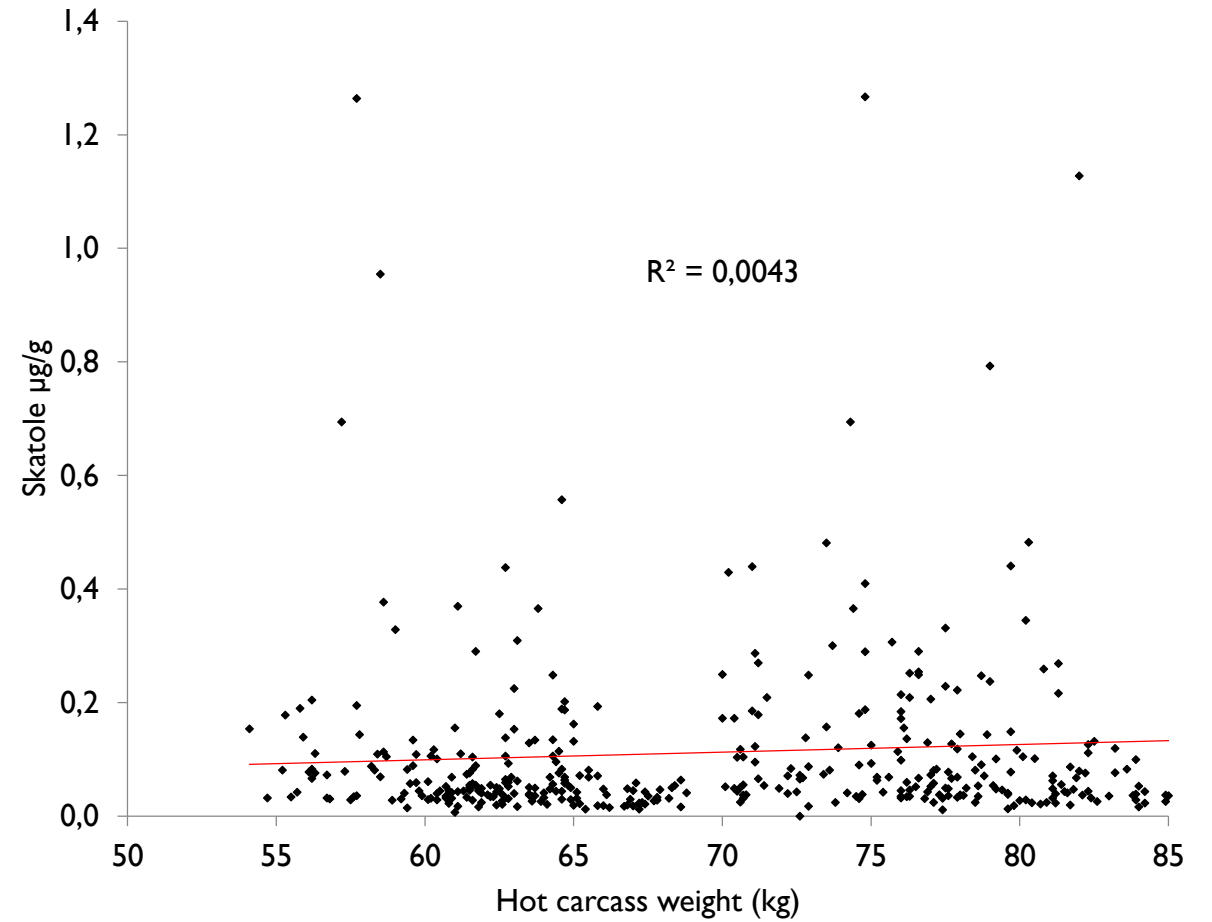
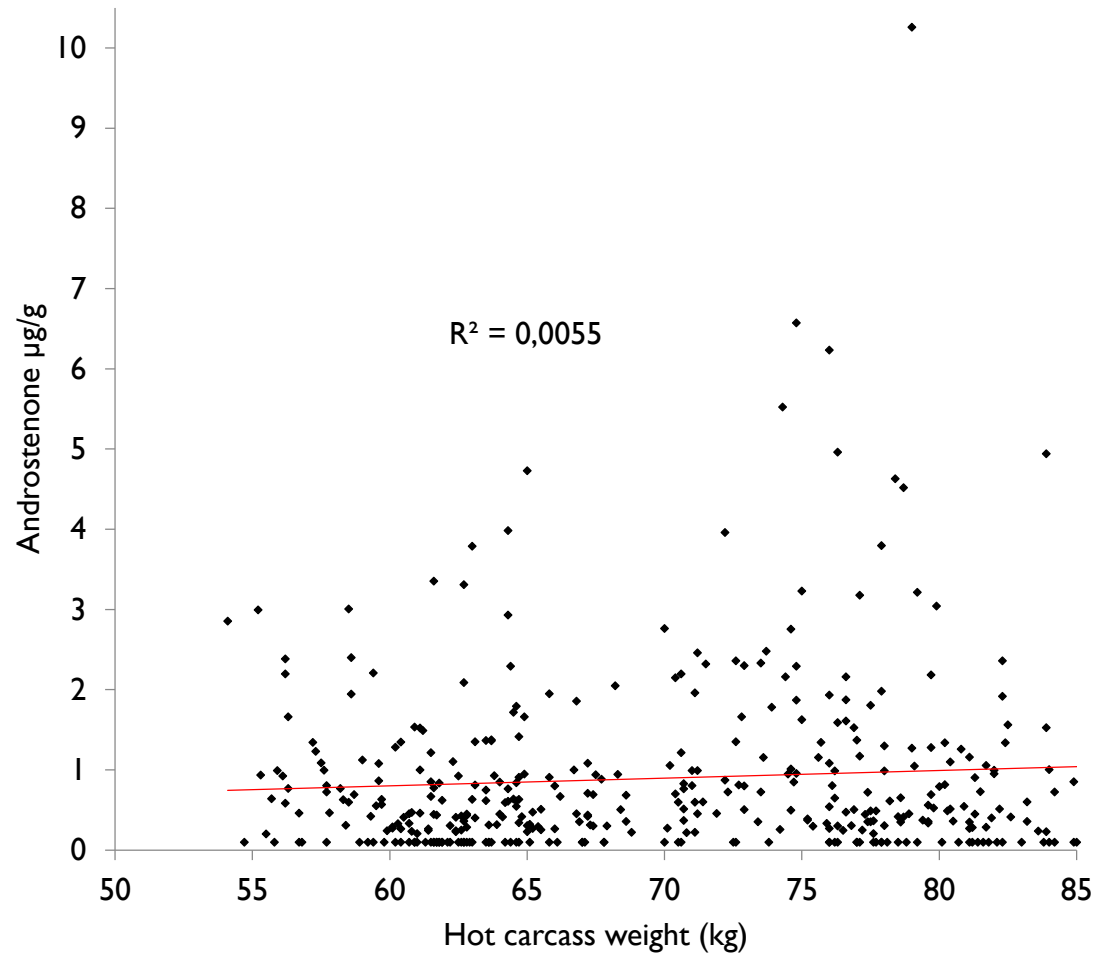
Cooked 'well done'  
(>75°C)



