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The potential to detect boar tainted carcasses by using an electronic nose based on mass spectrometry

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Introduction

Based on a parliamentary decision, in the year 2009 castration of male piglets without anesthesia will be banned in Switzerland. Thus, pig producers are forced to search for alternatives to the common practice. Rearing intact male pigs to market weight could constitute one possible alternative solution. However, producers, retailers, and consumers are concerned about the incidence of taint in pork. Therefore, a reliable, fast, and objective method to detect carcasses with the undesirable odor is a prerequisite for boar production.

The aim of this study was to evaluate the potential of an electronic nose (SMart Nose 151, LDZ, Switzerland) with a mass spectrometer (quadripole) as a detector to classify boar tainted carcasses.

Materials and Methods

In back fat (BF) samples of 35 boars and 3 castrates (essentially from Large Swiss White breed) obtained from the loin region, the concentrations of androstenone, skatole, and indole were determined by HPLC technique [1]. The androstenone, skatole, and indole concentration in the BF of boars ranged from 0.2 to 4.4, 0.02 to 0.68, and 0 to 0.14 mg/kg, respectively. As expected, the androstenone, skatole, and indole levels in the BF of castrates were lower and ranged from 0 to 0.32, 0 to 0.04, and 0 to 0.01 mg/kg, respectively. These results revealed that the highest androstenone and ska tole concentrations in the BF samples of the castrates were higher than the lowest concentrations determined in the BF of the boars.

The BF samples were also submitted to a sensory panel composed of 8 trained judges who performed an R-index olfaction test. This olfaction test was about the detection of boar taint on the BF samples as compared to a reference sample from a castrate.

Subsequent analyses of the BF samples with the SMart Nose were carried out using two different sampling modes: solid phase micro extraction (SPME) and pyrolysis. SPME was performed with a divinylbenzen/carboxen/polydimethylsiloxane fiber placed during 1 h in the headspace of a 10 mL glass vial containing 2 g of adipose tissue, heated to 90°C; data acquisition per sample lasted 7 min. Pyrolysis was performed at 700°C on a few µg of fat placed in a silica capillary tube; data acquisition lasted 200 sec. The obtained spectra were subjected to Principle Component Analysis (PC) and Discriminant Factor Analysis (DFA).

Results and discussion

PCA revealed that with SPME 97% of the BF samples and with the pyrolyser, directly coupled to the injector, 100% of the BF samples of boars were correctly discriminated against the BF samples of the castrates.

A DFA model classification (Fig. 1) based on Smart Nose-pyrolysis data (mass scanning from 10 to 160 amu), shows 100% correct classification with the following discriminating variables: 55*, 57*, 69*, 71*, 79*, 84, 85*, 89***, 90***, 91*, 93*, 94*, 111*, 124*, 130** amu (*belong to Androstenone mass spectra (MS), **belong to Skatole MS, ***belong to Indole MS).

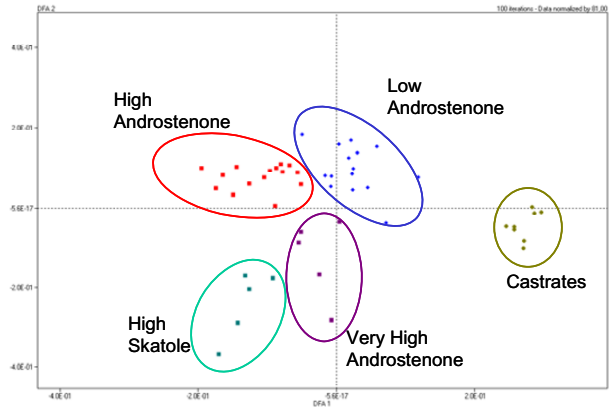

Figure 1
DFA model on 38 boar and castrate BF samples. Analysis performed with a pyrolyser directly coupled to the injection port of an electronic nose (SMart Nose). HPLC analysis was used as the reference method.

Using the DFA model, 15 out of 23 unknown samples were correctly classified into two groups: low level (<1.11 ppm) and high level (>1.11 ppm) of androstenone. This DFA model shows also trends for very high androstenone and high skatole.

From the eight misclassified samples (false positives), five were also detected as loaded with boar taint by the sensory panel. This is maybe due to the high sensitivity of panelist, or to the presence of an additional compound implicated in boar taint.

These preliminary results demonstrated the potential of the electronic nose to detect high and low levels of boar taint, independently of the taint-related compound, and therefore to sort-out boar tainted carcasses.

Additional work with considerably larger sample sets is necessary to improve the robustness of the method. Furthermore, electronic nose model classifications need to be better understood in relationship with consumers acceptance and HPLC concentrations altogether.

References

1. Hansen-Møller J: **Rapid High-Performance Liquid Chromatographic Method for Simultaneous Determination of Androstenone, Skatole and Indole in Back Fat from Pigs.** *J Chromatography B* 1994, **661**:219-230.