Validation of "human nose" based method for boar taint detection

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Abstract - **A Brussels Declaration claiming to voluntarily end surgical castration of pigs in Europe by 2018 has been signed. To ensure that boar tainted meat does not reach the consumers; validation of new methods has been initiated all over the EU. In Denmark, we have chosen to work with the so-called "hot water method" based on human nose assessment. The method set-up is simple: lard cut into (unspecified) smaller pieces are added to a 100 mL conical flask and 75 mL of boiled hot water are poured over the lard. The flask is "closed" with tinfoil and left standing for 2 min before assessment. The "hot water method" has been validated regarding the amount of lard and temperature at assessment, and it was concluded that 5 g of lard and a temperature of approx. 80°C is optimal for a valid assessment when detecting the presence of boar taint. It can further be concluded that there is no apparent decrease in assessor sensitivity during the assessment of 200 samples.**

Keywords—**Boar taint, hot water, human nose**

I. INTRODUCTION

In recent years, there has been a strong and increasing opposition towards the castrating of male piglets from, among others, various animal welfare organisations. Now a Brussels Declaration claiming to voluntarily end surgical castration of pigs in Europe by 2018 has been signed. A major problem is the risk of boar taint. Meat from some entire males develop an unpleasant flavour - boar taint - a flavour that is generally not accepted by consumers. Given the meat industry is to produce entire males in large scale, the consequences for product quality has to be addressed and a method for sorting out the tainted carcasses is needed. This has led to work all over the EU with methods that can be used in the slaughterhouses to screen and detect the tainted male pigs with the purpose of sorting out the meat from these pigs thereby ensuring that boar tainted meat does not reach the consumers. Formerly, the Danish pork sector developed a skatole method for detecting boar tainted carcasses on the slaughter line (Mortensen & Sørensen, 1984). The skatole method is still working in one Danish slaughterhouse. From an analytical point of view the method is not up to date. Furthermore, the capacity and its lifetime are limited. In addition to the skatole method, the „human nose test" is used in small productions both internationally (Agrarzeitung, 2010) and in Denmark.

In Denmark, we have chosen to work with the so-called "hot water method" based on human nose assessments. The method is dedicated to small productions of entire males and furthermore the test should be seen as a preliminary test until a new online detection method is developed and implemented. The aim of the present study was to validate some of the practical issues regarding the "hot water method".

II. MATERIALS AND METHOD

The method set-up is simple: lard cut into (unspecified) smaller pieces are added to a 100 mL conical flask and 75 mL of boiling hot water are poured over the lard. The flask is "closed" with tinfoil and left standing for 2 min before assessment.

Method validation was performed as a series of individual studies: 1) Optimal amount of lard, 2) optimal temperature at assessment and 3) manageable number of samples per day. All validation experiments were performed using lard in which the content of androstenone, skatole and indole (ASI) was known.

Optimal amount of lard. It was chosen to look at three amounts of lard; 1 g, 5 g and 10 g. The biopsy used today for skatole analysis weighs approx. 1 g. 5 g

and 10 g were chosen for variation. Three trained assessors performed the assessment.

Optimal temperature. It is important that the assessors do not "burn" their noses by the steam. However, it is equally important that the odour generated is suitable for proper assessment of the samples. The temperature development in samples were followed during 5 min in the following set-ups: 1) cold water poured over the lard and heated until boiling, 2) boiling hot water from electric kettle poured over the lard and 3) boiling water from electric kettle poured over the lard and heated until re-boiling. Three trained assessors assessed the samples.

Manageable number of samples per day. It is difficult to predict a future realistic number of samples for detection during a working day at a given slaughterhouse. Therefore we choose to look at any change in sensitivity during the assessment of 200 samples. Also the practical aspects regarding the execution of so many assessments were evaluated. Seven trained assessors performed the evaluation, and the scale used was based on four characters: 0, no boar taint; 1, weak boar taint; 2, strong boar taint and 3, doubt. The lard used was from ten pigs with variation in ASI-concentrations (Table 1), and the assessors evaluated each of the ten pigs 20 times with all ten pigs present in each round of replicates (the assessors did not know this design), all 200 samples had individual 3-digit codes.

III. RESULTS

Optimal amount of lard. It became clear that 1 g was generally too small an amount for valid detection. The odour was weak, also for known and always present odours such as "hot pig odour", "fatty odour" etc. However, lard with high contents of one or both of androstenone (e.g. 2 - 3 ppm) and skatole (e.g. above 0.5 ppm) did "stink" enough for detection of boar taint using only 1 g of lard. It was furthermore found that the assessment of samples from the same pigs using either 5 g or 10 g resulted in the same character. So, more than 5 g lard did not increase odour intensity. Therefore, 5 g of lard is recommended.

Optimal temperature. The temperature curves are shown in Figure 1. From the statements of the assessors we found that approx. 80°C was optimal. This was reached after 2 min when boiling water was added to the lard and no further heat treatment was performed. It was also found that the temperature of the lard (4°C or 20°C) had no influence on the sample temperature, nor had the three investigated amounts of lard (data not shown).

