

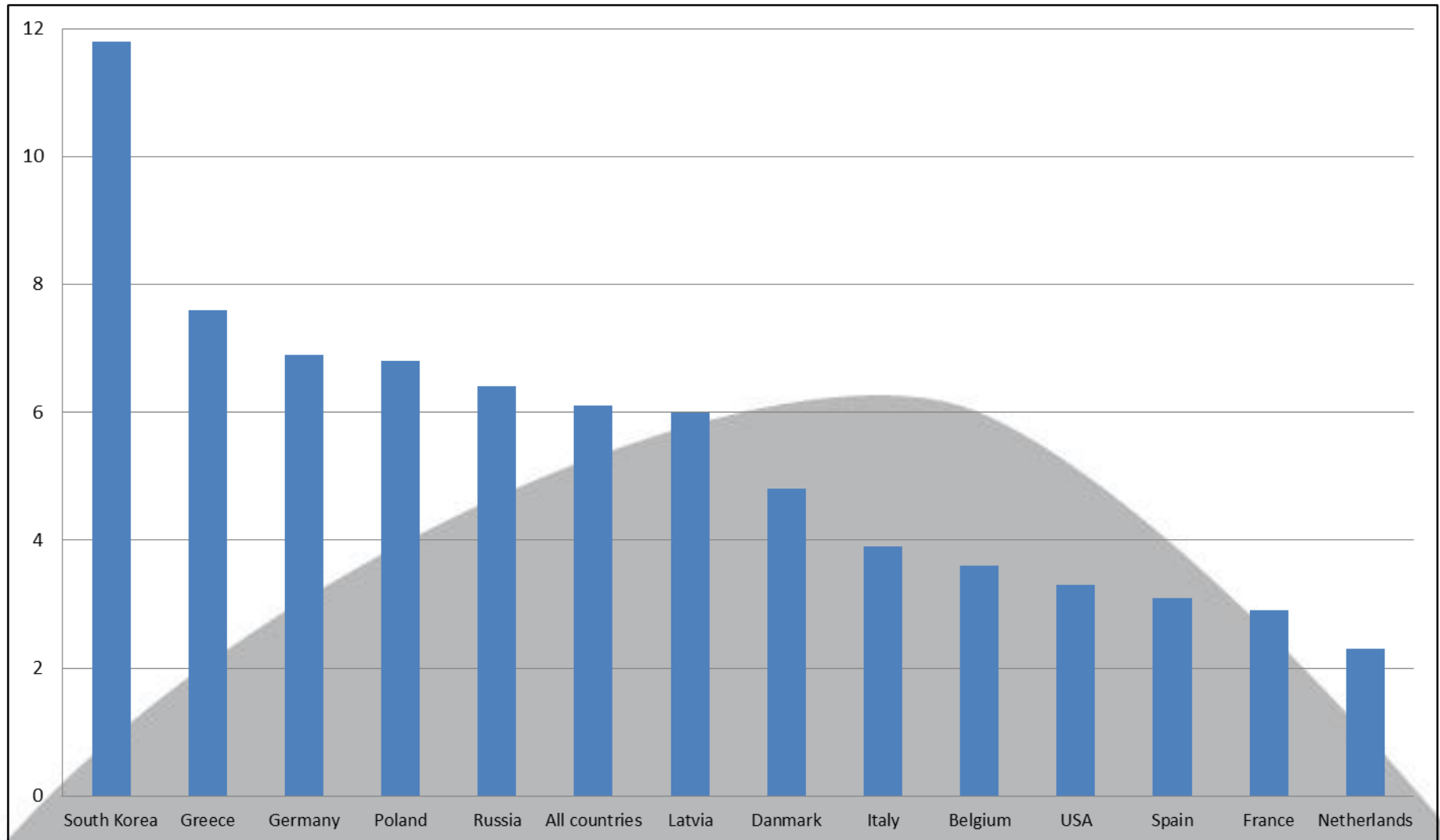
Human nose scoring system for boar taint