# High incidence of boar taint

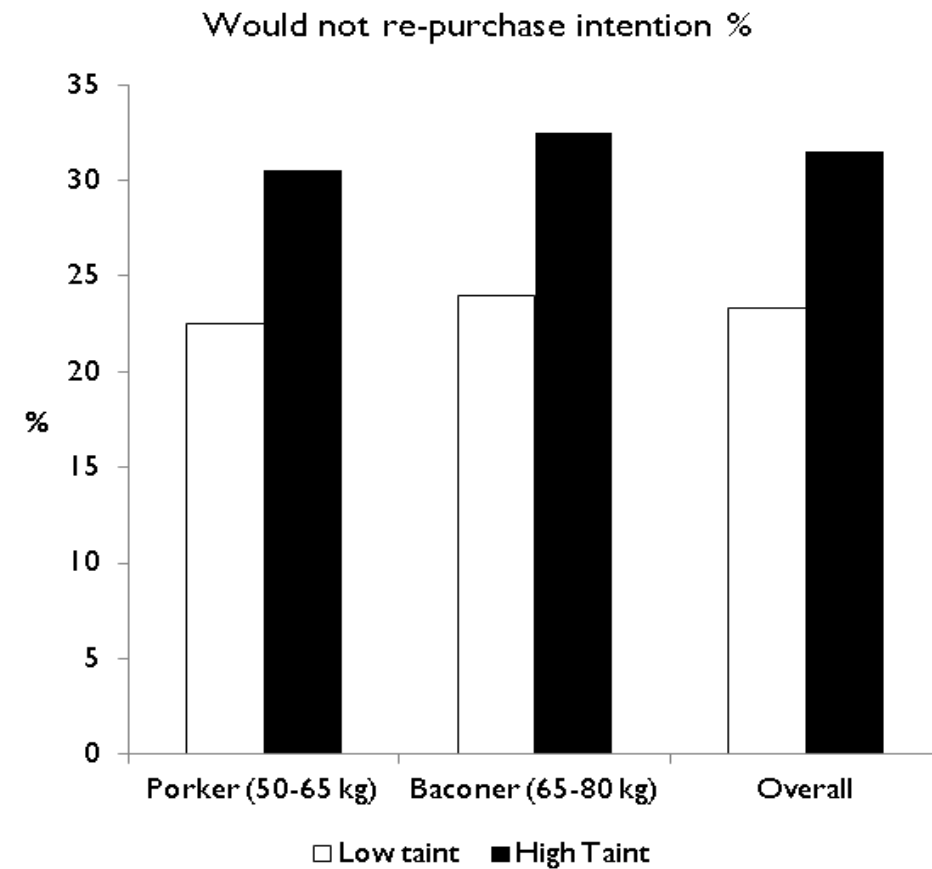
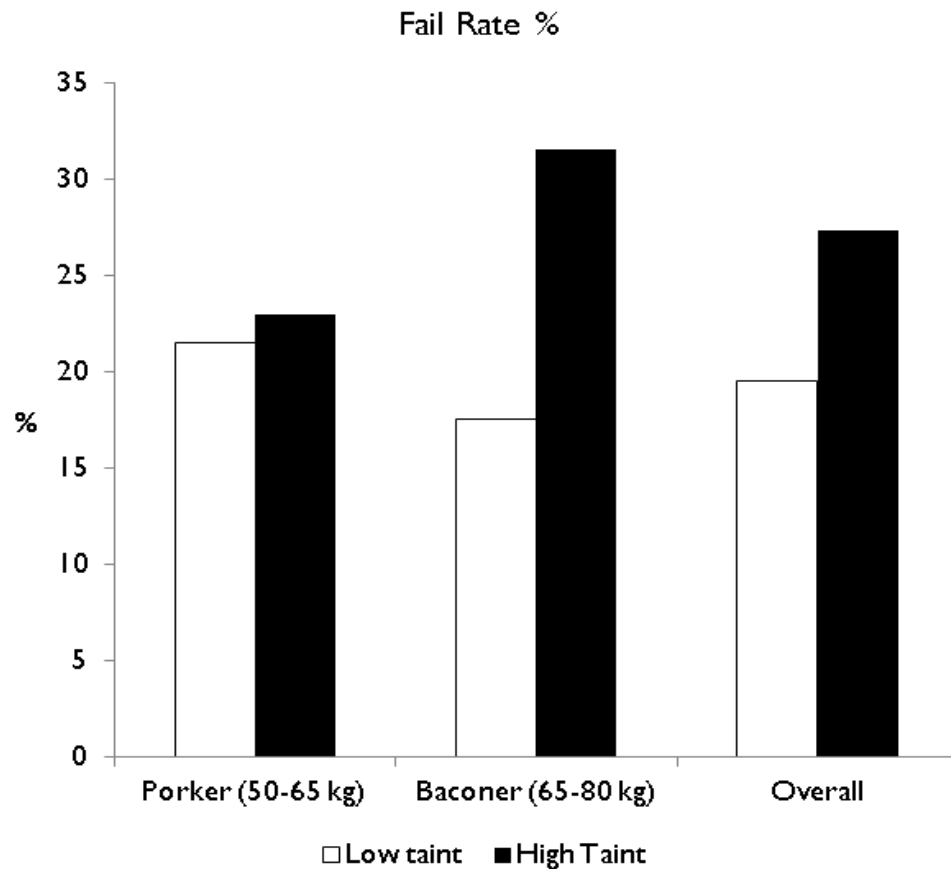


# Poor correlation between boar taint risk and carcass weight



(D'Souza et al., 2011)

# Carcase weight strategies don't work



Fail rate: % Quality Grade <3  