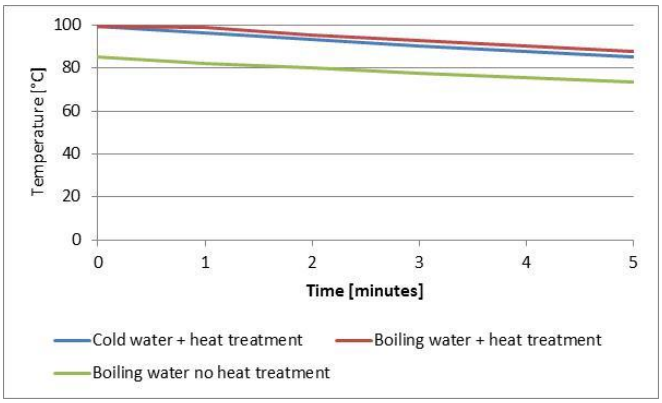

Figure 1. Temperature curves from the three different heat treatments

Manageable number of samples per day. Seven trained assessors evaluated 200 samples during one day. The validated hot water method was used (5 g of lard, boiling hot water was added and the sample was left standing for 2 min). There were no apparent problems with the assessment of 200 samples in one day. The lard used varied greatly in ASI-concentrations (Table 1) in order to reflect "real-life"-samples. The overall characters given for the ten pigs (all assessors, all 20 samples per pig) are also shown in Table 1.

It can be seen from Table 1 that based on skatole limit only, pigs 1 - 6 will theoretically have no boar taint, and pigs 8 - 10 will have boar taint and should be sorted out. However, pig no. 6 and 7 had a high content of androstenone, and they could therefore be expected to have boar taint. The panel did clearly reject pigs 6 - 10. Furthermore, half the panel also found boar taint in pig 3 and 5, both with androstenone concentrations of approx. 0.8 ppm.

Table 1. ASI-concentrations in the lard of the ten pigs. nd = not detectable. Overall assessment given for each pig by the trained panel (DMRI panel).

Gender and no.	Skatole ppm	Andro. ppm	Indole ppm	DMRI 0 = ok 1-2 = reject
Female 1	0.017	nd	Nd	0
Female 2	0.030	0.000	0.030	0
Male 3	0.032	0.758	Nd	0/1
Female 4	0.060	0.017	0.036	0
Male 5	0.105	0.829	0.061	0/1
Male 6	0.161	1.963	0.068	2
Male 7	0.208	2.262	0.649	1/2
Male 8	0.307	1.218	0.104	2
Male 9	0.579	3.490	0.432	2
Male 10	0.669	0.995	0.098	2

One way to evaluate assessor sensitivity is to look at the number of correct answers in each of the 20 rounds of replicates for each assessor, Figure 2.

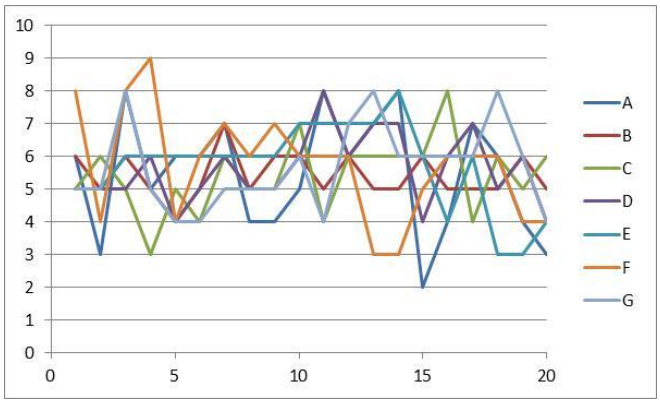

Figure 2. Number of correct answers (max 10) based on skatole limit (0.25 ppm) for each assessor (A - G) for each round of replicates (1 - 20).

It can be seen from Figure 2 that there was no clear decrease in the number of correct answers (here only based on skatole limit) during all replicates. On the other hand, all assessors seem to have fluctuated to different extents in their number of correct answers during the entire session.

IV. DISCUSSION

The validation work of the "hot water method" is on-going and will, among other issues, include a series of tests with 200 samples in order to elucidate whether sensitivity might develop over time (within this set-up). With many samples during one day at a slaughterhouse, this method will demand more than one person working with this analysis. Furthermore, it is of the outmost importance that the assessors performing the assessments are sensitive to both skatole and androstenone as the concentrations vary greatly between pigs (Table 1).

V. CONCLUSION

The "hot water method" has been validated regarding the amount of lard and temperature at assessment, and it was concluded that 5 g of lard and a temperature of approx. 80°C are optimal for a valid assessment when detecting the presence of boar taint. It can further be concluded that there is no apparent decrease in sensitivity during the assessment of 200 samples.

ACKNOWLEDGMENT

This work is financed by the Danish Pig Levy fond.

REFERENCES

1. Agrarzeitung (2010): Nur die menschliche Nase gibt Sicherheit. Agrarzeitung Ausgabe 21 / 28. Mai 2010

2. Mortensen, A.B. & Sørensen, S.E. (1984): Relationship between boar taint and skatole determined with a new analytical method. Proceedings 30th European Meeting of Meat Research Workers, Bristol, England, 394-396.