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THE RELEVANCE OF ELEVATED LEVELS OF BOAR TAINT COMPOUNDS IN IMMUNOCASTRATED PIGS

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I. INTRODUCTION

Vaccination with Improvac® is an active immunization against the gonadotropin-releasing hormone (GnRH), a key hormone in the endocrine cascade for the regulation of fertility. When used correctly, immunocastration and surgical castration lead to a comparable result in terms of boar taint [1, 2]. Despite the fact that vaccination with Improvac® has been utilised globally for over two decades, and a substantial corpus of scientific literature exists pertaining to numerous aspects of vaccination, there was a paucity of empirical research examining the repercussions of immunocastration under practical conditions. Herein, we studied the occurrence of boar taint compounds in IC vs. female pigs originating from a wide range of commercial farms. In addition, a sensitive approach for sensory evaluation was applied to study the practical relevance of elevated levels of androstenone and skatole in fat from IC vs. female pigs.

II. MATERIALS AND METHODS

Animals: A total of 426 immunocastrated male pigs (IC) and 414 female fattening pigs (S) originating from 40 different fattening farms were sampled on 7 slaughter days at a commercial slaughter house in Germany for carcass and meat quality assessment. The average carcass weight (*M* = 95.6 kg) is considered representative of currently slaughtered fattening pigs. *Chemical analysis of boar taint compounds:* The chemical analysis of androstenone (AND), skatole (SKA) and indole (IND) was performed from melted neck fat of IC (n=424) and female pigs (n=47) by solid phase extraction and gas chromatography coupled with mass spectrometry (SPE-GC-MS) using isotope-labeled reference standards [3]. The results are expressed in nanograms per gram of melted fat. *Sensory analysis:* For sensory evaluation IC and S were presented in a paired comparison a.k.a. 2-AFC test (“Which of the two samples smells has a higher odor intensity (of androstenone/skatole)?”). The neck fat samples were heated using a soldering iron. Each pair was evaluated by 10 trained panelists while using a balanced sample order design; all tests were repeated twice in independent sessions. Panelists were selected on their individual olfactory performance for the key compounds AND, SKA and IND and then trained for boar fat evaluation. Based on the chemical test results (see above), 2 cells of 10 animals each were formed, i.e. (potentially) suspicious IC due to elevated ASI levels and non-suspicious IC (low ASI values) (see Fig. 1 B). In each instance, female animals from the same fattening farm were selected for the purpose of conducting pairwise comparisons with the objective of excluding farm/diet effects. The statistical evaluation of the pairwise tests was carried out using the R package sensR.

III. RESULTS AND DISCUSSION

The IC exhibited an average concentration of 177 ng AND and 32 ng SKA per g of melted fat, with individual measurements reaching up to 1611 ng AND and 251 ng SKA (Table 1). Of the IC, 1 animal exceeded a tentative threshold for potential (slight) odor abnormalities of 1,500 ng AND, and 5 animals exceeded the tentative threshold of 150 ng skatole (Figure 1 A/B). This corresponds to a total of 1.4% of the IC carcasses examined (6/424). The mean SKA and IND values in backfat of female animals examined were, on average, comparable to IC. In individual females, however, up to 242 ng AND was measured, and comparatively high IND values were found in some female pigs (Table 1, Figure 1 A). The pairwise smell tests revealed that, with their levels of boar taint compounds in the non-suspicious (“safe”) range (AND < 500 ng/g melted fat, SKA < 150 ng/g fat) IC were rated less often as more intense than females. With elevated levels, however, IC were significantly more often rated as more intense overall (78% of all paired tests; Figure 1 C). When looking at the individual pairings of animals (with 20 paired comparisons each), 7 out of 10 IC were rated significantly more intense ($p < .05$) than their female counterpart (data not shown). Furthermore, a tentative threshold could be derived: backfat samples from IC with AND > 800 ng/g and/or SKA > 200 ng/g are more often perceived as more intense when compared directly to female animals.