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Prague, Februari 2017

Negative experiences with eating pork last 2 months (% of 11.294 consumers, October – November 2013)



- Test characteristics human nose method
 - Reproducibility (between tester comparability)
 - Repeatability (within tester comparability)
 - Correlation with chemical methods
 - Sensitivity and specificity



- Consequences for in-line detection

Human Nose Detection method (HNS)

- Lab
 - Trained panelists
 - Electric soldering iron
 - In small room „lab“
 - at own speed, max 100 samples
- Slaughter line
 - Trained panelists
 - Flaming soldering Iron
 - In slaughter line
 - At slaughter speed
 - 250-300 samples during an half hour



Critical elements certified in- line detection method

1. Documented procedure
2. Validated specification defining: sensitivity, specificity, repeatability and reproducibility, test time per individual animal, and operation time per tester.
3. Quality controls
4. Training
5. Separate logistic
6. Corrective and preventive measures
7. Feed-back to the farmer/sender
8. Audits



Why The Human Nose?

Low cost method with high through put

- Tester employment costs under 1€/test
- Additional test for genetic selection

Method that helps in making progress

- Feedback information for suppliers

Practicable for breeding purposes and slaughter line detection

- Method that fulfills requirements of Dutch-German retail
- Applied for breeding purposes



Materials and methods

- 6574 entire males, different genetic lines
- Neck fat, divided into three pieces
- Stored vacuum, -18°C, maximum 6 months

- Each time ± 100 samples were randomly selected
- heated by a soldering iron (Weller[®], Catalog number W100PG, 100 Watt).
 - 370°C.
 - hot iron tip, 6 mm wide and 20 mm long,
 - about 2-3 seconds
- the volatiles were sniffed by the panelist
- Each piece tested by 3 panelists
- Androstenon and Skatol (ASI) for 5025 of the samples
- 9 panelists

Scoring system

Score	Description	Decision
0	Normal pork smell	No boar taint
1	Deviant smell, but not boar taint	
2	Faint boar taint	
3	Boar taint	Boar taint
4	Strong boar taint	

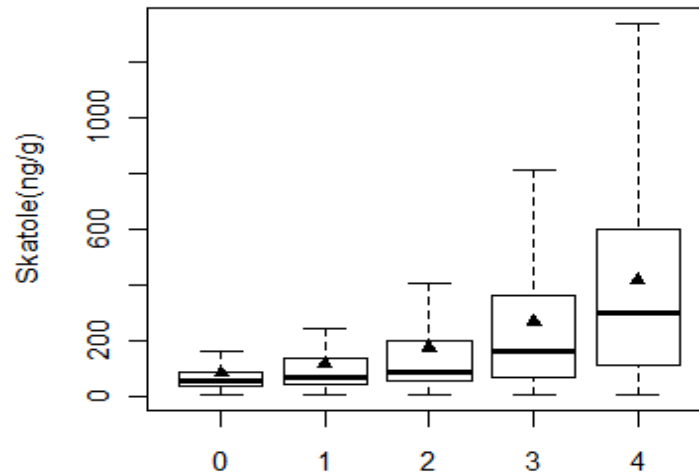
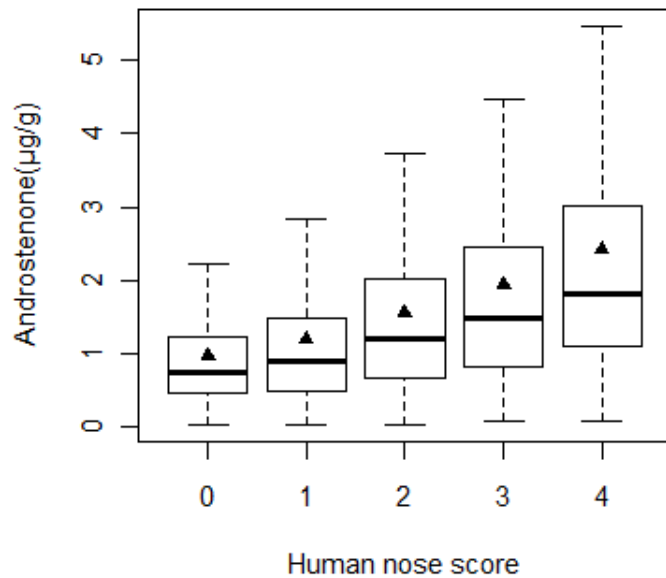
Laboratory panelist: selection and training