( 1 = Unsatisfactory; 2 = Below average; 3 = Average; 4 = Above average; 5 = Excellent)

# This presentation

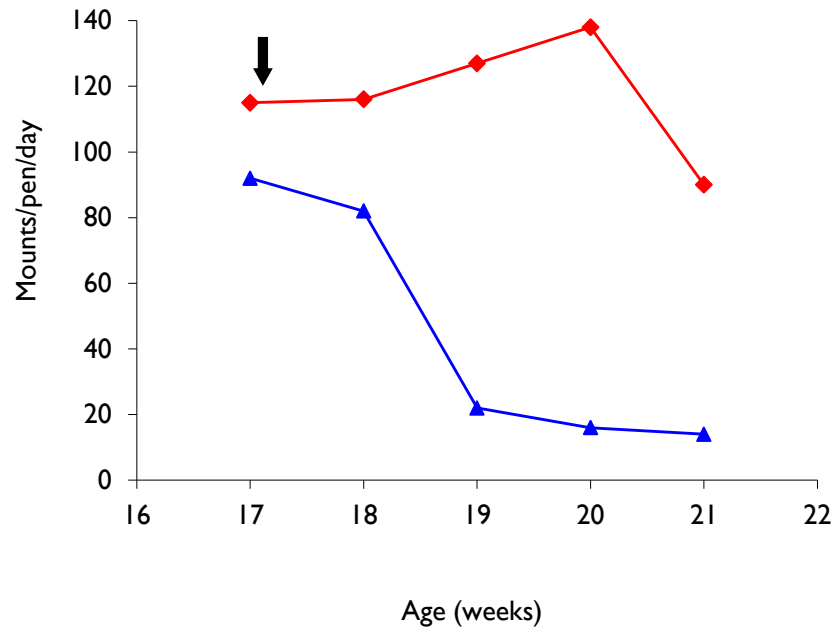
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  - **Australian R&D**
- Industry adoption and market acceptance
  - SunPork Group