Table 1 – Androstenone, skatole and indole levels (in ng/g melted fat) of immunocastrated male (IC) and female (S) pigs.

Variable/sex	*n*	Mean	SD	CV%	Median	Min	Max
Androstenone							
IC	423	177.9	144.32	81.1	138.8	52.3	1611.0
S	47	114.1	41.70	36.5	110	0.0	242
Skatole							
IC	424	32.8	26.86	81.8	26.5	0.2	251.7
S	47	29.9	21.18	71.0	30	0.0	110
Indole							
IC	47	18.7	12.03	64.3	18	0.0	53
S	423	23.1	20.06	86.8	18.2	0.3	169.5

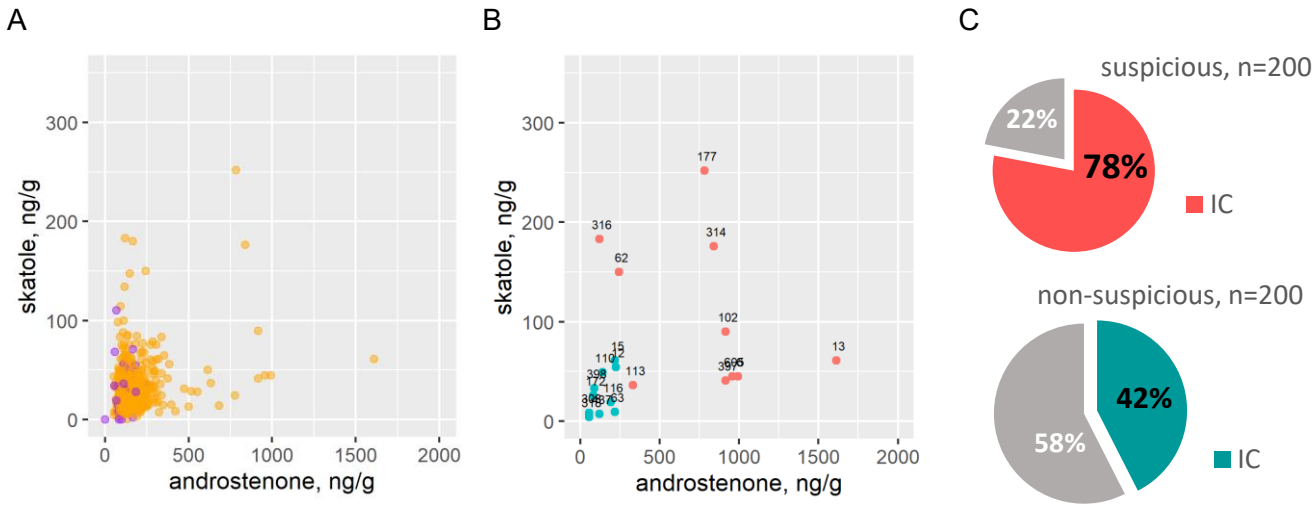


Figure 1: A) Content of androstenone and skatole in the examined neck fat samples of IC (orange) and female fattening pigs (purple), B) illustration of the selection of potentially conspicuous samples (red) and potentially inconspicuous (turquoise) IC samples for sensory evaluation (sample 113 had elevated indole levels and was therefore labelled “suspicious”; C) cumulative results of the pairwise comparisons. The percentage reported indicates which sample was selected as the “higher in boar odor”. With increased ASI content in the IC samples, these were significantly more often (78%) perceived as more intense than female samples (upper panel), while in chemically suspicious IC samples, the female samples (grey) are more frequently described as more intense (lower panel).

IV. CONCLUSION

Elevated levels of AND and SKA in IC indeed have an impact on the human perception. Backfat from IC with AND >800 ng/g and/or SKA >200 ng/g is perceived as more intense than fat from females. Not necessarily, however, fat (even less likely meat) of these animals is deprecated by consumers because highly trained panelists were used herein. Overall, IC yields a low risk of (slight) odor deviations, comparable to the incidence of cryptorchids[4].

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