Testers sensitive to pure Androstenon and Skatol

Instructions given about the method

Initial training by parallel testing and discussing outcomes

Relation score and chemical components



Source: Mathur et al. (2011) submitted to Meat Science Journal

Reproducibility: Correlation between testers

Poly-choric correlation: taking into account the categorical nature of the data
Selecting assessor crucial

Panelist	B	C	D	E	F	G	H	I
A	0.36	0.34	0.53	0.30	0.26	0.19	0.31	0.42
B		0.22	0.19	0.35	0.28	0.36	0.25	0.44
C			0.40	0.13	0.43	0.42	0.42	0.47
D				0.59	0.58	0.51	0.41	0.53
E					0.49	0.44	0.41	0.38
F						0.29	0.44	0.54
G							0.41	0.43
H								0.45

Average = 0.39

Source: Mathur et al. (2011) Meat Science Journal

Accuracy (sensitivity & specificity)

with androstenon and skatol as reference standard

- **S**ensitivity = True Positive tests / total positives
- **S**pecificity = true negatives / total negatives

Cut offs

- 1.0 µg/g for androstenone
- 0.250 µg/g for skatole

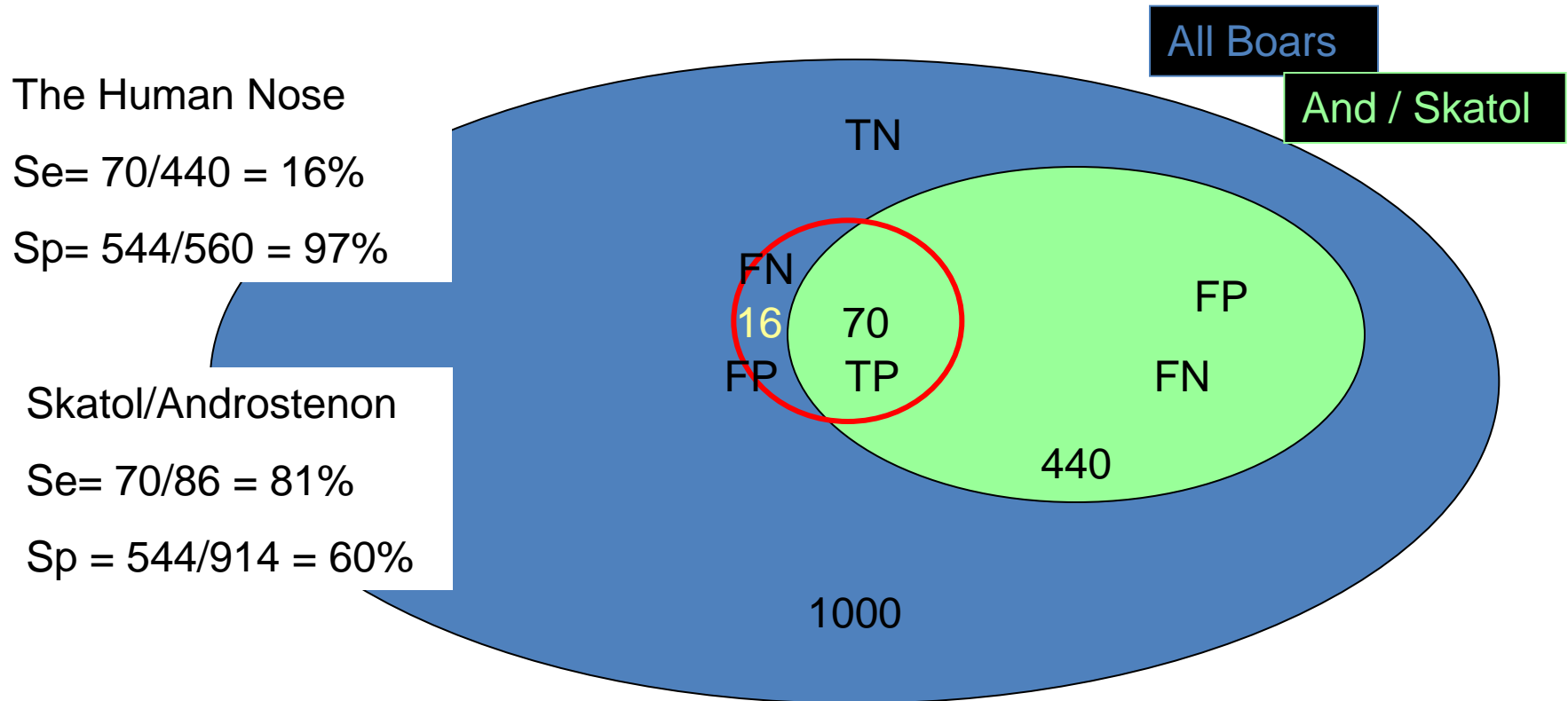
Proportion above reference:

