



The dilemma of entire male production from farm to consumer seen from an industrial point of view. How can research help the decision making?

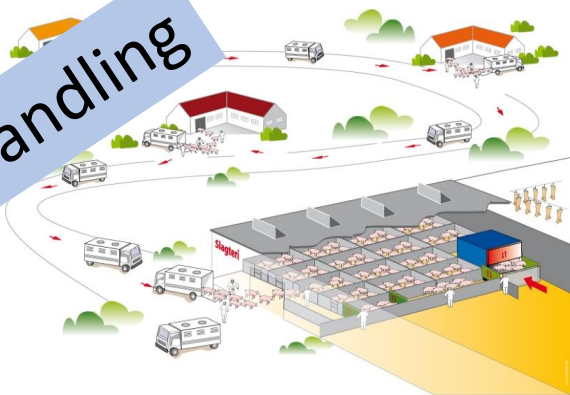
Margit Dall Aaslyng, mdag@DTI.dk



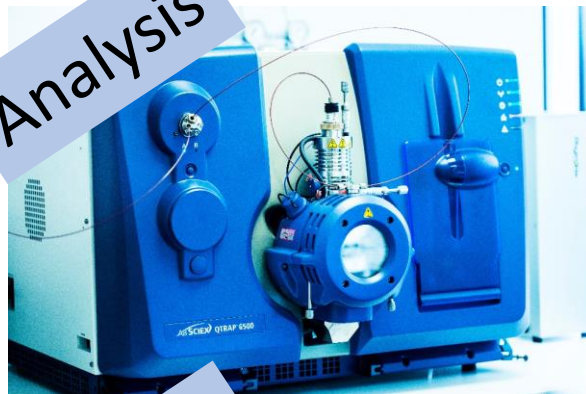
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Handling



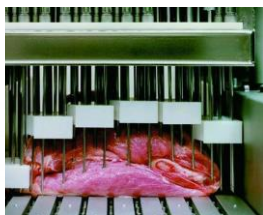
Analysis



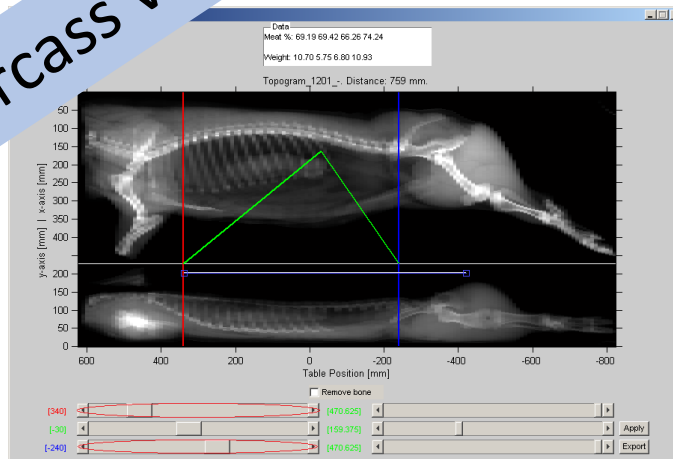
Sorting limits



Processing



Carcass value



Monetary value!

	Antal slagtinger i alt	% reduceret indtjening
Samlet værdi af hangrisproduktion, salg af 3 d		
10 Reduceret indtjening	-270.917,0	
11 Sigt indtjening		
12 I alt	-270.917,0	
13 Pr hangris		-36,1
14		
15		
16		
17 Samlet værdi af hangrisproduktion, midterstyk		
18 Reduceret indtjening	227.999,5	
19 Sigt indtjening	6.551,4	
20 I alt	221.347,9	
21 Pr hangris		28,1
22		
23		
24		
25 Samlet værdi af hangrisproduktion, midterstyk		
26 Reduceret indtjening	-237.387,9	
27 Sigt indtjening	6.551,4	
28 I alt	-230.836,5	
29 Pr hangris		-30,1
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- 1) Observational study (nine farms) => guidelines
- 2) Designed study to validate one of the guidelines

Guidelines

Loading at the farm directly from the pens or with short time in the pick-up facilities

The number of entire male pigs versus non-entire male pigs in the pens at the slaughterhouse is of minor importance

