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A sensory description of boar taint and the effects of crude and dried chicory roots (*Cichorium intybus* L.) and inulin feeding in male and female pork

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Abstract

Sensory profiling studies were carried out to evaluate the effects of chicory root (*Cichorium intybus* L.) and inulin bioactive feeding with respect to reducing the 'off-flavour' boar taint in intact male and female pork *Longissimus dorsi* and *Psoas major*. Feeding treatments significantly reduced perceived sensory boar taint in the cooked pork meat of intact males in both muscles. There were also indications that crude chicory was also effective in taint descriptor reduction in female pork, however not to the same systematic level as in male animals. Chemical measurements for skatole and androstenone were highly predictive of specific sensory descriptors of boar taint reduction. Feeding of crude, dried chicory and inulin were also determined not to impart negative sensory characteristics upon boar taint reduction. Chicory feeding therefore must be considered to have the potential for utilisation as part of a strategy for boar taint reduction in intact male pork.
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Keywords: Chicory; Boar taint; Pork meat; Descriptive sensory profiling; Multivariate data analysis

1. Introduction

Sensory boar taint is widely reported to have a distinctive and unpleasant character which evokes repulsion and rejection when perceived through a combination of odour, flavour and taste in pork and pork products during cooking and eating (e.g. Gunn et al., 2004). It has been described as consisting of key sensory characteristics reminiscent of 'male pig', 'animal', 'urine', 'faecal' and/or 'sweat' which are largely causal in terms of the negative reaction with respect to human sensory perception (e.g. Dijksterhuis et al., 2000; Gunn et al., 2004). It is widely considered that two compounds are largely causal in boar taint namely, 3-methyl indole and 5α-androst-16-3-one, commonly referred to as skatole and androstenone, respectively (e.g. Babol, Squires, & Gullet, 1996; Patterson, 1968; Vold, 1970; Walstra & Maarse, 1970).

Sensory profiling, a method by which a panel uses a developed sensory vocabulary to describe perceived sensory boar taint characteristics in the sample sets has been utilised in the present research (see Byrne, O'Sullivan, Dijksterhuis, Bredie, & Martens, 2001a; Byrne et al., 2001b; ISO, 1985, 1994a, 1994b; Meilgaard, Civille, & Carr, 2007). The resultant profiles are perceptual maps of the variation in a sample type that can be employed alone or in combination with chemical/instrumental measurements and potentially consumer studies in the explanation and elucidation of underlying predictive and causal relationships (e.g. Bryhni et al., 2002, 2003).

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Boar taint is an issue which requires renewed attention as for welfare reasons it is likely that castration of male piglets without analgesia will most likely be prohibited in the future in the European Union (Gunn et al., 2004). Legislation prohibiting castration of pigs is already scheduled to take effect in Norway in 2009 (Landbruksdepartementet, 2002) and in Switzerland in 2009 (CSEC, 2005). A similar legislation is under discussion in relation to Danish organic pig production. Thus, there is a pressing need for alternative means and approaches to control or avoid boar taint in pig production. One such approach is the use of specific 'bioactive' ingredients i.e. foods that exert biological effects not directly related to the nutritive value. Chicory roots (*Cichorium intybus* L.) are a bioactive crop that has been shown to reduce skatole and androstenone in intact male and female pigs thus this may positively affect eating quality (Hansen et al., 2006a).

The present research presents the sensory eating quality aspects with respect to a paper previously published which presents detailed feeding, production, growth and chemical results pertinent as background to the present articles feeding regimes (Hansen et al., 2006a). Hansen and co workers found that feeding chicory both in crude and dried form resulted in a significant reduction in boar taint related chemical compounds.

The objectives of the present study were to investigate the sensory variation that resulted from the effects of various bioactive (crude/dried chicory and inulin) finishing feeding strategies in intact male and female cooked pork. Of specific focus was the effect of such bioactive feeding on the 'off-odour/flavour' referred to as boar taint in the meat samples. To achieve these aims descriptive sensory vocabularies were developed with expert sensory panels and subsequently these panels were utilised to develop a sensory profile for the sets of meat samples, derived from male and female animals fed chicory and inulin for differing periods of time prior to slaughter.

2. Materials and methods

2.1. Meat samples

All experimental animals of two profiling investigations to be termed experiment 1 and 2, were Danish crossbred pigs of Duroc sire × zigzag crossbred dam of Danish Landrace × Large White (D× (L × Y) produced at Faculty of Agricultural Sciences, Tejle, University of Aarhus. In experiment 1 both intact male (total no. = 16) and female pigs (no. = 16) were used, intact male pigs only were used in experiment 2 (total no. = 32), (see Table 1 and Hansen et al., 2006a for additional details). The animals were treated in accordance with the guidelines outlined by The Danish Inspectorate of Animal Experimentation, which also gave permission to take blood samples. At the approved abattoir at Faculty of Agricultural Sciences, Tejle, University of Aarhus, the pigs were supervised by a veterinary surgeon before and after slaughter. Specific details of diet compositions are presented in Hansen et al. (2006a) and these conformed to Danish recommendations (Madsen, Petersen, and Soegaard, 1990). A summary of experiment 1 treatments, organic concentrate (control), (ConCtrl), organic concentrate + silage (OrgCtrl), and organic concentrate + crude chicory, 4 and 9 weeks (CC4 and CC9) are presented in Table 1. In the second experiment, pigs were allocated to the following four treatments organic concentrate + silage (control), (OrgCtrl) and organic concentrate + crude and dried chicory, 6 weeks (CC6, DC6) and Inulin, 6 weeks (I6) (Table 1).

2.2. Sample preparation for sensory profiling

2.2.1. Experiment 1. Profile Longissimus dorsi 1 (patties), intact male, and female animals

All *Longissimus dorsi* 1 (LD 1) muscles were stored vacuum packed in darkness at −20 °C until required for sen-

Table 1
Control and experimental diets for experiment 1, crude chicory feeding for 4 and 9 weeks and experiment 2, crude, dried chicory and inulin feeding for 6 weeks prior to slaughter

Treatment	Treatment abbreviations	Organic concentrate	Clover grass silage	Chicory roots		
				Crude (CC)	Dried (DC)	Inulin[c] (I)
Experiment 1						
Organic concentrate (no silage)	ConCtrl	100[d]	–	–	–	–
Organic concentrate + silage	OrgCtrl	95	*ad libitum*	–	–	–
Organic concentrate + crude chicory 4w	CC4	95[a]/70[b]	*ad libitum*[a]/–[b]	–[a]/25[b]	–	–
Organic concentrate + crude chicory 9w	CC9	70	–	25	–	–
Experiment 2						
Organic concentrate + silage	OrgCtrl	95	*ad libitum*	–	–	–
Organic concentrate + crude chicory 6w	CC6	70	–	25	–	–
Organic concentrate + dried chicory 6w	DC6	70	–	–	25	–
Organic concentrate + inulin 6w	I6	70	–	–	–	14

[a] Control treatment (OrgCtrl) day 0 to 35 (i.e. 5 weeks).
[b] Supplemented with chicory (CC4) day 35 to 63 (i.e. the last 4 weeks (w) before slaughter).
[c] Raftiline®HP, Orafti Ltd., Belgium (produced from chicory roots).
[d] According to Danish recommendations by Madsen et al. (1990) all energy values are given as % of total energy intake per day (see Hansen et al., 2006a).

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