- Androstenone/Skatol: 44.0%
- HNS: 8.7%

Panelist	SE(%)	SP(%)
A	15,0	95,3
B	12,0	97,7
C	29,4	91,4
D	17,1	96,4
E	13,2	97,1
F	17,9	99,7
G	18,3	96,3
H	15,7	99,3
I	19,4	98,0
all	16,1	97,1

Source: Mathur et al. (2011)

The True Boar taint



Accuracy (sensitivity & specificity) with average-HNS-score as reference standard

- Average per boar
- Average HNS cut off = 2,5

Panelist	SE (%)	SP(%)
A	61,0	92,9
B	79,1	95,6
C	81,4	85,1
D	81,6	93,0
E	66,7	94,4
F	72,2	98,3
G	74,1	92,3
H	75,8	95,8
I	82,1	93,4
All	75,4	93,7

Three on-line testers compared

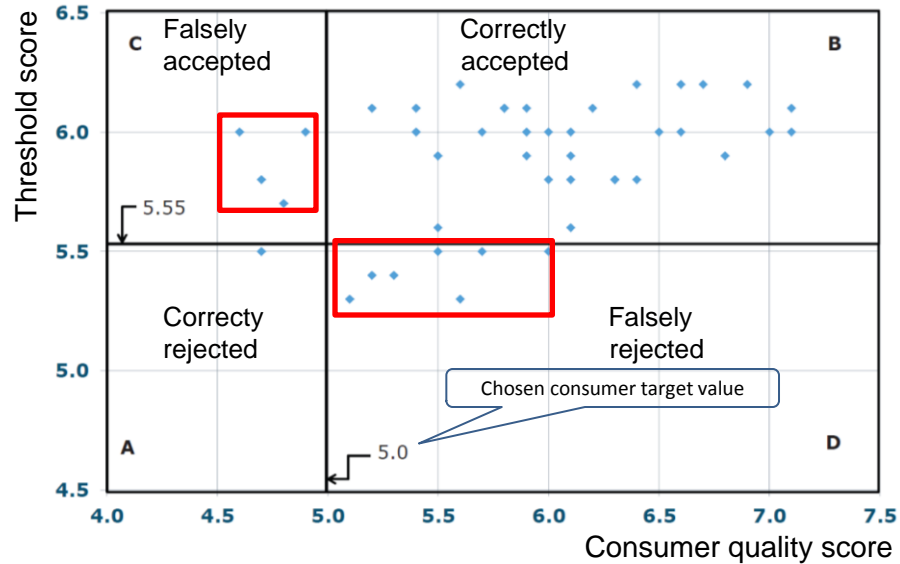
	Claudiu_4_7	Ruud_4_7	Martha_4_7	Claudiu_5_7	Ruud_5_7	Martha_5_7	Claudiu_6_7	Ruud_6_7	Martha_6_7	Claudiu_1_14	Ruud_1_14	Martha_1_14	Claudiu_2_14	Ruud_2_14	Martha_2_14	Claudiu_3_14	Ruud_3_14	Martha_3_14
Claudiu_4_7	1,00																	
Ruud_4_7	0,73	1,00																
Martha_4_7	0,71	0,63	1,00															
Claudiu_5_7	0,84	0,72	0,75	1,00														
Ruud_5_7	0,78	0,70	0,70	0,76	1,00													
Martha_5_7	0,68	0,60	0,71	0,67	0,68	1,00												
Claudiu_6_7	0,82	0,76	0,74	0,82	0,83	0,69	1,00											
Ruud_6_7	0,85	0,80	0,74	0,80	0,83	0,66	0,81	1,00										
Martha_6_7	0,80	0,73	0,70	0,80	0,77	0,73	0,82	0,76	1,00									
