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IMMUNOCASTRATION - A STRATEGY TO PRODUCE "TAINT-FREE" HIGH QUALITY PORK FROM INTACT BOARS.

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WHAT IS BOAR TAINT AND HOW DOES IT REDUCE MEAT QUALITY ?

Boar taint presents as a distinct unpleasant perspiration-like, faecal-like, or urine-like smell, when fat or meat from some entire mature boars is cooked. Taint is rarely detected in meat from gilts, castrated boars, or sexually immature boars. However, not all boars of the same age and weight will exhibit "taint". Furthermore, not all people are able to detect the compounds reported to cause taint. Thus not all "tainted" carcasses will be offensive to all consumers.

Two major compounds are thought to be responsible for the reduced meat quality associated with boar taint, androstenone and skatole. The concentration of both of these is higher in the fat of boars than in either castrates or gilts (Bonneau et al., 1991). The most common method of controlling taint is castration. However, animal welfare concerns about castration and the substantial production advantages of intact boars versus castrates are driving many countries to find alternative methods to control boar taint.

A PROMISING NEW STRATEGY FOR ENSURING HIGH MEAT QUALITY AND IMPROVING PRODUCTION EFFICIENCY

One method of improving production efficiency, whilst maintaining high meat quality by controlling boar taint, is to raise intact boars and to vaccinate against LHRH. We have previously reported on the development of a "user-friendly" vaccine which allows boars to be raised as functionally intact males for the majority of their life. When the vaccine is administered a few weeks prior to slaughter testicular function is rapidly and totally inhibited. The consequences of stopping testes function is that boar taint is eliminated (Hennessy et al., 1994). We report here the effects of vaccination of heavy boars on the chemical and sensory evaluation of taint.

METHODS

A synthetic LHRH peptide was conjugated to a carrier protein and mixed with an adjuvant, approved for use in food producing animals. At approximately 20 weeks of age, 16 intact Large White, Landrace crossbred boars were allocated to vaccinated or non-vaccinated control groups. The vaccinate group received two doses of vaccine (2 ml) given subcutaneously high on the neck, at 6 weeks and 3 weeks prior to slaughter. No adverse reactions to either vaccination were noted in any pig throughout the trial. The pigs were slaughtered at about 115 kg and the loins were collected and frozen at -20 ^{o}C until used for the sensory evaluation. Fat from the belly region from each pig was collected at slaughter for the analysis of taint, by measuring the fat concentration of androstenone; using a the method of Brabander and Verbeke, (1986); and of skatole using method of Hansen-Moeller (1992).

Sensory Evaluation

An untrained consumer-type panel consisting of 30 individuals was used to evaluate both cooked and raw samples of pork. Meat from vaccinated boars, non-vaccinated boars (control) and sows was included. The samples for each group were derived from eight animals. Graphic rating scales were used in the questionnaire.

Cooking and Presentation of Pork

The pork was cooked in a fan-forced electric oven at 260 ^{o}C for 8 minutes and cut into 2.5 cm square pieces. Each panellist assessed samples from six animals (two animals from each treatment group) and each animal was assessed by either six or nine panellists. A randomized incomplete block design was used to allocate samples to panellists. In addition, the six corresponding raw samples were evaluated by each panellist, however, different blinding codes were used for the raw samples. It was ensured that all samples were hot during the evaluations so that the boar odour and flavour could be easily detected.

REML analysis (Patterson and Thompson, 1971) was carried out on the response scores to determine any significant differences between treatments. Bartlett's test for homogeneity of variance was used to compare the variation in animals within each treatment group. All comparisons were at the 5% level.

RESULTS and DISCUSSION

The results of this experiment are in agreement with our other demonstrations (Hennessy et al., 1994) that vaccination against LHRH was highly effective in stopping testicular steroidogenesis and in subsequently reducing the fat concentration of both androstenone and skatole. In this trial testosterone in the vaccinates was almost non-detectable (see Table 1). Further evidence of a suppression of testes function can be seen in the significant reduction in mean testes weight ($P<0.01$, see Table 1).