Entire male pigs can be mixed with pigs from other producers

Short time in lairage for pens with unrestful pigs



14 entire male pigs/0 female pigs

10 entire male pigs/4 female pigs

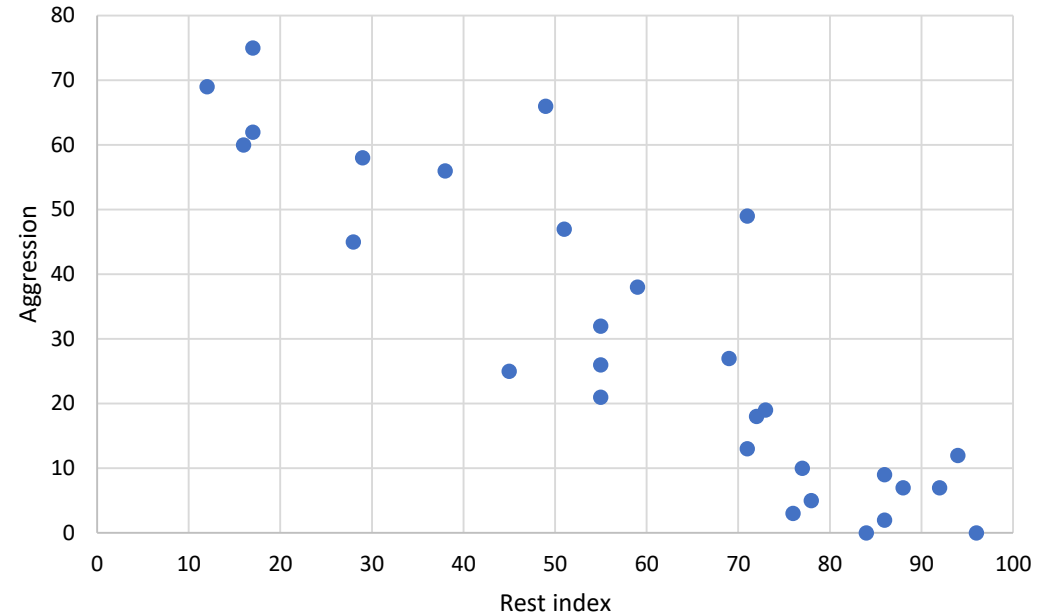
7 entire male pigs/7 female pigs

4 entire male pigs/10 female pigs

0 entire male pigs/14 female pigs

5 different farms, two of each pen-type per farm

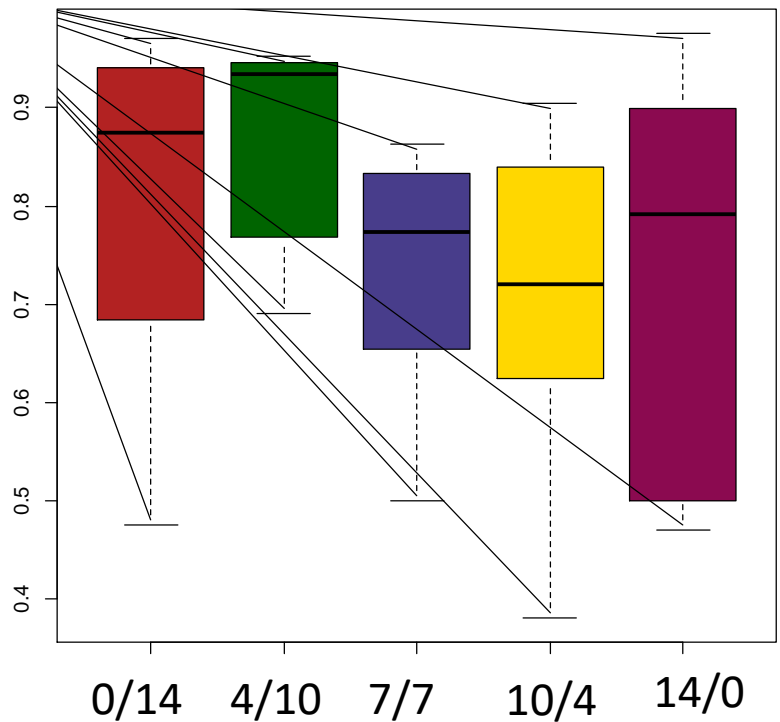
Screening every 5 minutes (laying/not laying)



$$\text{Rest index} = \frac{\sum(\text{number}_{\text{pigs-laying}}) * 100}{\text{number of pigs} * \text{number of observations}}$$

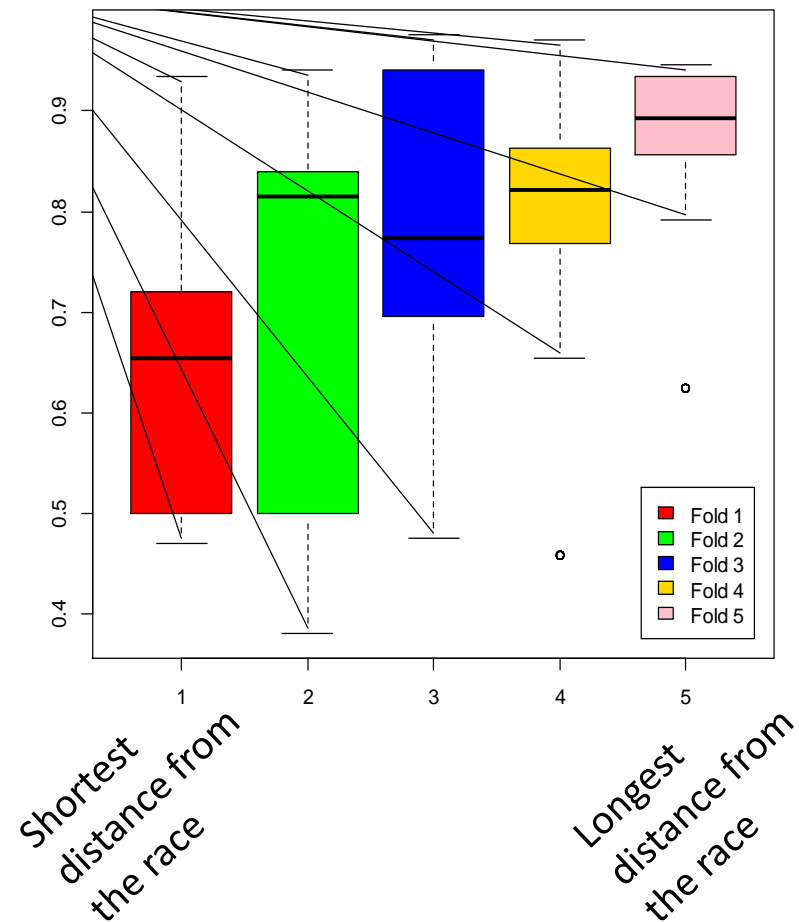


Rest index



Number of entire male pigs/female pigs

Rest index





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- 10 seconds per LDTD-MS/MS analysis
- 2880 samples per working day of 8 hours (360 per hour)
- Less than 40 minutes from sampling to analytical result
- Price: 1€ per sample
- Robust analytical system

	Limit of detection	Limit of quantification
Skatole	0.02 µg/g	0.05 µg/g
Androstenone	0.05 µg/g	0.1 µg/g

Want to know more? Please ask my colleagues:

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Sorting limits



How to set the sorting limits?