# Cost of production (cost/kg HSCW 75kg carcase)

Cost Area	Low Range	High Range	Average	Average (€)
Selling costs – freight, levies	\$0.09	\$0.14	\$0.12	<b>0.08</b>
Feed costs – inc mill and delivery	\$1.50 3.70:1 and \$405/t	\$1.70 3.95:1 and \$430/t	\$1.60	<b>1.02</b>
Labour	\$0.40	\$0.45	\$0.42	<b>0.27</b>
Utilities – electricity, water, gas	\$0.08	\$0.12	\$0.09	<b>0.06</b>
Repair and maintenance	\$0.06	\$0.12	\$0.09	<b>0.06</b>
AI/breeding stock/selection fees	\$0.07	\$0.10	\$0.08	<b>0.05</b>
Pharmaceutical costs(vacc; treatments, etc)	\$0.12	\$0.25	\$0.20	<b>0.13</b>
Facility costs inc depreciation, licences, rates	\$0.06	\$0.12	\$0.08	<b>0.05</b>
Vet/nutrition/consultants/audits	\$0.06	\$0.08	\$0.07	<b>0.05</b>
Consumables, straw, etc	\$0.04	\$0.12	\$0.06	<b>0.04</b>
Other misc costs incl corporate	\$0.04	\$0.06	\$0.05	<b>0.03</b>
Finance costs	\$0.02	\$0.05	\$0.03	<b>0.02</b>
Adjustment for Cull sow value	\$0.10	\$0.12	\$0.11	<b>0.07</b>
<b>TOTAL COSTS</b>	<b>\$2.64 (€1.67)</b>	<b>\$3.43 (€2.19)</b>	<b>\$3.00</b>	<b>€1.93</b>

Immunocastration  
\$0.05 - 0.09  
(€0.03 - 0.06)

# Immunocastration and aggression

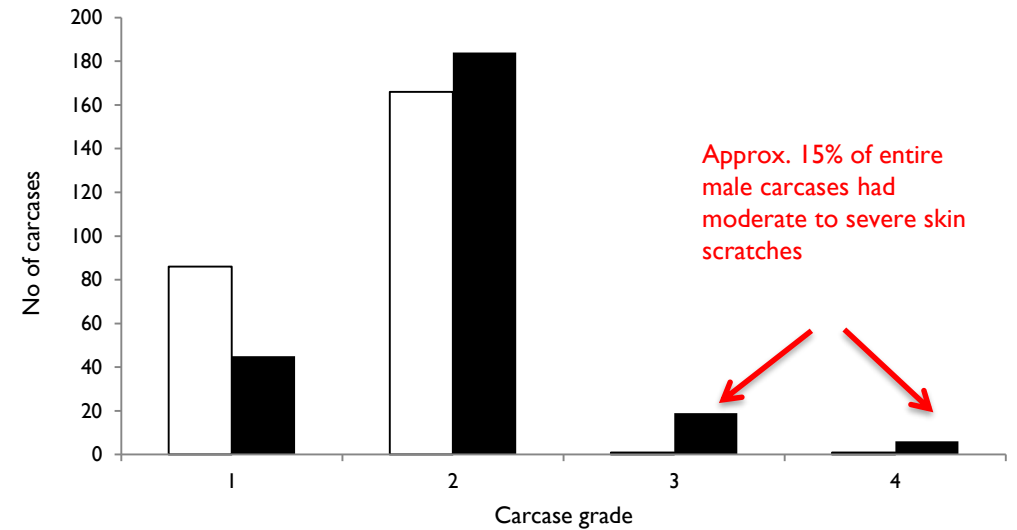


—◆— control —▲— Improvac

Cronin et al. (2003)

**Note:**

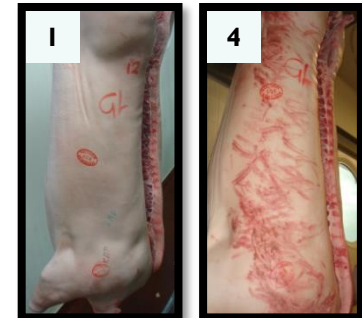
General observations indicate that there is an increase in leg damage in entire male pigs



□ Improvac ■ Entire

**Scratch damages scale:**

- 1 - None
- 2 - Carcass covered less than 20%
- 3 - Carcass covered 20% - 60%
- 4 - Carcass covered above 60%



(Karaconji al. 2011)



# Global Literature review

Compilation of large database containing over 250 published and non-published datasets on effects of production, processing and cooking parameters on pork eating and technological quality.

