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SCREENING OF ENTIRE MALES

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Screenings of entire males from 9 herds showed a rejection rate of 2.3% when based on skatole increasing to 11% when based on human nose score. 37% had an androstenone level above 1.0 ppm.

INSTITUTION: DANISH PIG RESEARCH CENTRE

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Abstract

If rejection of entire males at slaughter is based on skatole level and human nose score, rejection rates would become far too high for production of entire males to be profitable.

This screening based on entire males slaughtered from nine herds revealed an average rejection rate of 2.3% if based on skatole levels above 0.25 ppm. The percentage of entire males with a human nose score of 2 (equals boar taint) averaged 11%. When based on both skatole level and human nose score, rejection rates reached 11%. Furthermore, results showed an androstenone level above 1.00 ppm in 37% of the pigs. If rejection is based on all three criteria, rejection rates reached 38%. If the limits for both skatole level and human nose were used and the limit for androstenone was 2.00 pm, 9% would be rejected. All recordings that form the basis of these values were made in neck fat.

The percentage of entire males rejected solely on the basis of skatole (skatole level above 0.25 ppm) was low, which may be attributed to the fact that the pig producers in the trial are registered male pig producers. They have succeeded in keeping rejection rates low (measured on skatole level only) and have thereby maintained their male pig contract. Therefore, the result of this screening cannot be expected to apply to the entire population of entire males in Denmark if production of male pigs is introduced.

Background

In the EU, a declaration of intent has been signed to terminate castration in European pig production by 2018 with the primary aim of improving animal welfare. Today, only a small percentage of entire males are being produced on a contract in Denmark. Only pig producers who have succeeded in keeping rejection rates low (max. 5% entire males above 0.25 ppm) have been able to maintain a profitable production of entire males.

In production of entire males, some of the pigs will develop boar taint. Several of the countries importing Danish pork refuse to accept meat from entire males on account of the risk of boar taint, and the majority of Danish entire males are therefore castrated.

Production of castrates in its current form is not entirely profitable as castrates generally have a poorer feed conversion and a fatter carcass than entire males. The potential for lean meat gain is far better in entire males and their feed conversion is equal to or better than that of female pigs and far better than that of castrates [9].

Within a few years, castration of piglets is expected to be banned nationally and in the EU. Therefore, it is essential that the know-how and the methods necessary to reduce boar taint are available to keep rejection rates low to ensure that the economy and competitiveness of slaughterhouses and pig producers are not jeopardised. Consequently, the percentage of rejected entire males must remain low while at the same time methods must be developed for online detection of boar taint. In addition, it is essential that rejection limits be accepted by the consumers. Currently, various analysis equipment and rejection limits are being investigated.

For years, multiple research activities have focused on reduction of boar taint in entire males through feeding [4], [6], [10]. Results show that it is possible to reduce skatole levels through feeding, but not all fibre will be equally appropriate for this purpose. The level of androstenone in fatty tissue is related to maturity; the older or heavier a pig is, the greater is the risk of the pig having a high level of androstenone. It is unclear whether age or weight is the decisive factor, but there are indications that androstenone is affected by feed.

In 2014, Danish pig farms mainly produce castrates: approx. 2% entire males are produced on farms operating on a male pig contract. These pig producers have been able to maintain low rejection rates on the basis of skatole levels and are thereby able to continue a profitable production. In 1990s, rejection was based on skatole, but today, when pigs are older and heavier at slaughter, androstenone must also be included in the assessment of boar taint. German as well as Dutch slaughterhouses apply the human nose method for rejection of entire males on the slaughter line. In Denmark, the human nose method is applied in a separate lab to avoid confusion with other odour impressions. Lab technicians are skilled in detecting skatole as well as androstenone. As the level of androstenone and human nose score in Danish entire males are unknown, it is relevant to investigate the potential rejection rates if rejection is also based on androstenone and/or human nose score.

Aim

The aim is to investigate rejection rates and boar taint determined according to skatole, human nose and androstenone in a random sample of Danish entire males.

Material and method

At Danish Crown's slaughterhouse in Ringsted, entire males from nine herds were selected over a period of 2 weeks; the plan was for the screening to comprise samples from 50-100 entire males per herd. A total of 610 entire males were included in the trial. Slaughter weight, lean meat percentage, skatole level and human nose score were recorded at the slaughterhouse and samples of fat were collected for further analysis (see table 1).

Samples of fat were subject to analysis for boar taint according to the below methods:

- At the slaughterhouse in Ringsted:
 - a) Skatole level determined online (ppm) [2].
 - b) Boar taint determined with the human nose method [1] according to the following scale:
 - i) 0 = no boar taint
 - ii) 1 = faint boar taint
 - iii) 2 = boar taint
- At the laboratory at Aarhus University, skatole equivalent, indole and androstenone were recorded using HPLC equipment [3].