?
=



The experts?



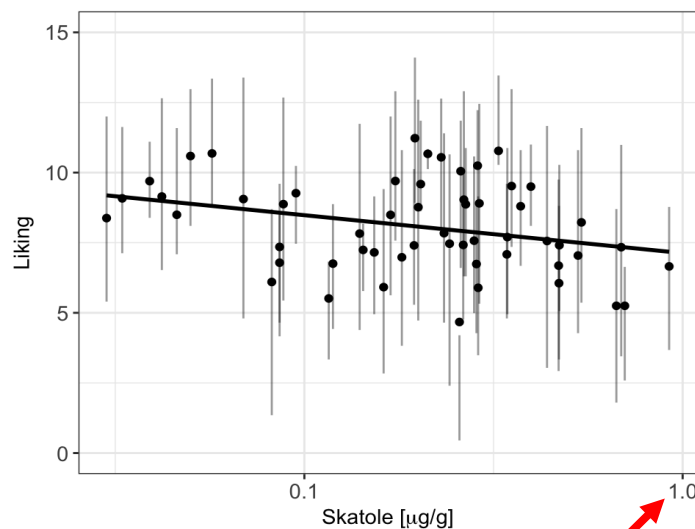
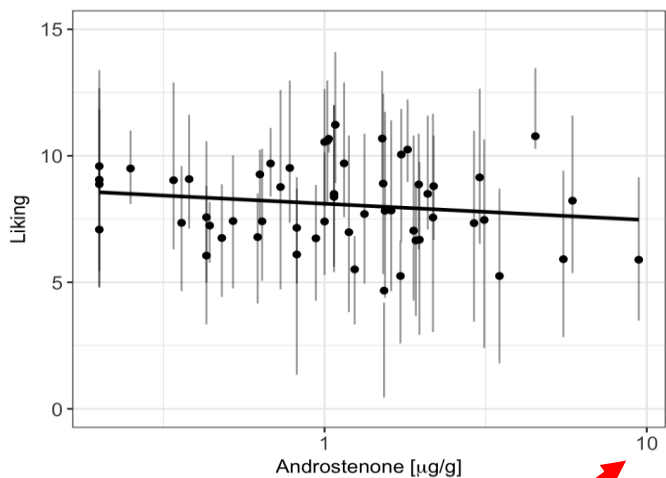
WHO?





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A huge consumer variation exists!

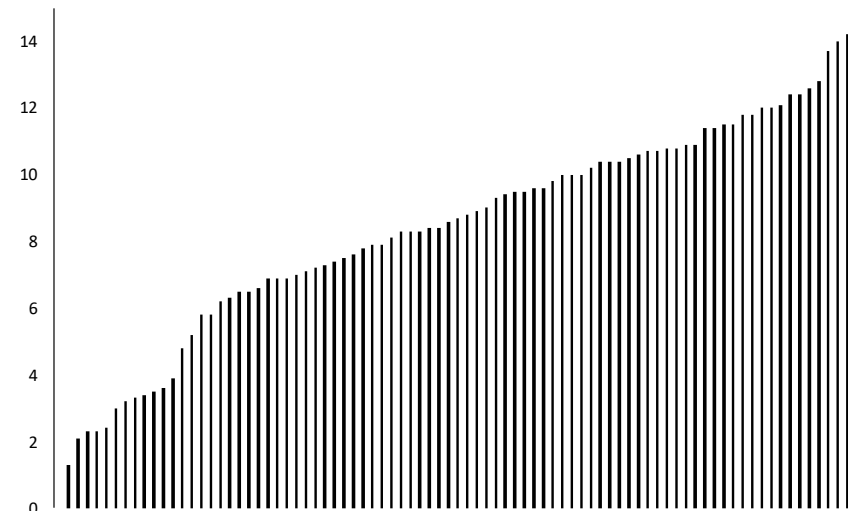


Pork chops, raw data, 25-75% fractiles

1.18 $\mu\text{g/g}$ skatole

8.7 $\mu\text{g/g}$ androstenone

Liking score



Consumers

Gammons, UK consumers, raw data



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Consumer liking



Model 1:
Mixed effect
logistic regression

Skatole and androstenone in
a random sample



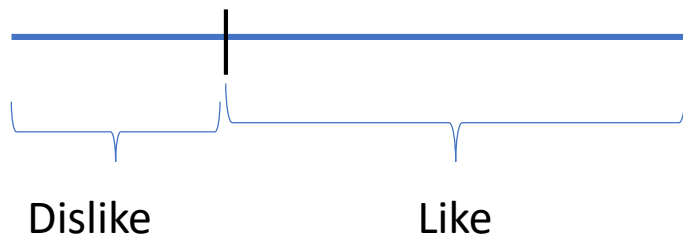
Model 2:
Bivariate normal log scaling
of skatole and androstenone



