DOES CHARCOAL REDUCE SKATOLE AND INDOLE IN THE CHYME OF PIGLETS?

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I. OBJECTIVES

Boar taint occurs by combining 3-methyl-indole (skatole) and 5α-androstenone (androstenone). The presence of skatole and indole in the large intestine is caused by fermentation of L-tryptophan in the colon (Deslandes et al., 2001; Lundström et al., 2009; Visscher et al., 2018). A clear correlation of concentration of these indoles in the intestine and their concentration in pigs' fat tissue has been demonstrated (Borg et al., 1993). Charcoal is known for its good adsorption capacity and already has been fed to pigs to reduce boar taint (Jen and Squires, 2011). Thus, application of a coated charcoal that remains available until the intestine to reduce boar-taint–causing substances might be possible. The hypothesis of this study was that coated charcoal adsorbs more skatole and indole than natural charcoal and control feed.

II. MATERIALS AND METHODS

Intact male piglets (n = 12; mother: German Landrace × German Edelschwein; father: Pietrain), born from 3 sows, were fattened for 21 d, beginning at 25 ± 1 d of life. Diet consisted of either 2% w/w natural charcoal or 4% w/w coated charcoal including 2% w/w charcoal (COATED CC) that were added to control feed. As control, 4 piglets were solely fattened with control feed. To prevent loading prior to colon, charcoal was coated with 50% rapeseed fat having a high melting point. Directly after euthanasia, chyme from caecum and colon was retrieved and kept frozen until analyses. Preparation of chyme samples was conducted by established method adapted from Gibis, Dehnhard, and Fischer (1991) and analyzed by ultraperformance liquid chromatography-tandem mass spectrometry (ACQUITY-UPLC-System, Waters/API4000, AB Sciex). An external reference of skatole and indole was used to calibrate. Results were given in µg/kg initial substance. Therefore, in a second step, moisture of chyme was evaporated by a drying chamber at 103°C and then dry matter calculated. Significant differences were determined using one-way analysis of variance in Sigma Plot 14.0 (Systat Software Inc., San Jose, CA), followed by a Tukey test ($P < 0.05$).

III. RESULTS

Besides significant differences between skatole or indole contents of animals in each feeding group, indole is significantly less abundant in the colon chyme of piglets fed with coated charcoal as well as skatole in the caecum chyme of piglets of NATURAL and COATED CC (Table 1). In the colon chyme, indole is reduced from control group 17 µg/g dry matter to 2 µg/g dry matter in the COATED CC, and in the caecum chyme, skatole is reduced from 28 to 3 µg/g dry matter, respectively. Moreover, tendencies towards reduced skatole contents in the colon chyme are obvious.

IV. CONCLUSION

Using coated charcoal seems to contribute to reductions in skatole and indole content in the chyme. NATURAL CC also reduced indoles but not as significant as COATED CC. However, considering that chyme only gives possibility of boar taint reduction, more research is needed. A feeding approach with a larger number of boars is running currently. Initial results of skatole and indole in the chyme do not support our findings here. In this study, we could not prove whether there have been interactions of charcoal on piglets' diet. Thus, variations can be due to diet but also caused by animal-individual issues. Nevertheless, skatole and androstenone reduction in fat will determine success of a boar-taint reduction by charcoal in pigs' diet.

Table 1: Mean ± standard error of the mean of indole and skatole (µg/g DM) contents in *colon* and *caecum* chyme of piglets from groups fed with solely control feed or additionally 2 % natural charcoal or 4 % coated charcoal with 2 % charcoal. Significant differences between indole and skatole contents in one group as well as between feeding groups are depicted by lower- and upper-case letters, resp., and were determined using One Way ANOVA and Tukey test ($p<0.05$). (n=3)

Colon	Indole (µg/g DM)			Skatole (µg/g DM)		
	Control	Natural CC	Coated CC	Control	Natural CC	Coated CC
1	$12.2^{a} \pm 0.9$	$1.4^{a} \pm 0.0$	$1.3^{a} \pm 0.0$	$169.0^{a} \pm 11.6$	$84.1^{a} \pm 9.4$	$1.3^{a} \pm 0.0$
2	$8.8^{a} \pm 0.3$	$5.1^{a} \pm 1.0$	$3.1^{b} \pm 0.4$	$38.0^{b} \pm 1.4$	$35.2^{b} \pm 2.7$	$51.7^{b} \pm 4.5$
3	$23.5^{b} \pm 3.3$	$27.6^{b} \pm 2.1$	$1.7^{a} \pm 0.0$	$73.3^{c} \pm 5.1$	$69.0^{a} \pm 5.1$	$38.4^{c} \pm 0.5$
4	$24.1^{b} \pm 1.8$	$33.0^{b} \pm 2.0$	$1.6^{a} \pm 0.0$	$4.2^{d} \pm 0.4$	$13.3^{b} \pm 0.8$	$20.6^{d} \pm 1.6$
Mean	$17.1^{A} \pm 2.0$	$16.8^{A} \pm 3.8$	$1.9^{B} \pm 0.2$	71.1 ± 17.3	50.4 ± 8.0	28.0 ± 5.3
Caecum						
1	$9.3^{a} \pm 1.2$	$2.5^{a} \pm 0.0$	$27.9^{a} \pm 1.9$	$26.9^{a} \pm 6.3$	$3.7^{a} \pm 0.6$	$2.9^{a} \pm 0.0$
2	$5.9^{a} \pm 1.1$	$12.7^{a} \pm 0.9$	$2.7^{b} \pm 0.5$	$2.3^{b} \pm 0.0$	$2.0^{a} \pm 0.0$	$2.3^{b} \pm 0.1$
3	$8.2^{a} \pm 0.5$	$45.8^{b} \pm 4.9$	$2.4^{b} \pm 0.0$	$81.2^{a} \pm 5.8$	$2.9^{a} \pm 0.0$	$2.6^{ab} \pm 0.2$
4	$23.9^{b} \pm 4.6$	$11.2^{a} \pm 1.2$	$2.4^{b} \pm 0.1$	$2.4^{b} \pm 0.0$	$2.8^{a} \pm 0.4$	$2.2^{ab} \pm 0.0$
Mean	11.8 ± 2.2	18.0 ± 4.7	8.8 ± 3.1	$28.2^{A} \pm 9.1$	$2.9^{B} \pm 0.2$	$2.5^{B} \pm 0.1$

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Keywords: boar taint, charcoal, coating, indole, skatole