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**Skatole and androstenone in small entire male pigs reared seasonally in one-unit system**

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*Photo 1 Entire male pigs in climate tent*

**Background**

Animal welfare is given high priority within organic production, and the omission of castration of male pigs may present a welfare benefit, the sow will not be stressed with the sound of the newly born piglets screaming, and the piglets avoid the painful operation as well as the risk of infections from the wound as a result. However, there may also be some disadvantages. The maturity of the male pigs may involve risks of undesirable behaviour and in addition there is a risk of meat with off-flavour and off-odour. This is most marked when the entire male pigs are maturing**.** One possible way to avoid the risk of off-flavour in the meat is to slaughter the pigs before maturity. The consumers expect organic meat to be delicious and healthy, one challenge is to ensure the consumers that meat from entire male pigs is delicious if they have once had meat with off-flavour.

*Photo 2 Straw based outdoor area*

*Photo 3 Suckling sow in one-unit pen*

Off-flavour in pig meat from boars is mainly caused by two compounds skatole and androstenone although some other steroid compounds could play a role too. A consumer study of Danish entire male pigs (Godt et al. 1998) showed less than 2 percent of the consumers dislike meat from entire male pigs with concentrations of androstenone at or les than 1.25µg/g fat and skatole at or less than 0.25µg/g fat (1.1 –1.6 µg/g fat) Two percent of the consumers dislike pig meat in general, despite the meat comes from female or castrated pigs and the concentrations of skatole is < 0. 15 µg and of androstenone is <0.50 µg. In our

data 14 % of the animal reached our safe limit at ≤1.25 ppm androstenone and ≤0.125 ppm skatole to minimize the risk of off-flavour.

*Photo 4 Sows in climate tents with grass paddocks*

**In this project the aim was to combine an animal welfare system with low slaughter weight of entire male pigs with a new meat product without off-flavour.**

An organic production system for pigs was established in one-unit-pens with deep litter bedding in the outdoor area at Research Centre Bygholm. The litters were born in climate tents with four litters in each tent. They were reared with their littermates from births to slaughtering without being mixed with stranger pigs.

*Photo 5 Weaned pigs with free access to feed*

The pigs were fed in ad libitum hoppers with free access to clover grass silage and they had water in a bowl in the deep litter area. The pigs grew up either in a group of a single litter or in a group of four litters, all born in the same tent. The female pigs and the entire male pigs grew up together. The pigs, which were reared litter wise, were separated from neighbour pens with a 40 cm high wall with two electric strings above.

*Photo 6 Slaughter pigs in the cabin of a climate tent*

Male pigs from four seasons and 40 different litters were slaughtered in the range of 100 to 150 days of age In the 1st and 2nd season the live weight was planned to be 70-75 kg and in 3rd and 4th season the weight at slaughter was decreased.

Three chiefs from admitted Danish restaurants made a preliminary test of the meat from an entire male pig each, and they all argued that small animals with soft and tender meat quality was preferred.

**Results of analyses**

The levels of skatole and androstenone in the back fat of the pigs were analysed by The Danish Meat Research Institute and recorded.

Androstenone level was increased with increasing slaughter weight and age.