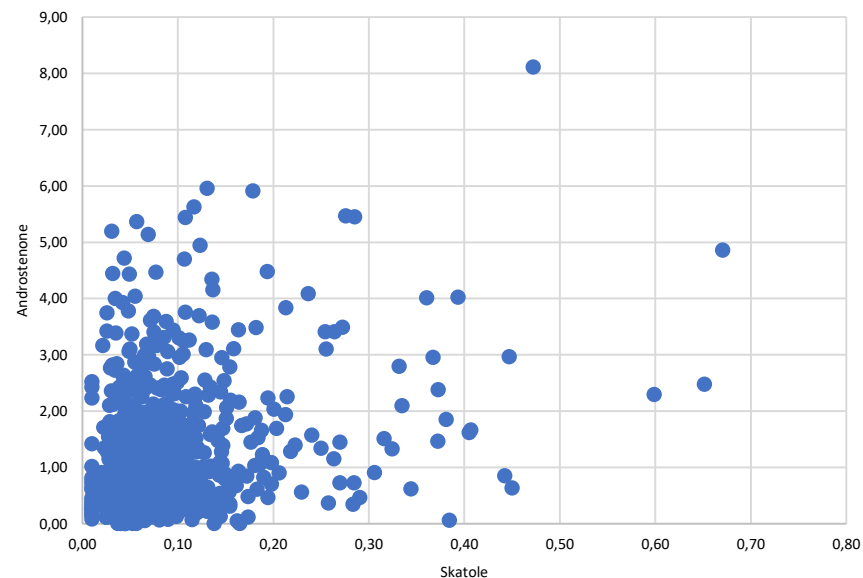
Model 3:
Expected[Risk(dislike)]

I do not like it at all

I really like it



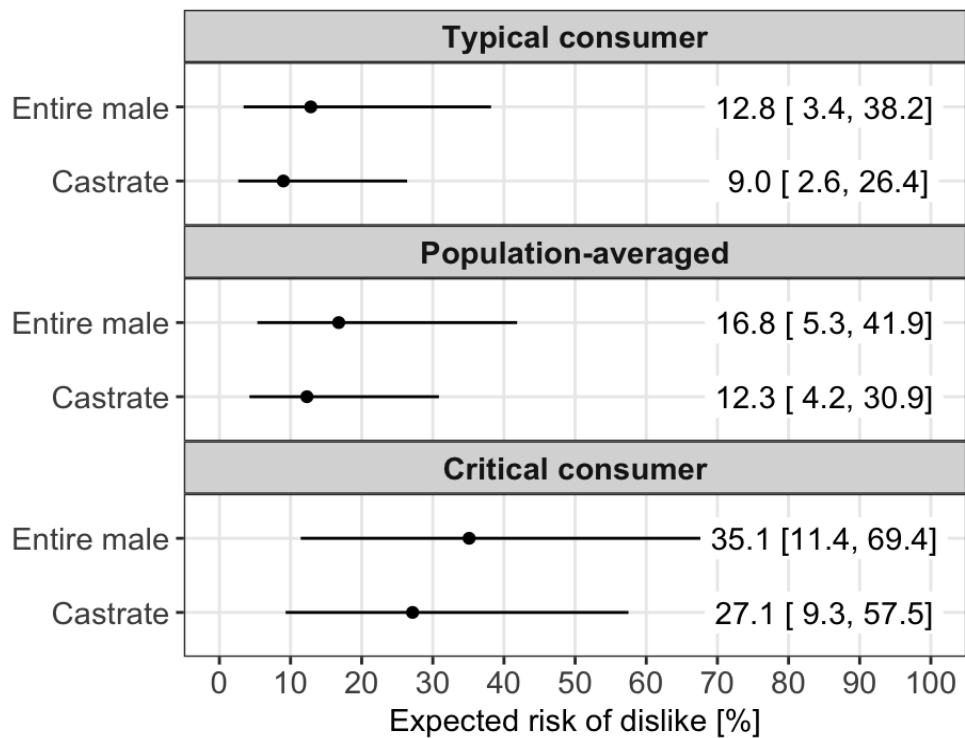
What is the risk that a consumer has a negative experience (dislike) when eating pork from entire male pigs?



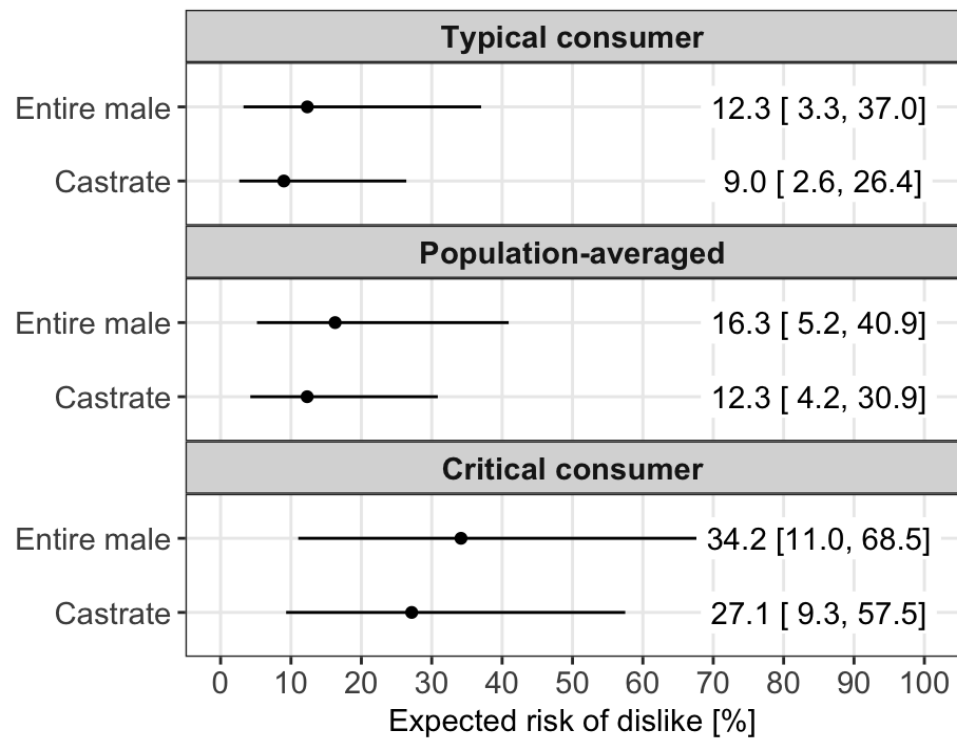


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No sorting (full entire male distribution)



Sorting limits: 0.25 µg/g skatole and 4.0 µg/g andro.





