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Effects of a short exposure period to deoxynivalenol (DON) contaminated wheat on health parameters and post weaning and fattening performances of pigs

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INTRODUCTION

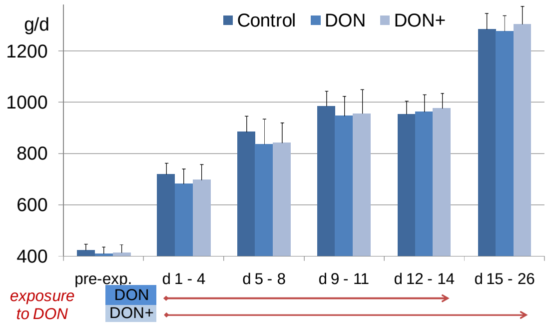
The contamination of feed with the *Fusarium* toxin deoxynivalenol (DON) decreases feed intake and daily gain of pigs but also affects their immune response (Étienne and Waché, 2008). Consequently, they could be predisposed to infectious disease. An experiment was conducted to evaluate the effects of a brief contamination of post-weaning feed with DON on performance and health condition during post-weaning and fattening periods.

MATERIALS AND METHODS

336 female and castrate male piglets, weaned at an average weight of 8.0 kg (28 days of age), were blocked and affected to 3 dietary treatments in a 40 d experiment. After a standard phase 1 diet, they received from 12.9 kg BW 1) a control phase 2 diet (C), 2) a mycotoxine-contaminated phase 2 diet for 14 days then the control diet (D), or 3) the mycotoxine-contaminated diet for 26 days (D+). The control diet contained 70 % of non contaminated wheat, whereas the contaminated diet contained 66 % of wheat naturally contaminated with *Fusarium* deoxynivalenol. Both diets were formulated to be iso-energetic and to contain the same levels of amino acids. Trichothecenes contents of wheat and DON concentration of feeds were quantified using GC-MS. The level of DON in the D/D+ diet was 1500 µg per kg.
Piglets were housed in 4 weaner pens of 14 piglets each, per treatment and sex. Piglets were individually weighed at weaning (d0), at the beginning and after 14 d of phase 2 diet distribution, and at the end of the post-weaning period, and feed consumptions were collected for each pen.
At d 40 after weaning, animals were transferred in two contrasting housing systems: fully vs. partly slatted, involving 150 and 120 pigs weighing around 33 and 29 kg at entry, respectively. The piglets were mixed and randomly affected to the fattening pens in order to have balanced numbers of the preceding treatments in each pen. During fattening, pigs were used to compare four space allocations (varying from 0.66 to 1.20 m^2/ pig) in the fully slatted system and two positions of the resting area (front vs. back of the pen) in the partly slatted system. Numbers per pen were 13 and 15, and pigs were finished to slaughter at around 120 and 115 kg, respectively. All fattening pigs received basal non-contaminated growing and finishing diets. They were individually weighted at 14 d intervals and feed consumption was measured for each pen.
The health of pigs was regularly monitored during the post-weaning and fattening periods and any medication and veterinary intervention was recorded.
Analysis was performed using the procedures of SAS (SAS Inst., Cary, NC). For the phase 2 period, performance results were analysed using proc GLM and health observations using proc NPAR1WAY, with pen mean as experimental unit. For the fattening period, individual weights and growths were analyzed with animal as experimental unit (GLM). As fattening pens contained pigs from all post-weaning treatments, data for feed intake and conversion were not analysed.

RESULTS AND DISCUSSION

Figure 1. Effect of exposure time to DON on piglet feed intake (mean ± SD)



The effect of DON exposure on piglet performance for the experimental phase 2 period is presented in Fig. 1 and Table 1. The histogram in Fig.1 indicates that feed intake was slightly but not significantly affected by DON and DON+ treatments during the first 11 days of exposure. However, this did not result in significantly lower daily feed intake in the phase 2 period from 12.9 kg to d 40 (mean: 1057 g/d). Neither daily gain (693 g/d) nor feed conversion (1.53 kg/kg) was affected by treatments. In the overall period from weaning to d 40 after weaning, piglets had similar DFI (mean: 831 g/d), ADG (572 g/d) and FCR (1.45 kg/kg).

During the growing-finishing phase (Table 2), feed intake was higher in the fully slatted housing system than in the partly slatted system (2.56 vs. 2.34 kg/d). This resulted in better daily gain (1029 vs. 900 g/d) and feed conversion ratio (2.49 vs. 2.60 kg/kg) for pigs housed in the fully slatted barn. The initial DON exposure had no negative carryover effect on growth performance or carcass quality. Surprisingly, pigs offered contaminated diets in the phase 2 period had better daily gain than control pigs in the fully slatted system (P=0.01), and there was a tendency (P=0.09) for this to occur in the partly slatted system.

