Developing Spray-Dried Animal Plasma Programs for DON Contaminated Diets

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SUMMARY

This study was designed to determine if feeding high quality diets supplemented with spray-dried animal plasma (SDAP) during the early post-weaning period, will provide benefits if deoxynivalenol (DON)contaminated diets are fed in subsequent phases. Two blocks of newly weaned pigs were fed according to a 3-phase feeding program such that phase I, II and III diets were fed for 1, 2, and 1 week, respectively. Neither DON nor SDAP inclusion had an effect on nursery pig growth performance. We suspect the low and variable levels of DON in the diets (1.8 to 2.8 ppm), compared with the target (4 ppm) dietary DON contributed to the lack effect of SDAP on performance in this study.

INTRODUCTION

Deoxynivalenol (DON), also known as vomitoxin, is a mycotoxin of great concern in the grain and livestock industry. When cereal grains are contaminated with DON, they are downgraded and typically used for livestock feed rather than for human consumption. Pigs are more sensitive to DON than other livestock species, with dietary levels above 1 ppm resulting in reduced feed intake, growth depression, redu, and health-related issues. lingestion of DON contaminated diets has been reported to cause gut lesions, and alter immune response of animals. Therefore, strategies need to be developed to mitigate the adverse effects of DON in case DON-contaminated grains are used for pig feed.

Several strategies have been used to reduce the negative effects of feeding grains contaminated with mycotoxins to swine. For instance, clay binders have been used to reduce the adverse effects of aflatoxins. However, these agents are less effective for DON contaminated diets. Recent research (Eastwood et al., 2013) at the Prairie Swine Centre showed that spray-dried porcine plasma (SDPP) was more effective in reducing the negative effects of DON in nursery pig diets than activated clay... The previous research used 8 % SDPP which would add considerably to diet cost, therefore, there is the need to determine how long it can be fed during the post-weaning period and still ameliorate negative effects of DON contamination. Moreover some producers have removed SDPP from their diets due to concerns related to transfer of PEDv. Thus, the objective of this study was to determine if SDAP, produced from bovine plasma (SDBP), fed for the first week post-weaning could confer performance benefits to piglets when fed DON-contaminated diets in subsequent diet phases in the nursery.

MATERIAL AND METHODS

Two blocks of 120 newly weaned pigs (26 ± 2 days of age) were used for this 28-day growth trial. Piglets were housed in groups of 5 pigs/pen and pens were randomly assigned to 6 dietary treatments (Table 1 and 2) to obtain 8 pens per dietary treatment. Diets were formulated to meet or exceed nutrient requirements for nursery pigs. The DON contaminated diets were produced by adjusting the inclusion of wheat naturally contaminated with DON to obtain a final dietary DON concentration of 4 ppm. Pigs were fed according to a 3-phase feeding program with Phase I, II and III fed for 1, 2 and 1 week, respectively. Body weight and feed intake were recorded weekly to calculate ADG, ADFI, and G:F. Diets were assayed for DON by liquid chromatography/ mass spectrometry at the Prairie Diagnostics Lab (Saskatoon, SK).

"Neither DON nor SDAP inclusion had an effect on nursery pig growth performance."

RESULTS AND DISCUSSION

Diets

The control diet had 0.2 ppm DON, whereas DON concentration in the DON contaminated diets ranged from 1.8 to 2.8 ppm. Thus, the analyzed DON levels in the contaminated diets were below the target level (4 ppm). The reason for the low and varying DON levels in the contaminated diets is not clear although we suspect uneven distribution of DON in the contaminated wheat and the complete feed.

Growth performance

Addition of SDBP to the diets reduced ($P < 0.05$) ADFI and tended ($P = 0.07$) to reduce ADG from day 8 to 21, and overall ADFI tended to be reduced ($P = 0.05$). Nursery pigs fed diets contaminated with DON had greater ($P < 0.05$) G:F from day 8 to 21 compared with those fed the non-contaminated diet. However, there was no effect of diet ($P > 0.10$) on final body weight,

Table 1. The 6 different treatments were designed to determine the optimum feeding strategy of SDAP if DON contaminated wheat is included in phase II or III.

	Phase I		Phase II		Phase III	
TRT	DON	SDAP	DON	SDAP	DON	SDAP
1	No	No	No	No	No	No
2	No	8%	No	4%	No	No
3	No	8%	Yes	4%	No	No
4	No	No	Yes	No	No	No
5	No	8%	No	4%	Yes	No
6	No	No	No	No	Yes	No

overall ADG, ADFI, and G:F, suggesting that neither DON nor SDBP inclusion influenced performance parameters in the present study. The DON level in the DON contaminated diet may have not been high enough to elicit the same detrimental effects on piglet performance observed previously (Eastwood et al. 2013)). Besides, the control diet contained 0.2 ppm and thus could have masked the adverse effect of DON on growth performance. Further, whereas recent research (Eastwood et al., 2013) at Prairie Swine Centre suggested that SDPP may be effective in DON-contaminated diets for nursery pigs, this was not observed in the current study. We speculate the ineffectiveness of SDBP to be due to the observed lack of effect of DON contamination on growth performance.