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Y:\Projects\P2003842_SAF 18 WP5 Vardisatning af hangrise/Fagligt/Risikovurdering/Diverse baggrundmateriale/DBN/RshinyApp - Shiny

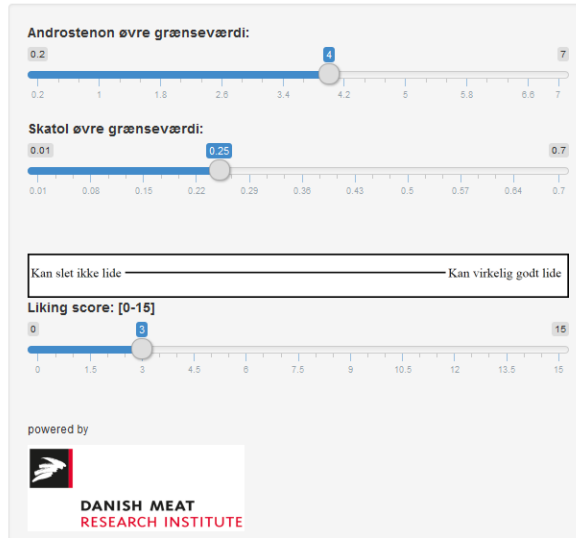
http://127.0.0.1:6028 Open in Browser

Publish

Sorting limit AND

Sorting limit SKA

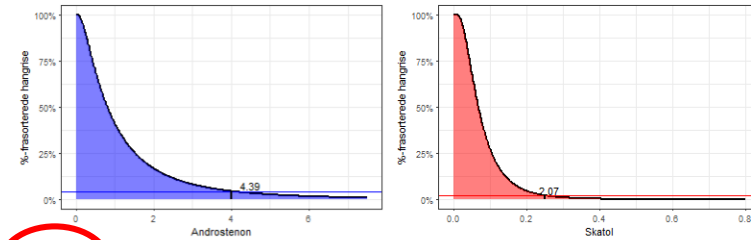
Limit for dislike



Fordeling af androstenon og skatol

De to log-normal fordelinger under er estimeret på baggrund af 871 tilfældig udvalgte hangrise

Andel af frasorterede hangrise bestemt ud fra grænseværdierne

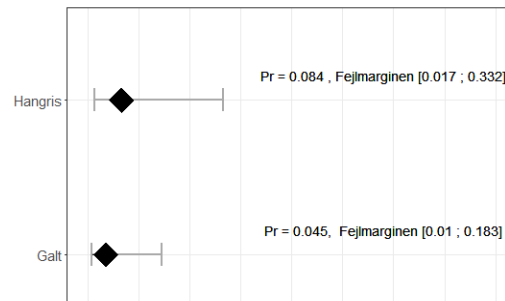


6.2% af grisene blev frasorteret med en øvre skatol grænse på 0.25ppm og androstenon grænse på 4.00ppm

% discarded

Plottet illustrerer

Sandsynligheden for at en typisk forbruger vil give kød fra en ikke-frasorteret hangris en score på 3 eller derunder



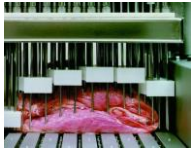
Risk of dislike – entire male pigs

Risk of dislike – castrates



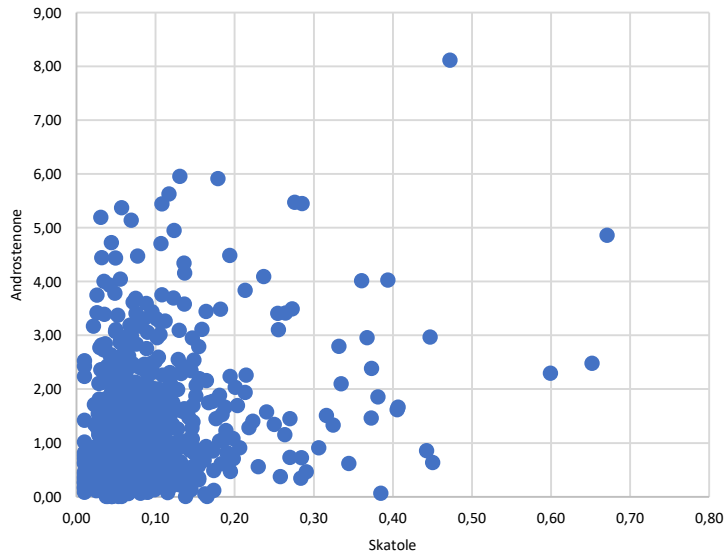
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Processing



16,000,000 pigs slaughtered
8,000,000 entire male pigs slaughtered
4% sorting = 320,000 carcasses with boar taint
84 kg/carcass
26,880,000 kg!

More or less intensive boar taint



*Which level of skatole and androstenone should be used in experiments?
How should the masking effect be evaluated?*





Smoke can mask!



How much smoke is necessary?

Which levels of boar taint/skatole and androstenone can be masked?