	Entire male	Female	Immunocastrate	Surgical castrate
Overall liking*	48.37	50.34	<b>57.60</b>	53.61
IMF %	1.82	1.92	<b>2.21</b>	2.34

\*0 - dislike extremely to 100 - like extremely

Channon et al., 2011

# Entire male pigs have highest fail rates (Australian data)

	Entire male	Female	Surgical castrate	Immunocastrate
% Fail rate	21.5	19.8	17.7	16.9

Average incidence for 6 studies and across different supply chains

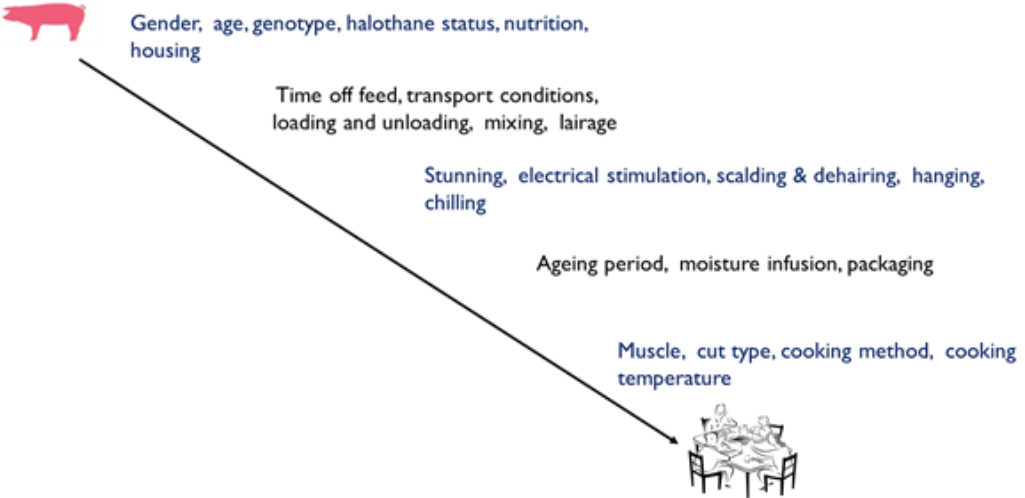
Fail rate: % Quality Grade <3 ( 1 = Unsatisfactory; 2 = Below average; 3 = Average; 4 = Above average; 5 = Excellent)

>14,000 consumer assessments

# Sensory fail rates for pork

	Fail rate (%)				P value
	Entire males	Females	Surgical castrates	Immunocastrates	
Channon et al. (2016)	23.0	19.1	17.7		0.005
Channon et al. (2018a)	17.8			15.7	0.19
Jose et al. (2013)	23.8			19.4	0.19
Channon et al. (2015)		19.6		15.8	0.004
Channon et al. (2018b)		21.9		18.7	0.031
Channon et al. (2018c)		19.1		18.5	0.75
Moore et al. (2017)	29.8			20.7	0.007

# Critical quality control points for pork



**Commercial issue**  
 Finding the most appropriate 'pork eating quality pathway' to reduce fail rate ~10%?

Critical Control point	Rating <sup>†</sup>
Breed	**
Sex	***
Age and slaughter weight	*
Nutrition	**
Housing	*
On-farm handling	*
Transport	**
Lairage / pre-slaughter handling	**
Time off feed	**
Stunning	*
Stimulation	**
Carcass processing	****
Product preparation	*****
Consumer preparation	*****

Taverner, 2001

<sup>†</sup> \* & \*\*Low risk/impact, \*\*\* Medium risk/impact, \*\*\*\*\* High risk/impact

# Eating quality pathway – increase demand for pork

Meat Science 144 (2018) 186–192



Contents lists available at ScienceDirect

Meat Science

journal homepage: [www.elsevier.com/locate/meatsci](http://www.elsevier.com/locate/meatsci)



Review

## Guaranteeing the quality and integrity of pork – An Australian case study

H.A. Channon<sup>a,b,\*</sup>, D.N. D'Souza<sup>c</sup>, R.G. Jarrett<sup>d</sup>, G.S.H. Lee<sup>e</sup>, R.J. Watling<sup>f,g</sup>, J.Y.C. Jolley<sup>d</sup>, F.R. Dunshea<sup>b</sup>