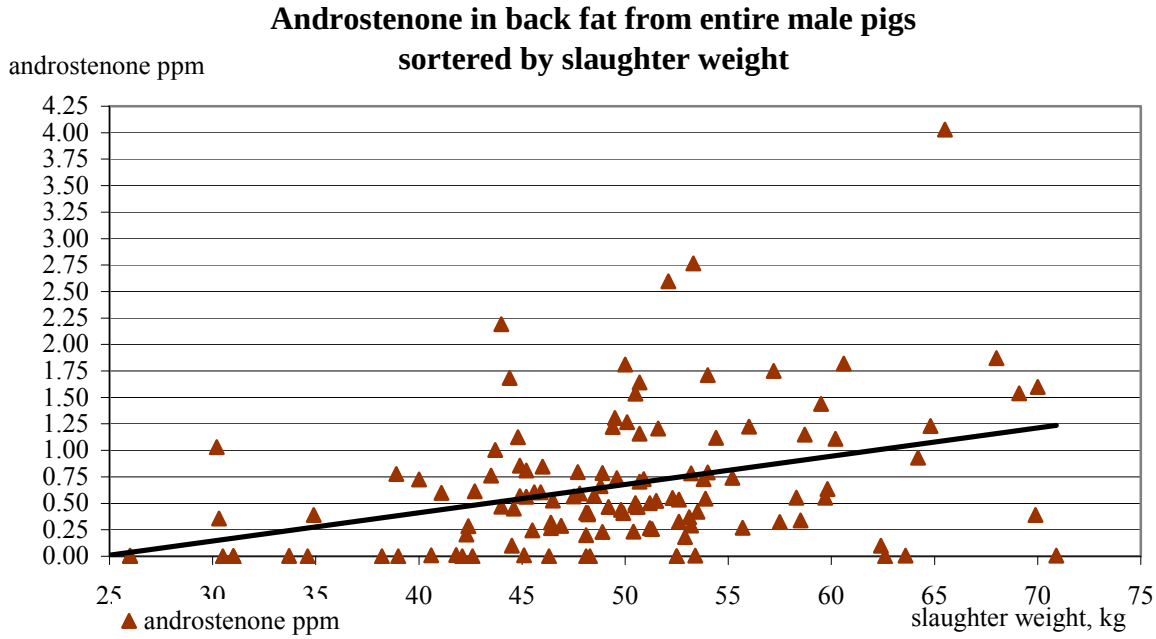


*Figure 1 Androstenone pattern in accordance to slaughter weight*

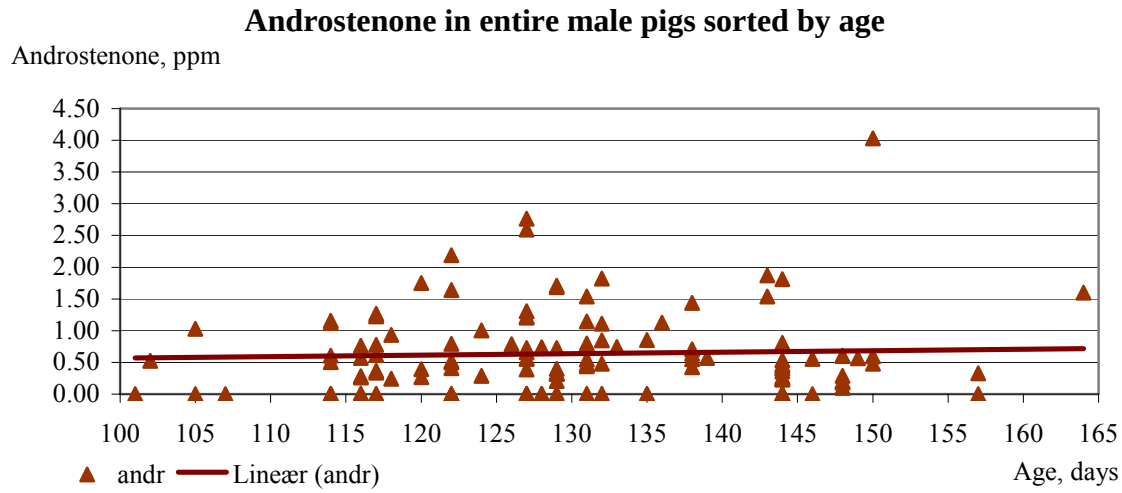


*Figure 2 Androstenone pattern in accordance with age at slaughter*

Skatole increased with age but not with weight, perhaps because skatole in fat is a result of maturity and management (pour hygiene).