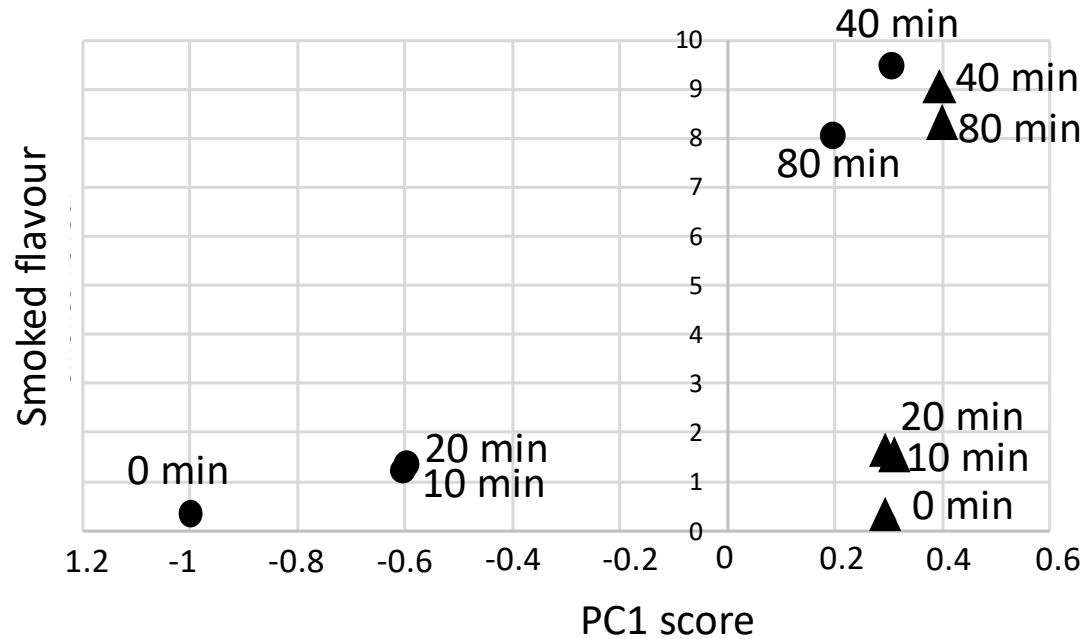
For whom should it be masked?





Smoking periods:
0, 10, 20, 40, 80 min

Meat from carcasses with 0.60 $\mu\text{g/g}$ SKA and 3.6 $\mu\text{g/g}$ AND
Fat from carcasses with 0.57 $\mu\text{g/g}$ SKA and 2.4 $\mu\text{g/g}$ AND



- ▲ Female pigs
- Entire male pigs

(The lower the PC1 score, the more intense boar taint)



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SMOKING

Smoking periods: 10, 30, 60 min Up to 0.61 $\mu\text{g/g}$ SKA
Up to 5.8 $\mu\text{g/g}$ AND



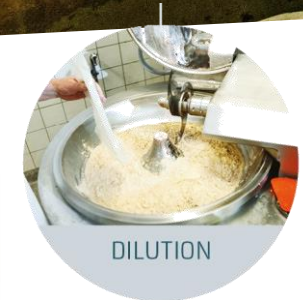
Table 4

The effect of skatole and androstenone expressed as the beta-regression coefficients on the boar taint flavour attributes in bacon depending on smoking time.

Smoking time	Log_skatole			Log_androstenone		
	10 min	30 min	60 min	10 min	30 min	60 min
Boar	3.2	2.6	1.6	0.9	2.2	1.6
Pungent	2.9	2.8	1.4	1.1	2.2	1.3
Sweat	2.4	2.3	1.4	0.7	2.0	1.0
Urine	2.3	2.1	1.3	0.6	1.6	1.0
Manure	2.1	2.2	1.1	0.7	1.6	0.9



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9 $\mu\text{g/g}$ A
0.9 $\mu\text{g/g}$ S



Max 10%



Theoretical calculation



Triangel test

Recommendation



Diluted at least 18 times



Diluted at least 10 times (the fat part)
Diluted at least twice (the meat part)



Model experiment - screening



Pulled pork

Stew

Fully or partially masked

Recommendations

Odour is more masked than flavour

Use a high concentration of the spices

Use strong spices such as cinnamon, chilli, oregano, thyme, mint, ginger and paprika