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<sup>g</sup> TSW Analytical Pty Ltd., Bibra Lake, WA 6163, Australia

Main effects and interactions in eating quality model to indicate significance of pathway factors

Term	df	Denominator df	F value	P value
Intercept	1	6.5	2395.0	<0.001
Gender	3	336.2	3.28	0.021
Ageing period	5	29.9	0.85	0.52
Cut type x cooking method	6	3065.8	113.70	<0.001
Endpoint temperature	1	3523.5	4.48	0.034
Moisture infusion	1	3258.1	95.15	<0.001
Electrical stimulation	1	337.9	7.40	0.007
Hanging method	1	321.7	6.57	0.011
Ultimate pH	1	1206.5	4.40	0.036
Gender:Temperature	3	3400.4	5.35	0.001
Age:Temperature	3	3243.6	5.75	<0.001
Cut type x cooking method: endpoint temperature	6	3074.7	5.31	<0.001
Moisture infusion: loin roast/stir fry vs. other cuts	1	3075.0	12.44	<0.001
Electrical stimulation: roast vs. other cuts	1	3091.0	8.96	0.003

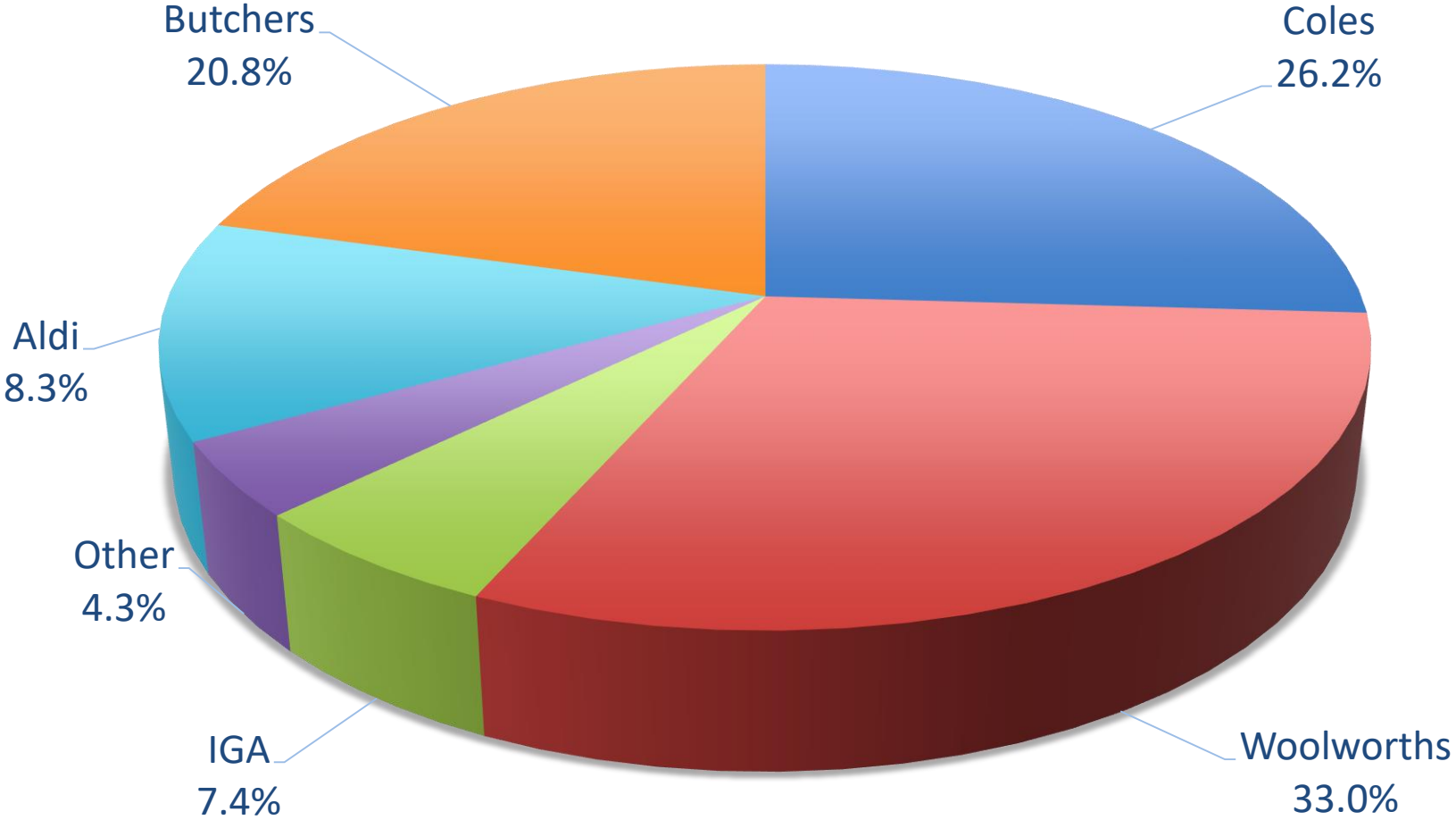
	Value <sup>a</sup>	70°C
Overall liking	52.4	
Gender	Entire male	0.00
	Female	2.1
Physical castrate	Physical castrate	3.5
	Immunocastrated male	2.4