Claudiu_1_14	0,81	0,66	0,72	0,76	0,68	0,59	0,78	0,77	0,70	1,00								
Ruud_1_14	0,82	0,70	0,70	0,76	0,73	0,60	0,80	0,81	0,75	0,84	1,00							
Martha_1_14	0,56	0,53	0,50	0,50	0,47	0,50	0,51	0,54	0,55	0,56	0,59	1,00						
Claudiu_2_14	0,82	0,75	0,73	0,81	0,80	0,69	0,85	0,81	0,83	0,77	0,79	0,55	1,00					
Ruud_2_14	0,74	0,76	0,58	0,68	0,73	0,55	0,76	0,74	0,68	0,65	0,71	0,49	0,78	1,00				
Martha_2_14	0,78	0,68	0,57	0,75	0,69	0,63	0,71	0,75	0,74	0,70	0,75	0,56	0,76	0,68	1,00			
Claudiu_3_14	0,71	0,64	0,66	0,71	0,70	0,62	0,75	0,75	0,76	0,65	0,72	0,46	0,74	0,60	0,65	1,00		
Ruud_3_14	0,83	0,77	0,75	0,84	0,81	0,70	0,86	0,86	0,82	0,78	0,78	0,53	0,84	0,73	0,77	0,77	1,00	
Martha_3_14	0,63	0,60	0,67	0,70	0,57	0,60	0,72	0,61	0,65	0,59	0,60	0,24	0,66	0,62	0,54	0,66	0,74	1,00

Rank order comparison detection systems

Consumer perception	Detection	Kendall's W	P-value
Taste at dinner	HNS	0.66	0.055
	AND	0.49	0.532
	SKA	0.57	0.220
Overall quality	HNS	0.65	0.065
	AND	0.49	0.510
	SKA	0.58	0.198

- Rank order comparison between consumer perception and selected boar taint detection systems: HumanNoseScoring, ANDrostenone, SKAtole
- Human Nose Score (HNS) best predictor of rank order of consumer perception
- Chemical analysis of Skatole (SKA) was the second best