A fat androstenone concentration of greater than 0.5 μg/g is associated with offensive odour, in people sensitive to androstenone. In the non-vaccinated controls androstenone was well above the sensory threshold in 6 of the 8 boars. In contrast, all of the vaccinates had androstenone concentrations well below the sensory threshold (see Table 1 for summary of data). Similarly, skatole in the vaccinates was consistently below the sensory threshold for skatole of 0.20 μg/g. A skatole concentration of greater than 0.2 μg/g fat is associated with offensive odour in people who are sensitive to skatole. In the control boars, skatole was generally higher and in 2 individuals was above 0.2 μg/g (see Table 1 for summary of data).

Consistent with our previous experiments there were no effects of vaccination on live-weight at slaughter or back-fat thickness in the current trial. On these parameters the growth of vaccinated boars was the same as non-vaccinated controls (see Table 1)

Table 1. Mean and standard deviation of live weight, paired testes weight, serum testosterone concentration and fat tissue concentration of skatole and androstenone in control and vaccinated intact boars.

	Live weight (kg)	Testes weight (gm)	Testosterone (nmol/L)	Skatole (µg/g)	Androstenone (µg/g)
Vaccinates	118.7 ± 5.1	315.1 ± 63.7	0.39 ± 0.13	0.044 ± 0.047	0.22 ± 0.08
Controls	113.5 ± 9.3	485.5 ± 62.5	8.7 ± 3.45	0.146 ± 0.285	0.87 ± 0.45

In the sensory evaluation of the meat panellists detected a significantly stronger unpleasant/boar odour and unpleasant/boar flavour in the samples from non-vaccinated boars than in those from the vaccinated boars and sows. There were no significant differences between the three groups in the acceptability of meat flavour however, the non-vaccinated boar meat had the lowest mean (A low score indicates lower acceptability). For acceptability of odour, the control boar group had a significantly lower mean score than the sows, but the mean score of the vaccinated boars was not significantly different from the non-vaccinated boars or the sows.

The evaluations of the raw meat showed that panellists did not perceive any significant differences in odour and colour between the three groups.

The variance of the vaccinates was significantly lower than that of the non-vaccinated boars for strength of meat flavour. With respect to unpleasant/boar flavour, the variance of the sows was significantly lower than the other two groups. It should be noted that although the difference between the vaccinated and non-vaccinated boars was not significant for unpleasant/boar flavour, the variance of the vaccinated boars was lower than that of the non-vaccinated control boars.

Although the test for homogeneity of animal treatment group variances was not significant ($p>0.15$), for either the acceptability of odour of raw meat or the intensity of unpleasant/boar odour of raw meat, when pairwise comparisons of the variances were completed (using the variance ratio (F) test), the variance of the vaccinated boars was found to be significantly lower than that of the non-vaccinated boars for both these attributes ($p<0.05$).

CONCLUSIONS and INDUSTRY SIGNIFICANCE

Our studies have shown that the meat quality of intact boars can be substantially improved by using anti-LHRH vaccines to eliminate boar taint. We have developed a user friendly, experimental vaccine, against LHRH, which is highly effective in reducing the fat concentration of androstenone and skatole to well below their respective sensory thresholds. When meat from vaccinated boars was assessed for taint, by sensory evaluation, it was found to be indistinguishable from meat from female pigs.

This vaccine promises to be a very useful management tool, which when used at strategic stages of production will enable producers to substantially increase production efficiency by marketing intact boars, of any weight, with confidence that they will be "taint-free". Further work is under way to determine whether such a vaccine can be produced on a commercially viable basis.

REFERENCES

Brabander, H.F. and Verbeke, R. (1986). *J. Chromatog.* **363:**293-302.

Bonneau, M., Le Denmat, M., Vaudelet, J.C. and Veloso Nunes, J.R. (1991). *J. Rech. Porc* **23:**325-338.

Hansen-Moeller, J. (1992). *J. Chromatog.* **624:**479-490.

Hennessy, D.P., McColl, M., McNamara, M., Mosbey, J., Wan, S.S., Salvatore, L., Sali, L. and Waldron, D. (1994). *Proc 13th Int Pig Vet Soc* , Bangkok, June 1994, p 487

Patterson, H.D. and Thompson, R. (1971). *Biometrika* **58:**545-554

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