<sup>a</sup>Non-moisture infused loin roast sample from a non-electrically stimulated, Achilles hung entire male carcass aged for 1 day with ultimate pH of < 5.5 cooked to an endpoint temperature of 70°C

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# Retail share of fresh meat trade



# Immunocastration

- The biggest shift, retailers have recognised the issues with entire male pig production
- Immunocastration now accepted by all retailers
- Most immunocastrate pigs sold on contracts
- Entire male pigs do incur a penalty (\$0.03-\$0.10/kg)
- Surgical castration is <1% of entire male pigs (not sustainable)
- In the absence of other viable technologies, use of boar taint vaccine continues to increase
- Current adoption is >60% of entire male pigs, and growing!

**No consumer  
backlash!**

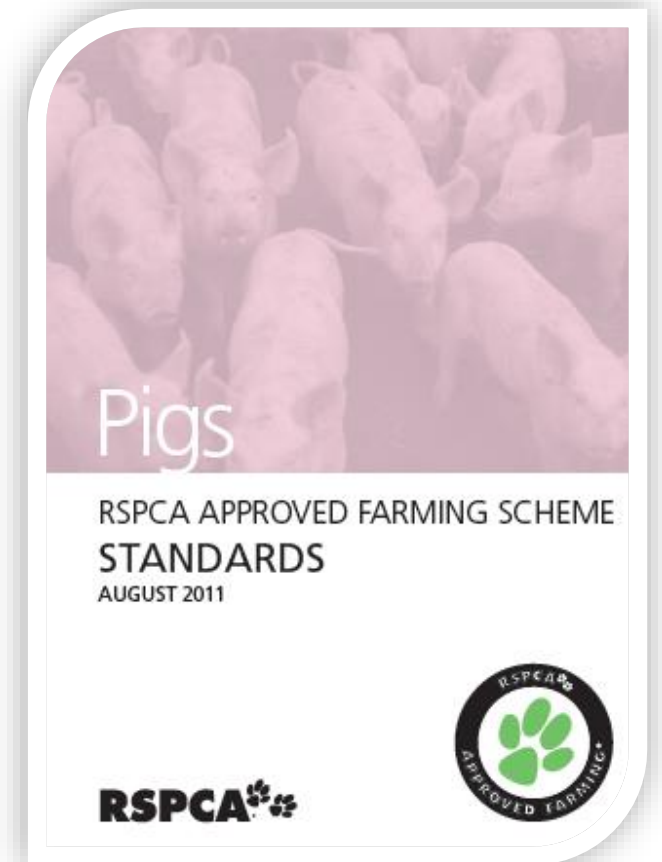


# Welfare based approval

Boar taint vaccine permitted by Royal Society for the Prevention of Cruelty to Animals (RSPCA) Australia

## Castration

- 5.2 Physical (surgical) castration is not permitted.
- 5.3 Where the risk of 'boar taint' is high, immunological castration<sup>3</sup> is permitted.



# Australian industry takes position on boar taint vaccine



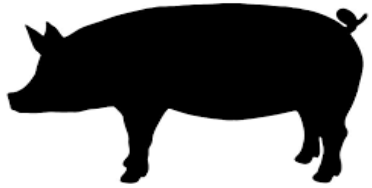
Australian pork industry supports the choice for use of the boar taint vaccine on the basis that;

- It improves welfare of entire male pigs
- RSPCA approved
- It eliminates boar taint
- It improves carcass and product quality
- It is accepted by consumers
- No other viable alternative to the boar taint vaccine

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# Immunocastration: SunPork Group Markets



Breeding herd size : ~42,000 sows  
 Annual slaughter: 0.97M pigs  
 18% of Australian production  
 PIC Australia: Genetics >50% of industry



Major retail 55%  
 Independent retail 7%  
 Export 10%  
 Wholesale 20%  
 Food service 8%