Overall pig health was good. There were no significant effects of dietary treatments on phase 2 losses and health conditions. In the fattening period, no consistent effect of the DON exposure was observed on mortality rate and veterinary treatments.

The ingestion of DON by pigs mainly resulted in reduced feed intake (Étienne and Waché, 2008). The magnitude of this decrease for piglet or pig is estimated at 4% per 1 mg DON /kg feed by Dänicke (2002) and Grosjean et al (2007). Additionally, ingestion of DON changes some physio-biochemical parameters of young pigs (Rotter et al (1994) and transitory modulates the immune response of piglets (Grosjean et al, 2002; Pinton et al, 2006; Waché, 2009). In the current study, no pathologies were observed. This accords with most previous studies, which found no clinical sign of disease in pigs fed medium doses of DON (Pollmann et al (1985; Smith et al (1997). Furthermore, this study did not detect any evidence of carryover effect of DON on health status. In their review, it was suggested by Rotter et al (1996) that pigs fed low to moderate doses of DON are able to recover from initial weight losses and that haematological, clinical and immunological changes are also transitory and decrease as adaptation mechanisms are established. The current results also corroborate the findings of Grosjean et al, 2007 who concluded that DON has a more negative impact on productivity than on pig health.

However, further research should be done to investigate the possible interactions of DON with immune function in poor health conditions or during a disease outbreak.

CONCLUSION

It is concluded that, in good rearing conditions, a brief initial exposure of pigs with a medium level of DON (1500 µg/kg) might lead to similar health and growth parameters until market weight.

Keywords: Deoxynivalenol, DON, wheat, pig, health, performance.

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Table 1. Effect of phase 2 dietary treatment on piglet performance and health[1]

	Control	DON	DON+	rmse	T[2]
number	112	112	112		
weight at phase 2, kg	12.9	13.0	12.9	0.3	ns
weight at post weaning end, kg	31.0	30.9	30.7	0.5	ns
DFI, g/d	1064	1062	1045	37	ns
ADG, g/d	698	695	687	16	ns
FCR, kg/kg	1.52	1.53	1.52	0.04	ns
losses, n	0	1	0		ns
treated piglets, n	4	4	8		ns
vet treatments per pig, %	3.6	3.6	7.1		ns
• coughing	2.7	3.6	7.1		ns

1 Performance values in the table are presented as least-square means and root mean square error (rmse) for 12 pens of 14 piglets each. Health values are the number or % of observations per treatment.

2 From analysis of variance including the effects of DON exposure (T), sex, bloc and interaction for performance data and non parametric analysis for health events. ns (not significant) P > 0.05.

Table 2. Effect of post-weaning treatment on fattening pig performance and health[1]

	control	DON	DON+	rmse	T^2
Group A (fully slatted floor)					
number	49	51	50		
weight d 1, kg	32.7	33.3	33.2		ns
weight d 30, kg	64.3	65.8	64.2	2.7	0.06
live BW at slaughter, kg	119.5	120.2	120.0	5.4	ns
dressing %	77.6	77.8	77.6	1.0	ns
lean meat, %	58.4	57.9	57.9	2.4	ns
gain d 1 to 30, g	1032	1081	1030	91	0.06
gain d 1 to harvest, g	1007a	1054b	1038b	74	0.01
losses, n	3	2	0		
treated pigs, n	4	2	0		
vet treatments per pig, %	13.7	7.5	0.0		
• lameness	5.9	5.7	0.0		
• other	7.9	1.9	0.0		
Group B (partly slatted floor)					
number	43	41	36		
weight d 1, kg	29.4	29.3	29.2	1.7	ns
weight d 48, kg	70.8	71.3	72.2	5.0	ns
live BW at slaughter, kg	113.5	114.7	116.5	6.3	ns
dressing %	78.4	78.2	78.5	1.4	ns
lean meat, %	60.8	60.0	60.2	2.3	ns
gain d 1 to 48, g	863	874	893	103	ns
gain d 1 to harvest, g	886	897	922	72	0.09
removed, n	1	0	0		
treated pigs, n	5	7	2		
vet treatments per pig, %	14.0	17.1	5.6		
• poor condition	7.0	9.8	2.8		
• other	7.0	7.3	2.8		

1 Data in the table are least-square means and root mean square error for individual performance and carcass values, and number or % of observations per treatment for health parameters. 2 From analysis of variance including the effects of post-weaning treatment (T), fattening treatment, sex, and interactions. ns (not significant) P > 0.10.

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