CONCLUSION

We cannot make concrete conclusions regarding DON or SDBP effects in nursey pigs because of the difficulties encountered in this study. Thus, we were not able to achieve the target 4 ppm of DON in the contaminated diets, whereas the DON levels in the contaminated diets varied greatly. Nonetheless, research is ongoing to clarify the discrepancies in results observed in this study and previous studies.

ACKNOWLEDGEMENTS

We would like to acknowledge the strategic program funding provided by Saskatchewan Pork Development Board, Alberta Pork, Manitoba Port Council, and Ontario Pork, and project funding provided by Saskatchewan Agriculture Development Fund. In addition, we wish to acknowledge the support of the production and research technicians at Prairie Swine Centre that made it possible to conduct this research.

Table 2. Composition of nursery pig diets (as-fed basis)[1]

	Phase I		Phase II				Phase III	
DON	No	No	No	No	Yes	Yes	No	Yes
SDAP	No	8%	No	4%	4%	No	No	No
Wheat (clean)	57.7	54.9	42.1	45.6	16.6	13.1	44.2	15.2
Wheat (DON)[2]	-	-	-	-	29.0	29.0	.	29.0
Soybean meal	22.0	17.0	21.0	16.9	16.9	21.0	18.6	18.6
Barley	-	2.7	27.9	28.0	28.0	27.9	31.9	31.9
Whey powder	11.4	11.4	-	-	-	-	-	-
SDAP[3]	-	8.0	-	4.0	4.0	-	-	-
Fish meal	3.9	-	3.2	-	-	3.2	-	-
Canola oil	1.9	2.5	2.4	1.9	1.9	2.4	2.0	2.0
Salt	0.40	0.20	0.57	0.34	0.34	0.57	0.45	0.45
Amino acids[4]	0.902	0.566	0.804	0.905	0.905	2.104	0.571	0.571
Monocalcium phosphate	-	0.20	-	-	-	-	-	-
Limestone	1.05	1.80	1.30	1.65	1.65	1.30	1.55	1.55
Premix[5]	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72

[1] SDAP, spray-dried animal plasma
[2] DON contaminated wheat was obtained from Southern Saskatchewan in 2015 and contained 10.9 ppm DON, upon analysis.
[3] American Protein Corporation (APC 920).
[4] Amino acids (using synthetic lysine, threonine, methionine and tryptophan) were added to meet amino acid requirements.
[5] Diets contained equal amounts of vitamin and mineral premixes, choline chloride and CuSO4-5H2O.

Table 3. Growth performance of piglets fed DON- and SDAP-containing diets

	Treatment						SEM	Contrasts[1]				
	1	2	3	4	5	6		1 vs. 2	1-2 vs. 4-6	3 vs. 4	5 vs. 6	2 vs. 4+6
Body weight (kg)												
d 0	8.39	8.40	8.31	8.36	8.36	8.36	0.07	NS	NS	NS	NS	NS
d 7	8.99	8.99	8.85	8.65	8.95	9.03	0.15	NS	NS	NS	NS	NS
d 21	13.1	12.5	13.1	12.9	12.9	13.2	0.32	NS	NS	NS	NS	NS
d 28	17.4	16.6	17.6	17.2	16.8	17.1	0.43	NS	NS	NS	NS	NS
Average daily gain (kg/d)												
d 0-7	0.086	0.086	0.076	0.041	0.084	0.096	0.015	NS	NS	0.09	NS	NS
d 8–21	0.295	0.249	0.302	0.303	0.281	0.298	0.017	0.07	NS	NS	NS	0.02
d 22–28	0.616	0.581	0.644	0.610	0.566	0.560	0.029	NS	NS	NS	NS	NS
d 0-28	0.323	0.291	0.331	0.314	0.303	0.313	0.014	NS	NS	NS	NS	NS
Average daily feed intake (kg/d)												
d 0-7	0.132	0.127	0.127	0.088	0.141	0.134	0.010	NS	NS	<0.01	NS	NS
d 8-21	0.441	0.392	0.429	0396	0.416	0.407	0.016	0.04	NS	NS	NS	NS
d 22–28	0.864	0.810	0.883	0.824	0.831	0.846	0.026	NS	NS	NS	NS	NS
d 0-28	0.469	0.430	0.467	0.426	0.451	0.448	0.014	0.05	NS	0.04	NS	NS
Feed conversion (kg gain/kg feed)												
d 0-7	0.60	0.66	0.50	0.49	0.59	0.69	0.10	NS	NS	NS	NS	NS
d 8–21	0.67	0.64	0.70	0.77	0.67	0.73	0.04	NS	0.03	NS	NS	0.01
d 22–28	0.71	0.72	0.73	0.74	0.68	0.66	0.03	NS	NS	NS	NS	NS
d 0-28	0.69	0.68	0.71	0.74	0.67	0.70	0.02	NS	NS	NS	NS	NS

1Contrast statements were designed to answer the following questions (refer to Table 1 for treatment descriptions): 1 vs. 2 = effect of SDAP inclusion; 1 and 2 vs. 4 to 6 = effect of DON contamination; 3 vs. 4 = effect of DON and SDAP inclusion in Phase II; 5 vs. 6 = effect of SDAP inclusion in Phase II followed by DON inclusion in Phase III; 2 vs. 4 and 6 = comparing the effect of SDAP vs. DON inclusion.