

PE1.44 Vaccination against GnRF and dietary inulin decrease fat skatole with the former being prolonged and reducing fat androstenone 284.00

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Abstract—The principal compounds contributing to taint in boars are androstenone and skatole, which are found at much higher levels in the carcasses from boars than from either gilts or barrows. Immunisation against GnRF offers a means of reducing the boar taint compounds androstenone and skatole while maintaining most of the production efficiencies associated with entire boars. In addition, there may be nutritional means of reducing skatole such as inulin supplementation. Twenty four boars (16 weeks of age) were allocated to either control, dietary inulin (2.5%) or vaccination against GnRF. Vaccinated boars were given the anti-GnRF vaccine (Improvac®, Pfizer Animal Health, Parkville) at 16 and 20 weeks of age while inulin was fed from 22 weeks of age. Adipose tissue biopsies were taken at approximately weekly intervals between 20 and 24 weeks of age and analysed for skatole. Vaccination against GnRF decreased ($P<0.05$) adipose tissue skatole concentrations by 17 days after the secondary vaccination and continued to decline until 28 days after the vaccination. Dietary inulin supplementation suppressed ($P<0.05$) adipose tissue skatole 4 days after commencing the supplementation although the concentrations had rebounded 7 days later. Vaccination against GnRF decreased ($P<0.006$) adipose tissue androstenone concentrations at slaughter while dietary inulin had no effect. In conclusion, vaccination against GnRF decreases testes growth, plasma testosterone and adipose tissue skatole and androstenone with these effects being maintained for at least 4 weeks after the secondary vaccination. Dietary inulin does have the potential to decrease adipose tissue skatole but not androstenone.

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I. INTRODUCTION

The major reason why male pigs are still castrated in much of the world is because of the issue of boar taint. The principal compounds contributing to taint in boars are androstenone and skatole, which are found at much higher levels in the carcasses from boars than from either gilts or barrows. A large multisite European study has demonstrated that both androstenone and skatole have negative effects on consumer perception of pork quality, although there are clearly differences between men and women and people from different regions in levels of each compound that cause dissatisfaction [1,2,3,8]. Although the authors stated that it was not possible to determine threshold values, they presented regression equations to predict consumer dissatisfaction [8]. Overall, 21.5 and 32.5% and 18.5 and 26.0% of consumers were dissatisfied with the flavor and odor of boars and gilts, respectively [2].

Dunshea et al. [4] found that fat from boars had androstenone and skatole levels over ten and 2.5 times greater respectively, than those of barrows. Disturbingly, 10% of boars had high concentrations of both androstenone ($>1.0 \mu\text{g/g}$) and skatole ($>0.20 \mu\text{g/g}$). Recently, a vaccine (Improvac™) containing a modified form of GnRF in a low reactogenic adjuvant system has been developed to reduce the production and accumulation of both androstenone and skatole in pig carcasses [4]. The vaccine formulation and protocol allows the pigs to receive the secondary vaccination relatively close to slaughter. Any taint substances already present are progressively metabolised, allowing the entire boar to be slaughtered at a higher live-weight without taint and after having earlier benefited from the effects of its own testicular steroids on growth and carcass composition [4]. An alternative approach to reducing one of the taint substances, skatole, is through altering microbial tryptophan catabolism in the hind gut through providing fermentable dietary carbohydrates such as inulin [5,6,7]. The aim of this study was to examine the temporal pattern of adipose tissue skatole after immunological castration and dietary inulin supplementation.

II. MATERIALS AND METHODS

A. Animals and handling

Twenty four Large White x Landrace boars (16 weeks of age) were weighed, blocked by weight and allocated randomly within each block to one of three treatments: control, dietary inulin or vaccination against GnRF. The standard wheat and barley based finisher diet was formulated to contain 14.1 MJ/kg DE, 16.3% protein, approximately 8% fiber and 0.77 g lysine/MJ DE, except for the period where the inulin group were also supplemented with 2.5% w/w inulin (Rafteline, Bleaky Foods, Silverwater, NSW). Feed was provided *ad libitum*.

At 16 weeks of age the 8 boars destined to be immunologically castrated were given a primary vaccination with 2 mL of the vaccine (Improvac™, Pfizer Animal Health, Parkville), subcutaneously in a single site in the back of the neck. All the animals were housed in a single pen for four weeks until at 20 weeks of age they were moved to individual pens at which time pigs were revaccinated with the same volume of vaccine on the other side of the neck. Blood and biopsy samples of back fat were collected from each animal. Blood and biopsy samples were taken a week later. One week later the inulin group were started on the inulin supplemented feed. Two days after the start of the inulin treatment, blood and biopsy samples were taken from each animal. One week after the start of the inulin treatment (four days after the previous sampling) a further set of blood and biopsy samples were taken. Seven days later, the pigs were slaughtered at a commercial abattoir and blood, testes, fat and carcass measurements were collected.

B. Chemical and statistical analyses

Fat skatole and androstenone and plasma anti-LHRH titres and testosterone were measured using validated assays [4]. Plasma anti-LHRH titres and testosterone were measured in only the control and vaccinated boars on days 0, 17 and 28. Adipose tissue skatole and plasma measures were analysed by Residual Maximum Likelihood ANOVA (Genstat Release 11) for the main and interactive effects of treatment and time. Adipose tissue androstenone at slaughter data were analysed by ANOVA for the effect of treatment. Data were log-transformed before analyses due to the heterogeneous nature of the variances. Data are presented as back-transformed geometric means.