Table 1. Analysis methods and rejection limits.

Method		Unit	Rejection limit
Slaughterhouse, 2012	Skatole	ppm = mg/kg	> 0.25 [1]
	Human nose	Score 0, 1, 2	= 2 [1]
Laboratory, HPLC	Skatole	ppm = mg/kg	> 0.25 [1]
	Indole	ppm = mg/kg	-
	Androstenone	ppm = mg/kg	> 1.00 / 2.00 [5], [8]

Internationally, scientists are discussing the correct limit for rejection based on androstenone. Currently, two levels are being discussed: > 1.00 ppm and > 0.50 ppm androstenone [5], but also 2.00 ppm is being discussed by some scientists. Scientists at the Danish Meat Research Institute (the Danish Technological Institute) are currently investigating the correct rejection limit for boar taint (measured on skatole, androstenone and human nose) from a consumer point of view.

Statistics

An average of lean meat percentage, slaughter weight and human nose score was calculated for each herd and in total. The distribution of skatole and androstenone is log normal. These variables were therefore log transformed and median was determined in the transformed data following ranking. The median is constituted by the back-transformed value.

Results and discussion

General

Slaughter weight averaged 80.8 kg varying from 78.5 to 87.0, and lean meat percentage averaged 60.6% varying from 58.8% to 62.5.

Skatole

The skatole median was 0.06 ppm. Based on skatole above 0.25 ppm, rejection rates reached 2.3% (14 of 610 entire males). Overall, skatole levels and rejection rates were low as the pig producers in this screening have been producing entire males for years and have succeeded in delivering entire males with low rejection rates based on skatole levels alone. This has enabled them to keep producing entire males on a male pig contract and at the same time keep this production profitable. Analyses of the herds showed that the skatole median ranged from 0.04 to 0.09 and rejection rates (skatole > 0.25 ppm) varied from 0 to 5.6% (see figure 1 and tables 2 and 3).

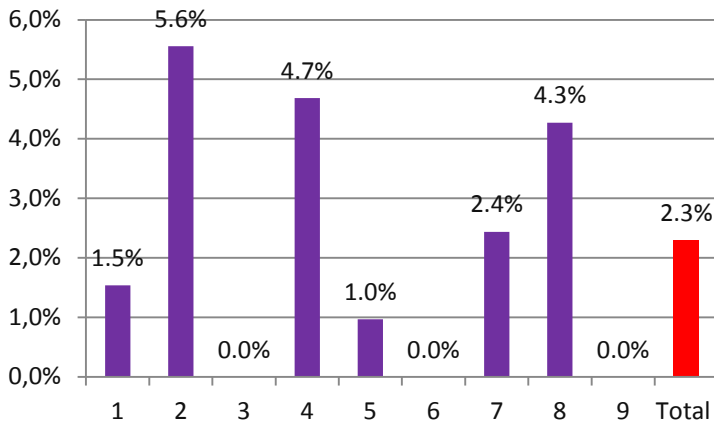


Figure 1. Rejection rates if skatole > 0.25 ppm (herds 1-9 and total).

Human Nose

Human nose score averaged 0.3. Score 2, which equals boar taint, was given to 11% of the pigs (see figure 2 and tables 2 and 3).

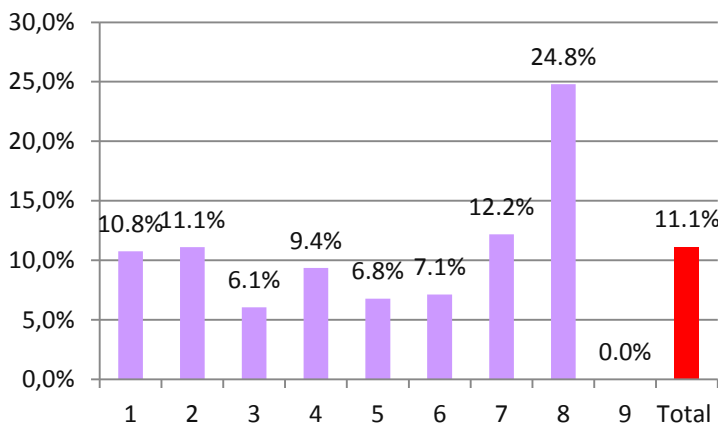


Figure 2. Percentage of with human nose score = 2 (herds 1-9 and total).