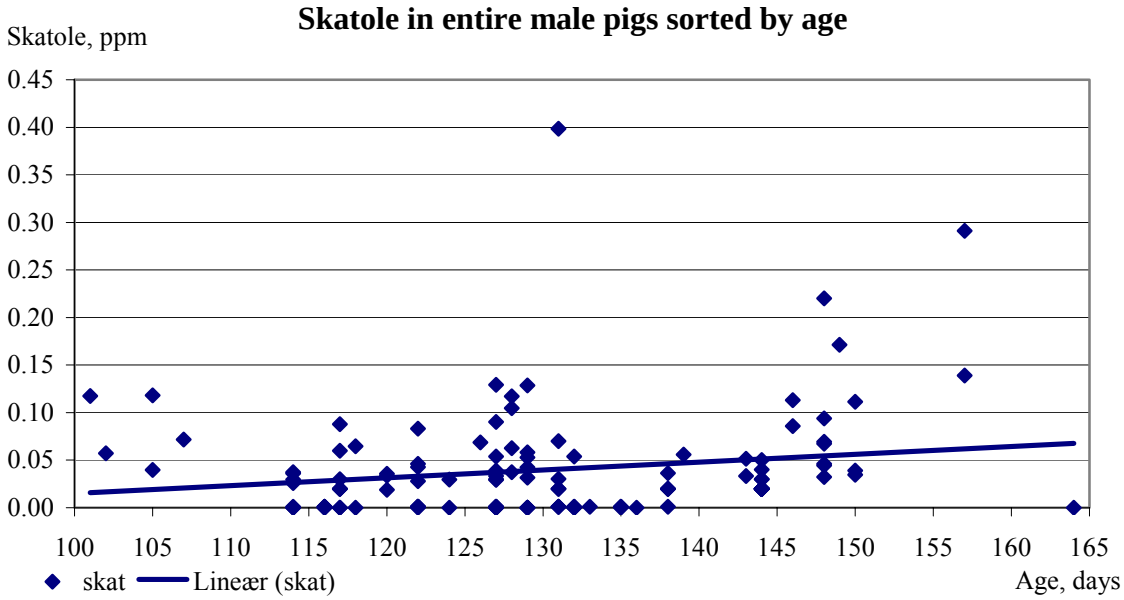


*Figure 3 of the androstenone and skatole pattern with age*

All though the tendency line showed higher levels of androstenone in group reared male pigs than in litters, the androstenone level did not differ significantly between pigs reared in groups and litter wise.