	Retail	Wholesale	Export	Foodservice
<b>Customers</b>	<ul style="list-style-type: none"> <li>Woolworths</li> <li>Coles</li> <li>Costco</li> <li>Metcash</li> <li>Independents</li> </ul>	<ul style="list-style-type: none"> <li>Butchers</li> <li>Traders</li> <li>Further manufacturers</li> </ul>	<ul style="list-style-type: none"> <li>Singapore processors</li> <li>Hong Kong supermarkets</li> <li>SE Asia and Pacific</li> </ul>	<ul style="list-style-type: none"> <li>Pubs and clubs</li> <li>Fine dining</li> </ul>
<b>Products</b>	<ul style="list-style-type: none"> <li>Fresh boxed pork</li> <li>Value added pork</li> </ul>	<ul style="list-style-type: none"> <li>Carcase</li> <li>Fresh &amp; frozen boxed pork</li> <li>Value added pork</li> </ul>	<ul style="list-style-type: none"> <li>Carcase</li> <li>Fresh boxed pork</li> <li>Value added pork</li> <li>Offal</li> </ul>	<ul style="list-style-type: none"> <li>Fresh boxed pork</li> <li>Value added pork</li> </ul>

# Carcass requirements per market

	Costco	Wholesale	Export	Woolworths	Coles
<b>Sex</b>	Female IC	Female IC	Female IC	IC	Female IC
<b>Backfat P2 (mm)</b>	<15	<12	<12	<12	<12
<b>Weight (HSCW; Kg)</b>	90 - 110	70 - 90	70 - 90	65 - 85	65-75
<b>Source (Farms)</b>	QLD, SA	QLD, NSW, SA	QLD, NSW, SA	QLD	SA

# Altering timing of immunocastration – optimise production

Carcase fat:

Surgical castrate > Immunocastrate > entire male pig

Improvac<sup>®</sup> flexibility allows us to manage this;

1. Prevent backfat increases associated with immunocastrates

OR

2. Increase intramuscular fat in heavier slaughter weight markets

# Managing immunocastrates: Control backfat

	Time post-last vaccination (weeks)					
	0	2	3	4	6	P-value
Feed intake	2.43	2.56	2.75	2.78	2.91	0.024
ADG (g)	1112	1108	1102	1159	1181	0.157
FCR	2.18	2.32	2.50	2.40	2.46	0.095
Slaughter wt (kg)	105.4	105.1	104.4	107.4	108.9	0.025
Carcase wt (kg)	70.1	68.5	67.7	70.6	71.8	0.086
P2 Backfat (mm)	11.6	11.4	12.7	12.6	13.8	0.057
Androstenone (ug/g)	0.91	0.11	0.11	0.10	0.13	0.001
Skatole (ug/g)	0.05	0.04	0.03	0.04	0.04	0.420

# Assuring boar taint free pork

## (1) Test every male carcase



Meat Science

Volume 100, February 2015, Pages 73-84



Evaluating the performance of sensory quality control: The case of boar taint

Lisa Meier-Dinkel <sup>a</sup>, Jan Gertheiss <sup>b</sup>, Simone Müller <sup>c</sup>, Raffael Wesoly <sup>d</sup>, Daniel Mörlein <sup>a</sup>



Source: <http://boars2018.com/wp-content/uploads/2013/02/timthumb-1-960x250.jpg>



exemplarily evaluated. Using the panel average score, sensitivity and specificity of sensory analysis ranged from 61 to 69% and 77 to 85%, respectively. Performance of individual assessors varied highly (sensitivity: 47 to 86%; specificity: 45 to 88%) and correlated to olfactory acuity to the compounds. According to receiver operating characteristic-curves, the



# Assuring boar taint free pork

## (2) Monitoring for socio-sexual behaviour

Two stage verification with corrective actions;

- (i) On farm behavioural inspection for socio-sexual behaviours after 7-10 days post second vaccination
  - At risk animals vaccinated again
  
- (ii) Lairage ante-mortem inspection for socio-sexual behaviours
  - At risk animal are identified and segregated post-slaughter

# Export markets

- Biggest markets are Singapore and Hong Kong
- No issues with offal – accepted by all markets
- Currently export female (only) carcasses to Singapore
  - This issue relates to visibility of testicle cut lines on carcase
  - Cannot be used in traditional wet markets (premium grade)
- No issue with immunocastrates for boxed product in Hong Kong or other export markets



## Take home messages

- Entire male pig production does negatively impact welfare, carcass and eating quality
- Immunocastration has helped to address these entire male pig issues
- Market acceptance of immunocastration is not an issue in the domestic market (retail, food service or processed segments)
- Some acceptance issues in export markets but these predominantly relate to carcass trade
- Consumer acceptance of immunocastration does not appear to be an issue



# Thank you

Dr Darryl D'Souza  
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