Combine with other strategies e.g. a complex serving



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COMPLEXITY



Trained assessors

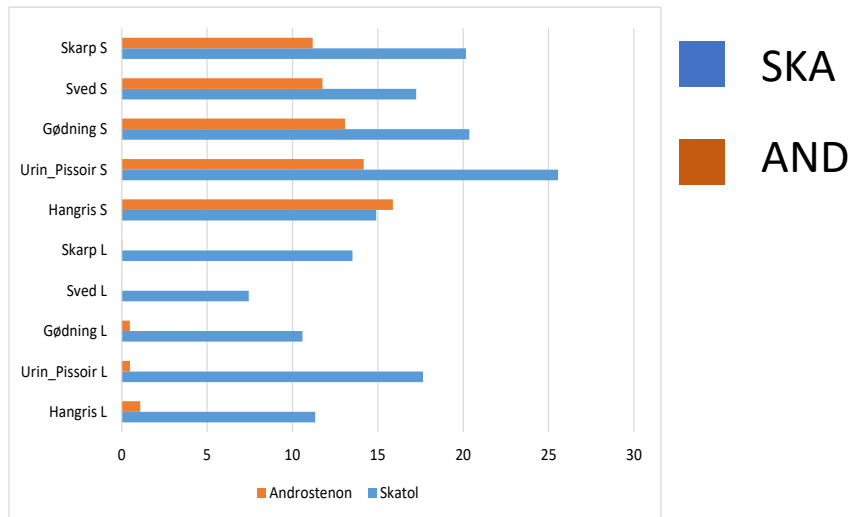


Consumers

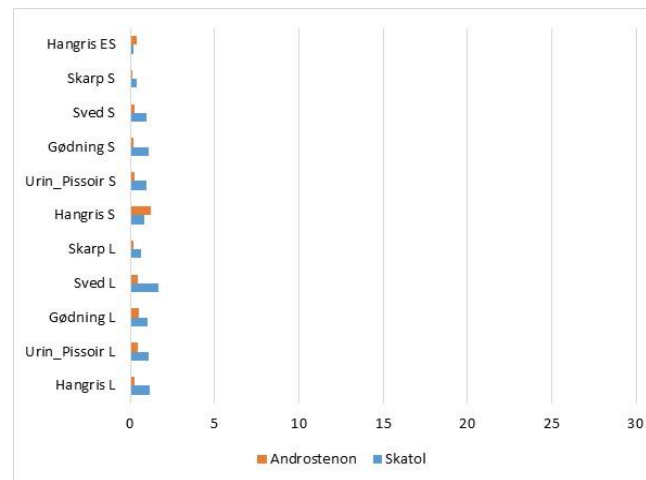


Trained assessors
Consumers

F-values - ham



F-values - toast



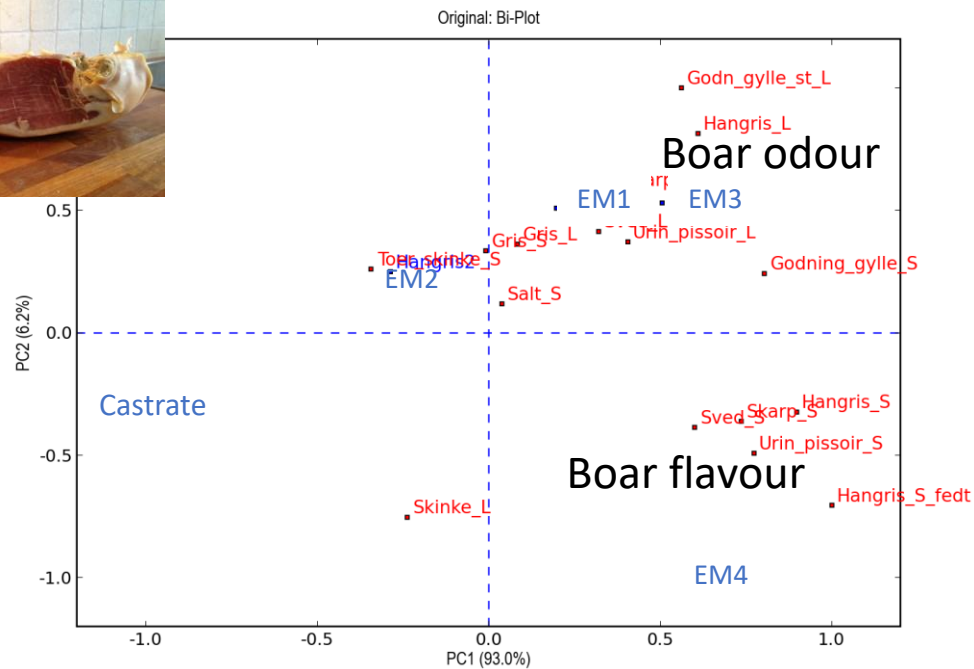
No effect of skatole and androstenone on consumer liking in sandwich or toast



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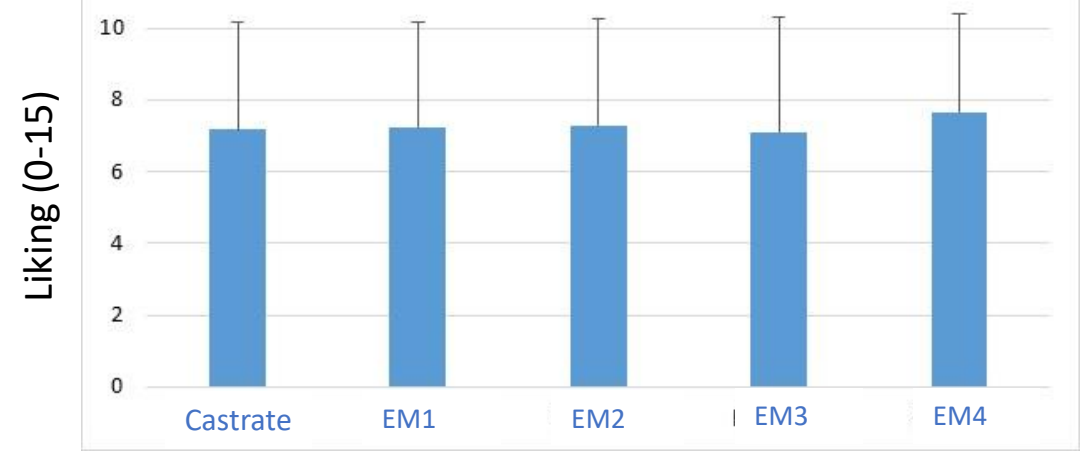


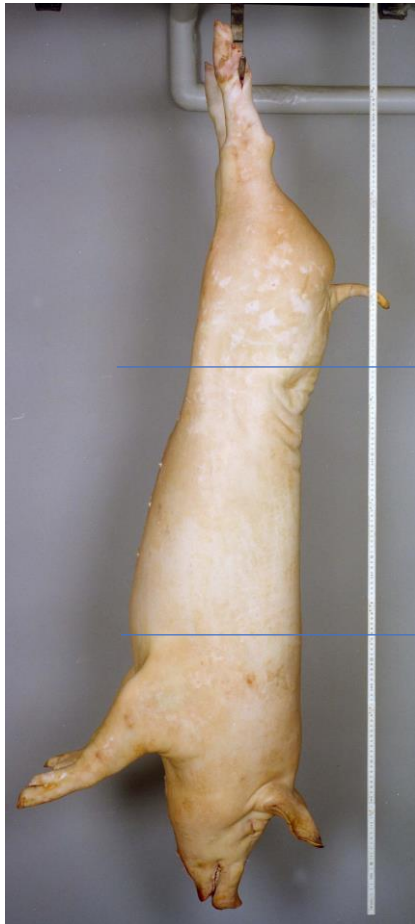
Trained panel



PanelCheck

Consumer panel





Dilution Smoke Masking Complexity Fermentation Temperature

✓ ✓ ✓

Smoked (ham), masked (ready to eat stew) or served as a ham-cheese toast

✓ ✓ ✓

Smoked (bacon), masked (e.g. ready to eat pork chops) or served in a meal (bacon on burger)