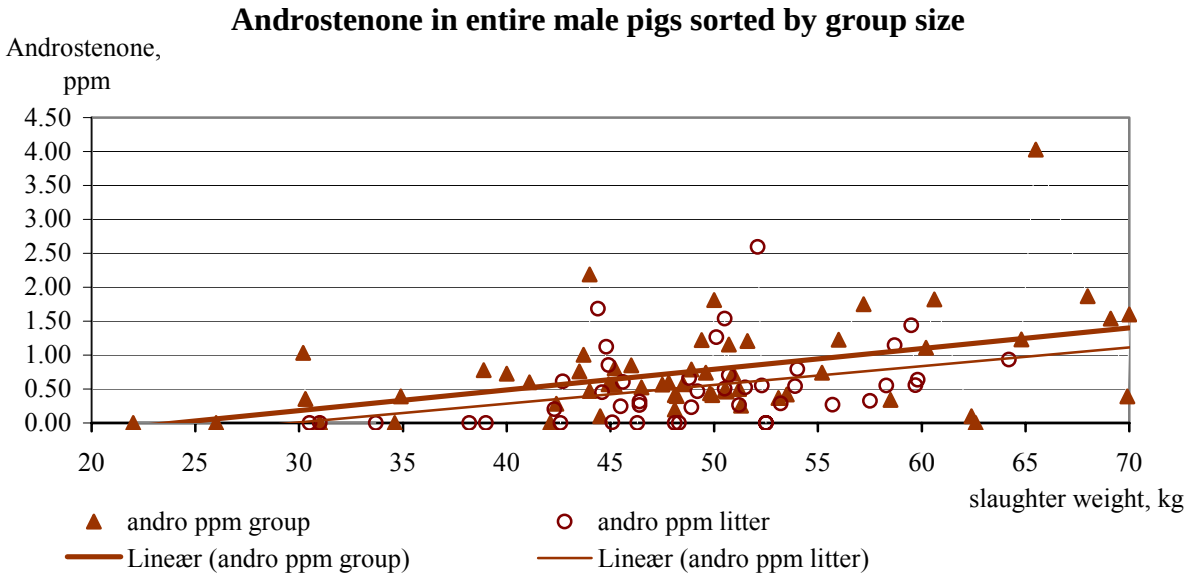


*Figure 3 Androstenone pattern in male pigs divided group or litter wise*

In 11 pens out of 12 at least one male pig had a concentration of androstenone in back fat ≥ 1.0 ppm and the two next samples exceeded 0.50 ppm. In the last pen four litters were kept separated and all the male pigs from this tent had androstenone concentrations near 0 (0.01 ppm). When the occurrence of entire male pigs with androstenone levels above 1 ppm is higher in this project, than the 10% at 70 kg live weight found by Støjer & Olsen (1998) from the Danish Meat Research Institute, it could be a result of high range male pigs' effect on litter mates as found by Giersing et al. (2000), all though the pigs in our study were not mixed with unfamiliar pigs.

The level of indole did not differ significantly in our results.

**Variation in androstenone and skatole content**

Fourteen percent of the entire male pigs had levels of androstenone (>1.25 ppm) or skatole (>0.15 ppm) that could be detected as off-flavour. The youngest pig, which had a high concentration of androstenone at 1.81 ppm, was 118 days old. The lightest pig with a high level of androstenone at 2.19 ppm had a slaughter weight of 44.0 kg, this pig moreover had the highest level of skatole (0.40 ppm). The smallest pig with skatole level above 0.15 ppm weighted 34 kg slaughtered and was 149 days old.

**Table 1 Entire male pigs with high levels of androstenone or skatole in back fat.**

| Weight classes | Numbers in class | Skatole av.ppm | numbers ≥0.15 ppm | % ≥0,15 ppm | Androstenon av. ppm | ≥1.25 ppm | % ≥1.25 ppm |
|---|---|---|---|---|---|---|---|
| < 28 kg | 3 | 0.06 | 0 | 0 | 0.00 | 0 | 0 |
| 28.0-33.0 kg | 6 | 0.07 | 0 | 0 | 0.23 | 0 | 0 |
| 33.1-38.0 | 3 | 0.10 | 1 | 0 | 0.13 | 0 | 0 |
| 38.1-43.0 kg | 12 | 0.04 | 0 | 0 | 0.27 | 0 | 0 |
| 43.1-48.0 kg | 25 | 0.04 | 1 | 0 | 0.65 | 2 | 8 |
| 48.1-53.0 kg | 39 | 0.02 | 0 | 0 | 0.66 | 4 | 10 |
| 53.1-58.0 kg | 16 | 0.06 | 2 | 12.5 | 0.86 | 3 | 19 |
| 58.1-63.0 kg | 10 | 0.04 | 0 | 0 | 0.77 | 2 | 20 |
| 63.1-68.0 | 5 | 0.02 | 0 | 0 | 1.61 | 1 | 20 |
| >68 | 11 | 0.02 | 0 | 0 | 0.88 | 2 | 25 |
| Av. | 127 | 0.04 | 4 | 3.3 | 0.65 | 14 | 11 |

**Parents**
Semen from 25 known boars was used to mate the 20 sows. Fourteen boars and twelve sows had offspring with high levels of androstenone (≥ 1.25 ppm), while 5 boars and 6 sows had offspring with levels of skatole ≥ 0.125 ppm. These limits were sat as our "safe" limits in this project

High levels (≥1.25 ppm) of androstenone were common in the herd, while approximately 20% of the parents had offspring with moderate levels (≥0.125 ppm) of skatole. High levels of androstenone and skatole could be minimised by genetically selecting for low levels, lowering the slaughter weight, keeping a high summer hygiene and adjusting the feed to a production of entire male pigs.

*Photo 7 Weaned pigs born in spring in one-unit pens*

**Conclusion**
To ensure that the meat will not have an off-flavour, the male pigs should neither be older than 120 days nor heavier than 55kg of live weight at the time of slaughtering. In our project we ended up with a slaughter weight at 28 – 33 kg, to obtain the tender meat quality, in this weight range no pigs had skatol levels above 0.1 ppm or androstenone levels above 1.25 ppm but it was just nine animals and further research in this weight range is needed.

**References**
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