

# SKATOLE AND ANDROSTENONE CONTENT OF PORK FAT FROM FINISHER PIGS FED CHICORY INULIN OR ORGANIC IRON SUPPLEMENT

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Competitive Pork Industry

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## Executive Summary

This project was undertaken by the Victorian Department of Primary Industries to provide quantitative analysis of pork fat samples collected from an experiment conducted at DPI Werribee pig research facilities in pigs fed chicory inulin or organic iron as a dietary supplement. The experimental design and the outcomes on growth performance, blood parameters and muscle composition have been reported previously to Pork CRC Pty Ltd under the DPI VIC project agreement CMI-102740 (MIS-08578): Nutritional Manipulation of Iron level in Finisher Pigs and Fresh Pork.

There was an inulin × sex interaction such that inulin reduced ( $P < 0.06$ ) skatole content in males (0.031 vs 0.025 mg/ kg fat tissue) while in female pigs (0.025 vs 0.034) the levels were increased. Similarly, there was an interaction between inulin and iron supplementation that inulin with organic iron reduced ( $P < 0.03$ ) skatole concentration (0.041 vs 0.020 mg/ kg fat tissue) but not with organic iron without inulin (0.026 vs 0.027) supplementation. Neither inulin nor organic iron had main effect on androstenone concentration including their (inulin or organic iron) interactions. The results suggest that dietary inulin, with or without organic iron, may lower the skatole content of pork in male pigs. This might have been due to the digestion and absorption process associated with chicory inulin fibre in the large intestine and warrants further investigation.

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## 1. Introduction

Taint from skatole and androstenone compounds in pork is an off-flavour that influences consumer perception and acceptability and therefore, the marketing and profitability of the pork industry. In general, male pigs produce more taint than females or castrates due to their greater anabolic potential, their higher level of intestinal exfoliation and the inhibitive effect of testosterone on skatole degradation and absorption (Babol *et al.*, 1999). Chicory inulin is a non-digestible oligosaccharide that stimulates the growth and activity of specific bacteria species in the large intestine and releases short-chain fatty acids (SCFA). Skatole released during tryptophan breakdown in large intestine by bacteria and absorbed in fat tissues in the body is believed to cause boar taint (Verheyden *et al.* 2007). The SCFA produced in the large intestine with chicory inulin may influence the level of skatole production in male pigs. This study investigated the effect of chicory inulin or organic iron supplement or the combination, fed to finisher pigs, on skatole and androstenone content of pork.

## 2. Methodology

For details of diets, management of animals, slaughter procedure and sample collection refer final research report submitted to Pork CRC through DPI VIC project agreement CMI-102740 (MIS-08578): Nutritional Manipulation of Iron level in Finisher Pigs and Fresh Pork. In brief, thirty two finisher pigs (Large White x Landrace; 16 males and 16 females) weighing  $51.1 \pm 0.41$  kg were allocated to a 2x2x2 factorial with supplemental chicory inulin (0 and 50 g/kg Fibruline®, Warcoing, S.A. Belgium) or organic iron (0 and 500 mg/kg Bioplex™, Alltech Inc., Kentucky, USA) and sex as respective factors. Pigs were housed individually and had *ad libitum* access to feed and water for five weeks feeding study. After 5 weeks of feeding, pigs were slaughtered at a commercial abattoir. At 24 h post slaughter, adipose tissue around the 12<sup>th</sup>/13<sup>th</sup> rib was collected and stored under -18°C until further analysis. Fat tissues were processed and skatole and androstenone concentrations were determined by liquid chromatography tandem mass spectrometry analysis. Detailed methodology is reported in the DPI final research report submitted to the Pork CRC separately as part of this project.

## 3. Outcomes

Table 1 shows the skatole and androstenone concentrations of pork fat tissues used in the present study. The skatole and androstenone concentrations in pork in the present study were lower than the threshold levels for the development of off-flavour published in the literature. This could be due to the type of basal diets used or the clean rearing condition of pigs. Organic iron supplementation reduced skatole concentration ( $P < 0.04$ ) in pork both in males (0.033 vs 0.024 mg/kg fat tissue) and females (0.034 vs 0.022). Inulin or sex had no main effect ( $P > 0.05$ ). There was an inulin  $\times$  sex interaction such that inulin reduced ( $P < 0.06$ ) skatole content in males (0.031 vs 0.025 mg/ kg fat tissue) while in female pigs (0.025 vs 0.034) the levels were increased. Similarly, there was an interaction between inulin and iron supplementation such that inulin with organic iron reduced ( $P < 0.03$ ) skatole concentration (0.041 vs 0.020 mg/ kg fat tissue) but not with organic iron without inulin (0.026 vs 0.027) supplementation. There was no interaction between sex and organic iron supplementation on skatole level. However, there was an interaction between sex and inulin and organic iron, where in both males and females, inulin with organic iron reduced ( $P < 0.05$ ) skatole levels but not with organic iron without inulin supplementation (Table 1). Neither inulin nor organic iron had main effect on androstenone concentration including their (inulin or organic iron) interactions (Table 1). The results demonstrate that dietary inulin with or without organic iron may lower the skatole content of pork in male pigs, which is associated with the digestion process of chicory inulin in the large intestine and warrants further investigation.

#### **4. Application of Research**

The results presented in this report will be used along with other measurements in scientific publications or industry articles related to the effect of dietary inulin or organic iron supplement on pig performance and pork flavour characteristics and quality.

#### **5. Conclusion**

The results demonstrate that dietary inulin, with or without organic iron, may lower the skatole content of pork in male pigs. This might have been due to the digestion and absorption process associated with chicory inulin fibre in the large intestine that warrants further investigation.

#### **6. Limitations/Risks**

The concentrations were analysed using a new methodology developed from a modified procedure of published journal article (Verheyden *et al.* 2007). This modified procedure needs to be published including the validation of the methodology.

#### **7. Recommendations**

None

#### **8. References**

J. Babol, E. J. Squires and K. Lundstrom (1999) Relationship between metabolism of androstenone and skatole in intact male pigs. *Journal of Animal Science*, 77:84-92.

Verheyden, K., Noppe, H., Aluwe M., Millet, S., Vanden Bussche, J., and DE Brabander, H.F. (2007) Development and validation of a method for simultaneous analysis of the boar taint compounds indole, skatole and androstenone in pig fat using liquid chromatography-multiple mass spectrometry. *Journal of Chromatography*, 1174:132-137.

**Table 1.** Effect of dietary chicory Inulin (g/kg) or organic iron (mg/kg) supplement or the combination on skatole and androstenone concentration of pork fat in finisher pigs (mg/ kg fat tissue)<sup>a</sup>.

Sex (S)	Male				Female				SED <sup>b</sup>	Significance		
	0		50		0		50			S	In	Fe
Inulin (In)	0		50		0		50					
Iron (Fe),	0	500	0	500	0	500	0	500				
Skatole	0.034	0.027	0.030	0.020	0.017	0.026	0.050	0.018	0.006	0.97	0.76	0.03
Androstenone <sup>c</sup>	0.071	0.076	0.098	0.096	ND	ND	ND	ND	0.024	0.01	0.92	0.53

<sup>a</sup>Adipose tissue collected from 28 pigs was included in this study.

<sup>b</sup>SED for sex × inulin × organic iron interaction. <sup>c</sup>ND = Concentrations not detected in the analysis.