Androstenone

Scientists have yet to determine the limit value for androstenone that will provide a guarantee to consumers that the product contains no boar taint. In literature, several limit values for androstenone are proposed: 0.5 ppm, 1.00 ppm [5] and 2.00 pm [8]. Rejection of entire males based on androstenone is not practised in any country today. Androstenone and skatole are the two substances documented to have the greatest impact on the development of boar taint. Internationally, scientists are currently in the process of developing equipment for analysis of androstenone and skatole on the slaughter line.

The androstenone median of the nine herds in this screening was 0.73, which is level with results from previous trials [4], but significantly below the level of organic male pigs where research results showed an average level of androstenone of 2.3 ppm [7]. If a maximum androstenone level of 1.00 ppm is

applied, which is the value most commonly used internationally, 37% of the pigs would be rejected (see figure 3 and table 3) varying from 17 to 53% between the nine herds. If the limit is raised to 2.00 ppm, 9% of the male pigs would be rejected. If, on the other hand, the limit is lowered to 0.50 ppm, 75% of the pigs would be rejected. A rejection limit for androstenone has yet to be determined as there is no method for analysing androstenone on the slaughter line. Scientists are currently working on developing equipment for analysis on the slaughter line and on determining rejection limits for androstenone as well as skatole.

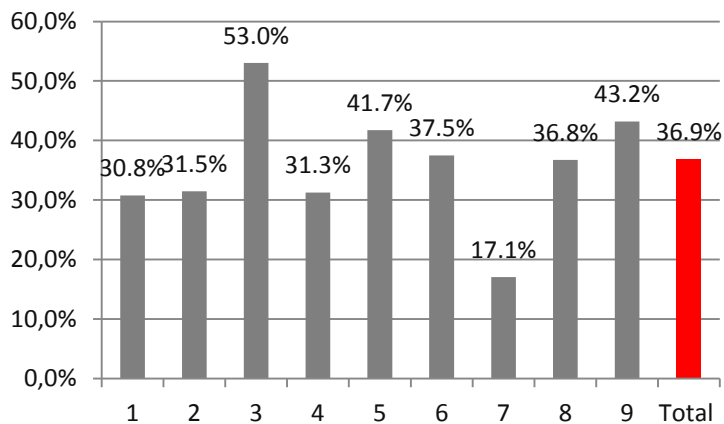


Figure 3. Percentage of entire males with androstenone > 1.00 ppm (herds 1-9 and total).

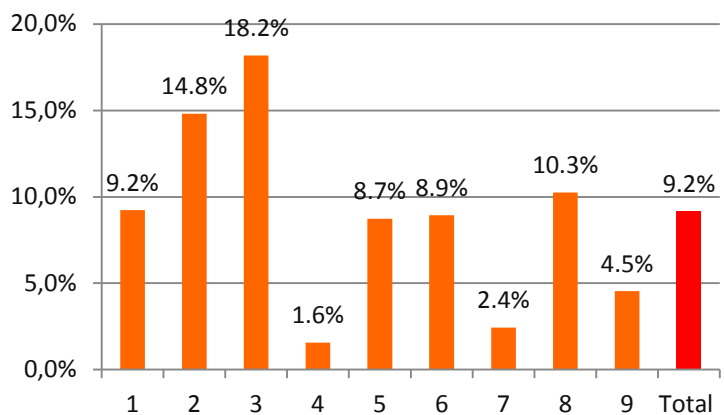


Figure 4. Percentage of entire males with androstenone > 2.00 ppm (herds 1-9 and total)

Boar taint – overall observations

If the limits for 1) skatole is 0.25 ppm; 2) human nose score is 2; and 3) androstenone level is 1.00 ppm, 37% of the entire males **would be rejected** (see table 3 and figure 5). If the limit for androstenone is raised to 2.00 ppm, 11% of the entire males would be above the limit (see figure 6).

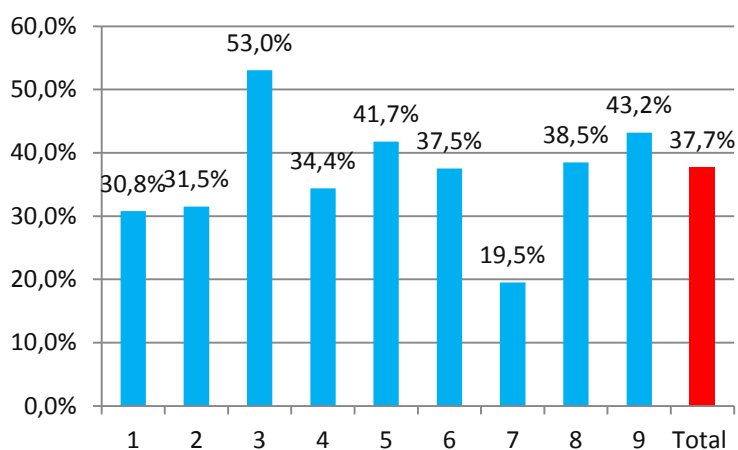


Figure 5. Percentage of entire males with skatole > 0.25 ppm, > 1.00 ppm androstenone and human nose = 2 (herds 1-9 and total).