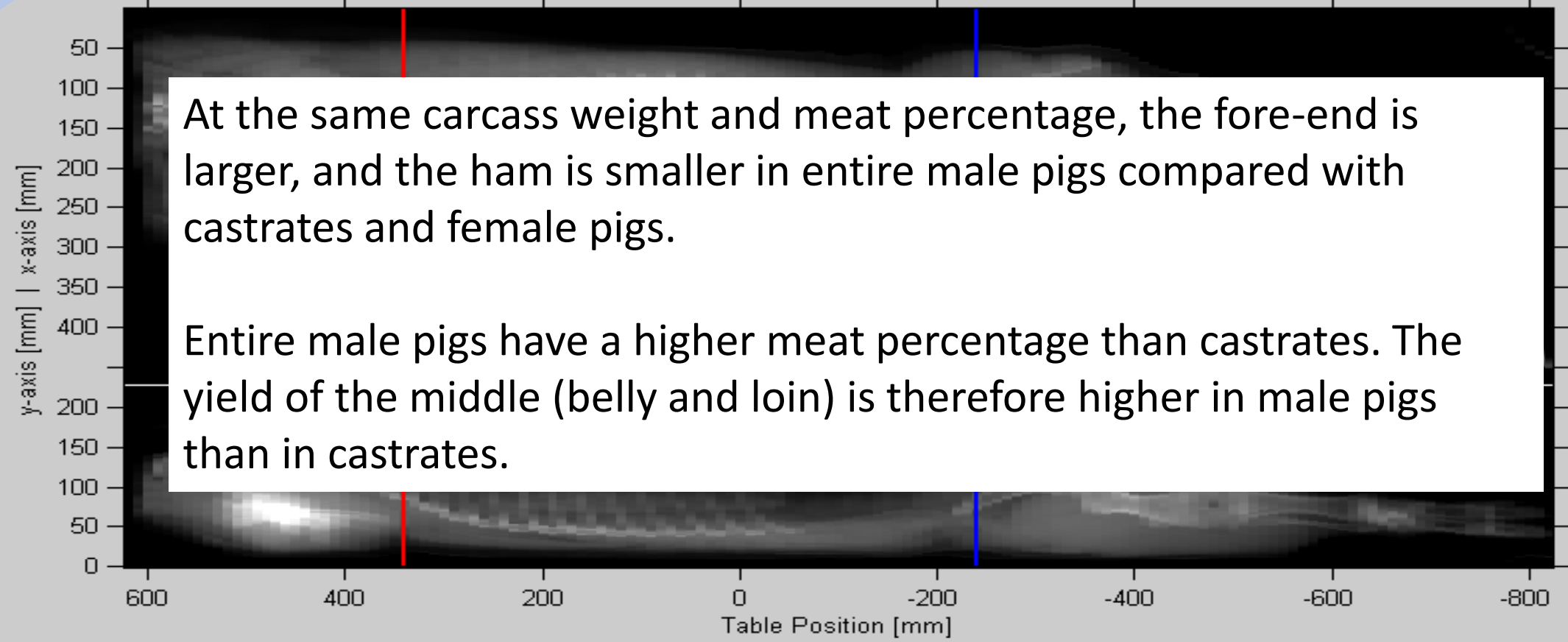
✓ ✓ ✓

Minced, diluted and perhaps smoked, masked e.g. in pulled pork

Carcass value

Data
 Meat %: 69.19 69.42 66.26 74.24
 Weight: 10.70 5.75 6.80 10.93

Topogram_1201_-. Distance: 759 mm.



At the same carcass weight and meat percentage, the fore-end is larger, and the ham is smaller in entire male pigs compared with castrates and female pigs.

Entire male pigs have a higher meat percentage than castrates. The yield of the middle (belly and loin) is therefore higher in male pigs than in castrates.

Remove bone

[340] [470.625] [Apply]

[-30] [159.375] [Export]

[-240] [470.625] [Apply]



Monetary value

Scenarios!

Scenario 1: **Cost: 3.36 Euro/entire male pig**

- 2% discarded carcasses (0.25 $\mu\text{g/g}$ skatole, no sorting on androstenone)
- No effect of protein content or eating quality
- The carcass is sold as fore-end, middle and ham

Scenario 2: **Cost: 3.96 Euro/entire male pig**

- 4.5% discarded carcasses (0.25 $\mu\text{g/g}$ skatole, 5 $\mu\text{g/g}$ androstenone)
- Protein content and eating quality have an economic value in a small part of the production
- The middle part is sold as belly and back (180 mm back)

Scenario 3: **Cost: 9.80 Euro/entire male pig**

- 18% discarded carcasses (0.25 $\mu\text{g/g}$ skatole, 2 $\mu\text{g/g}$ androstenone)
- Protein content and eating quality have an economic value in a significant part of the production
- The middle part is sold as belly and back (180 mm back)



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Please visit www.boartaint.dk

A great thanks to the team behind all the results

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All the boar taint sensitive sensory assessors and all the technicians in the chemical laboratory

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