III. RESULTS AND DISCUSSION

The vaccination was successful as assessed by adequate anti-GnRF titres of 1430 ± 210 and

890 ± 110 at 14 and 28 days after secondary vaccination while plasma testosterone was reduced ($P < 0.001$) at both 14 (5.0 v. 0.1 nmol/L for entire and vaccinated boars, respectively) and 28 (39.4 v. 0.5 nmol/L) days after secondary vaccination. Testes weights at slaughter were also lower ($P < 0.001$) in the vaccinated boars (474 v. 267 and 435 g for entire, vaccinated and inulin-fed boars, respectively). The magnitude of these effects are very similar to those observed previously in vaccinated boars [4,9,10].

Vaccination against GnRF decreased ($P < 0.05$) adipose tissue skatole concentrations by 17 days after the secondary vaccination and continued to decline until 28 days after the vaccination (Figure 1).

Dietary inulin supplementation suppressed ($P < 0.05$) adipose tissue skatole 4 days after commencing the supplementation although the concentrations had rebounded 7 days later (Figure 1). Possibly because of low replication there was no effect of treatment on the number of animals with adipose tissue skatole above 0.20 $\mu\text{g/g}$ (2 v. 0 and 2 for entire, vaccinated and inulin-fed boars, respectively, $P = 0.16$). Vaccination against GnRF has previously reduced adipose skatole to a similar extent by 28 days after vaccination [4,9].

For example, Dunshea et al. [4] found that entire boars had fat skatole levels double those of the vaccinated boars with 11 and 0% of the control and vaccinated boars with fat skatole concentrations above 0.20 $\mu\text{g/g}$, respectively. A number of researchers have investigated whether hindgut tryptophan catabolism could be reduced using fermentable carbohydrates that escape digestion in the small intestine such as chicory, raw potato starch, and inulin as a means of reducing skatole absorption and accumulation in adipose tissue [5,6,7].

For example, Jensen [6] found that raw potato starch was the most effective of a number of fibre sources in reducing plasma skatole.

Also, others we were able to reduce adipose tissue skatole by feeding chicory or inulin for between 4 and 9 weeks [5]. Dietary chicory reduced plasma skatole within 3 days with the reduction being maintained until at least 14 days [5]. In the present study the effect of dietary inulin on skatole (-37%) was evident after 4 days but the effect had disappeared 1 week later.

The reasons for the differences are unclear but may be due to the inclusion rate of inulin (2.5%) being insufficient to maintain suppression of tryptophan catabolism.

Vaccination against GnRF decreased adipose tissue androstenone concentrations at slaughter while dietary inulin had no effect (0.60 v. 0.15 and 0.51 $\mu\text{g/g}$ for entire, vaccinated and inulin-fed

boars, respectively, $P < 0.006$). Despite the low replication there was no effect of treatment on the number of animals with adipose tissue skatole above $0.50 \mu\text{g/g}$ (4 v. 0 and 5 for entire, vaccinated and inulin-fed boars, respectively, $P = 0.006$). Vaccination against GnRF has previously reduced adipose tissue androstenone to a similarly [4,9,10]. For example, Dunshea et al. [4] found that entire boars had fat skatole levels 8x those of the vaccinated boars. Others have also failed to see an effect of dietary inulin or fermentable carbohydrate on plasma or adipose tissue androstenone [5].

IV. CONCLUSION

In conclusion, vaccination against GnRF decreases testes growth, plasma testosterone and adipose tissue skatole and androstenone with these effects being maintained for at least 4 weeks after the secondary vaccination. Dietary inulin does have the potential to decrease adipose tissue skatole but not testes function or adipose tissue androstenone. In markets where skatole alone is considered to cause boar taint then strategic use of dietary inulin may improve meat quality of pork from entire boars. However, in markets where both skatole and androstenone contribute to boars taint, vaccination against GnRF offers an environmentally and animal welfare friendly alternative to ensure the production of high quality pork.

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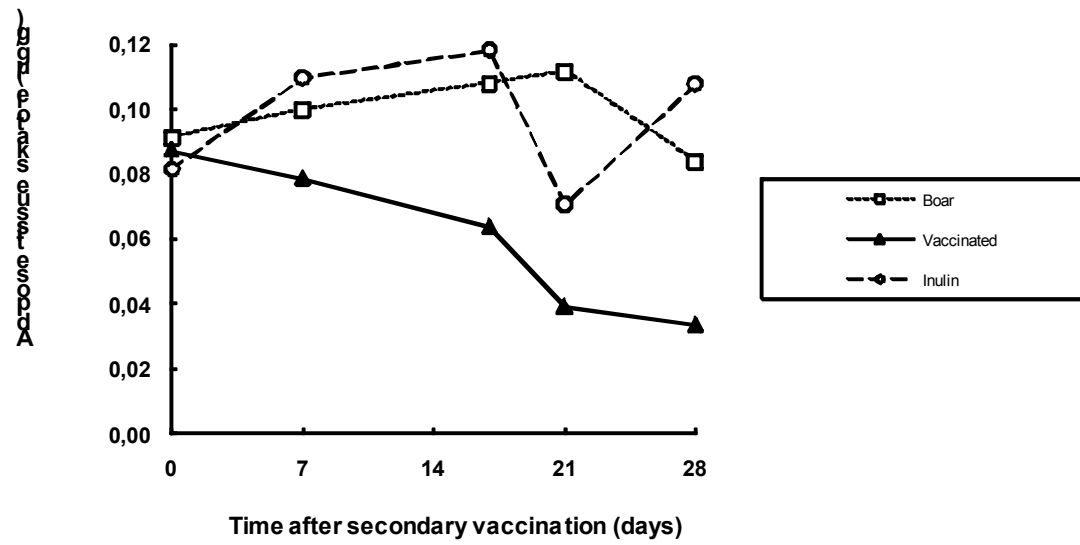


Figure 1. Effect of immunological castration and dietary inulin on fat skatole concentrations.