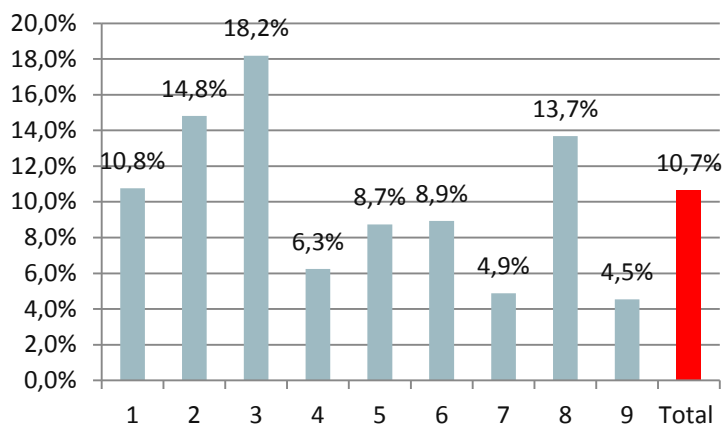


Figure 6. Percentage of entire males with skatole > 0.25 ppm, > 2.00 ppm androstenone and human nose = 2 (herds 1-9 and total).

Table 2. Skatole level, human nose score, weight and lean meat % recorded at the slaughterhouse.

Herd	1	2	3	4	5	6	7	8	9	All
Number of pigs	65	54	66	64	103	56	41	117	44	610
Lean meat % (av.)	60.3	60.9	61.0	61.3	61.2	60.6	62.5	58.8	60.0	60.6
Slaughter weight (av.)	82.6	78.8	80.7	87.0	79.1	82.1	81.7	77.8	81.3	80.8
Skatole ppm (median)	0.04	0.06	0.05	0.06	0.04	0.07	0.08	0.09	0.04	0.06
Androstenone ppm (median)	0.65	0.43	0.93	0.70	0.85	0.78	0.43	0.83	0.93	0.73
Human nose (av.)	0.3	0.3	0.3	0.3	0.2	0.3	0.4	0.6	0.0	0.3

Table 3. Rejection rates based on skatole level*, human nose score and androstenone level.

Herd	1	2	3	4	5	6	7	8	9	All
Skatole > 0.25 ppm	2.3	5.6	0	4.7	1	0	2.4	4.3	0	2.3
Human nose = 2	10.8	11.1	6.1	9.4	6.8	7.1	12.2	24.8	0	11.1
Androstenone >1.00 ppm	30.8	31.5	53.0	31.3	41.7	37.5	17.1	36.8	43.2	36.9
Androstenone >2.00 ppm	9.2	14.8	18.2	1.6	8.7	8.9	2.4	10.3	4.5	9.2
Skatole >0.25 ppm & Human nose= 2	10.8	11.1	6.1	9.4	6.8	7.1	12.2	24.8	0	11.1
Skatole >0.25 ppm & Human nose = 2 & Androstenone >1.0 ppm	30.8	31.5	53.0	34.4	41.7	37.5	19.5	38.5	43.2	37.7

* 0.25 ppm skatole is the level used at slaughter today for rejection of entire males. The consequence for the pig producer is a reduction of DKK 2 per kg slaughter weight.

Compared to entire males from six organic production herds, rejection rates in conventional production units were found to be significantly lower and the variations between herds lower [7]. If rejection is based on skatole (0.25 ppm) and human nose (=2), 24% organic entire males would be rejected versus 11% from conventional herds. A larger percentage of organic pigs were found to have an androstenone level above 1.00 ppm compared with conventional pigs (66% vs 37%).

If rejection is based on skatole levels and human nose score, the rejection rates will be far too high for production of entire males to be profitable [9].

Conclusion

In the nine herds included in this screening, rejection rates reached 2.3% when skatole was above 0.25 ppm. Entire males with a human nose score of 2, which equals boar taint, averaged 11%, and entire males with an androstenone level > 1.00 ppm averaged 37%. If all three rejection criteria were used, rejection rates would reach 38%. If the limit for androstenone was raised to 2.00 ppm, rejection rates would reach 9%.

If rejection is based on skatole levels and human nose score, the rejection rates will be far too high for production of entire males to be profitable.

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