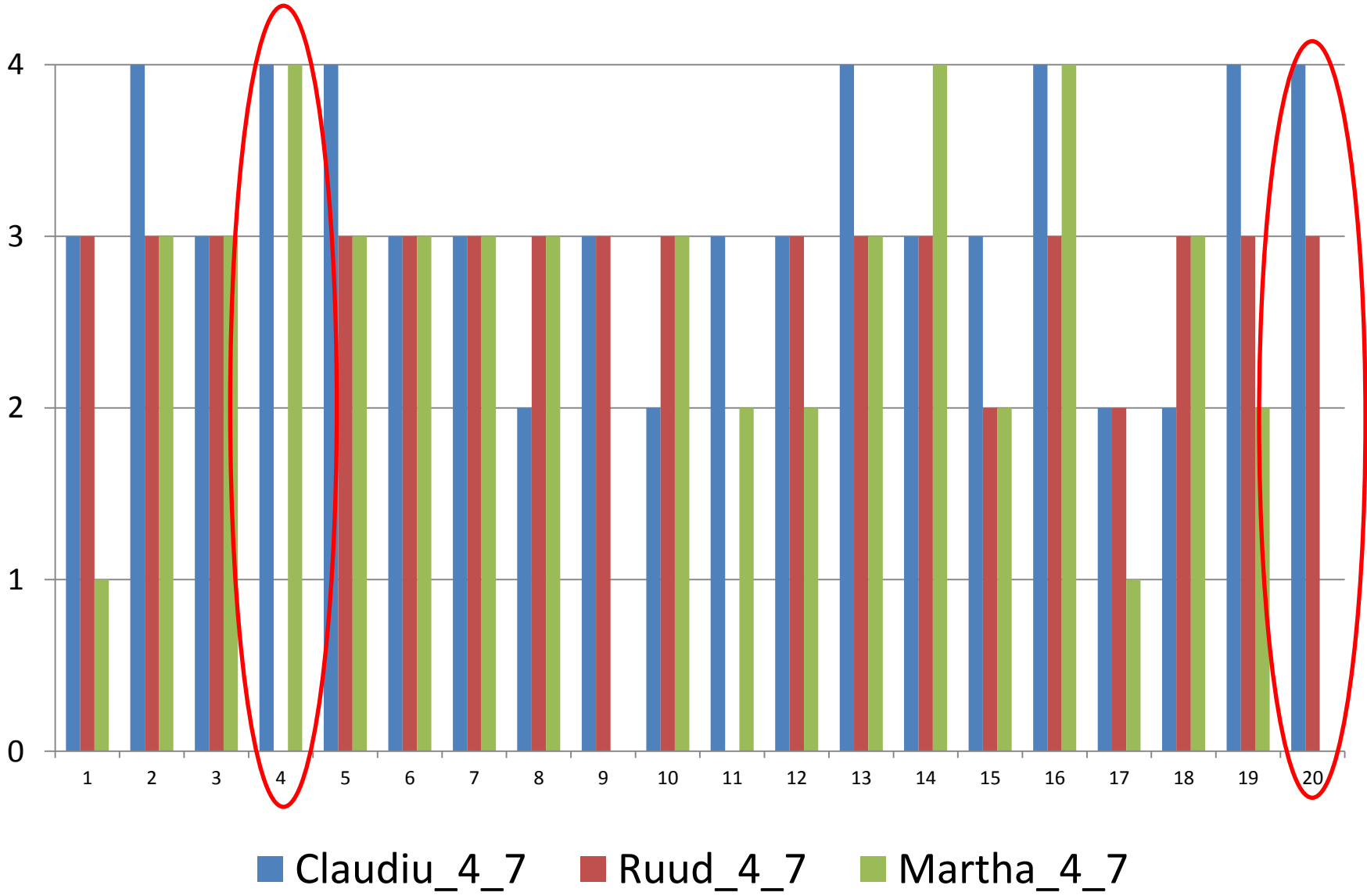
Detecting boar taint: false negatives and false positives!



Threshold score	Correctly		Falsely	
	Rejected (A)	Accepted (B)	Accepted (C)	Rejected (D)
5.0	0	40	5	0
5.5	0	36	5	4
5.55	1	33	4	7
5.75	2	31	3	9

- False accepted (C) hamper market acceptance
- False rejected (D) reduce market value
- Detection threshold values: risk management and cost benefit analysis**

Tester results in-line detection: 20 test results with boar taint



Conclusions

- Characteristics HNS-method/ASI-method
- Consequences for implemented in-line HNS method
 - Good correlations with the compounds
 - Good repeatability between testers
 - High number of false positives with Androstenon and Skatol
 - May falsely lead to undervaluation of the HNS test
 - False negatives with Androstenon and Skatol
 - Low cost and faster speed than boar taint compounds
 - Close to consumer perception of boar taint



Thank you for your attention!

For more information

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