

Comparison of a β -glucan-supplemented wheat-based diet with an oat-based diet on apparent total tract nutrient digestibility, nitrogen utilisation and accompanying manure odour and ammonia emissions from finisher pigs

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Introduction Increasing consumption of β -glucans in finisher pig diets through dietary provision of oats has been demonstrated to promote carbohydrate fermentation in the distal gastrointestinal tract, with accompanying reductions in manure ammonia and odour emissions as compared with conventional wheat-based diets (O'Shea *et al.*, 2009a). However, offering a source of endogenous β -glucans is associated with decreased nutrient digestibility, due to the presence of other poorly digestible carbohydrates present in the parent oat grain (O'Shea *et al.*, 2009a). The objective of the current study was to investigate the influence of supplementing a wheat-based diet with oat-derived β -glucans compared with an intact source of β -glucans (oat-based diet) on apparent nutrient digestibility and manure odour and ammonia emissions from finisher pigs. An enzyme composite containing β -glucanase and β -xylanase was included to elucidate the effect of both endogenous and exogenous β -glucans on the aforementioned selected parameters.

Materials and methods A complete randomized design experiment was conducted to investigate the source of dietary β -glucans and the inclusion or not of an enzyme containing β -glucanase on nutrient digestibility and manure emissions from finisher boars. Experimental diets were as follows: 1) oat-based diet (O), 2) oat-based diet +enzyme (OE), 3) wheat-based diet + β -glucans (WG) and 4) wheat-based diet + β -glucans + enzyme (WGE). All diets were formulated to contain similar concentrations of digestible energy (DE; 13.7MJ/kg), and apparent ileal digestible lysine (8.6g/kg) and total β -glucans. Purified β -glucans were oat-derived (Cambridge Commodities, Cambridgeshire, UK). The enzyme supplement was derived from *Penicillium funiculosum* (IMI SD 101) and contained Endo-1,3 (4)- β -glucanase (EC 3.2.1.6) and Endo-1,4- β -xylanase (EC 3.2.1.8). Sixteen boars were blocked based on live-weight (60.5kg sd 2 kg) and assigned to one of four dietary treatments (n=4). After a two week dietary adaption period pigs were transferred to metabolism crates for a 7-day apparent total tract nutrient digestibility, nitrogen utilisation (O'Shea *et al.*, 2009b) and manure collection study (n=4). *In vitro* manure ammonia and odour emissions were conducted as described previously (O'Shea *et al.*, 2009b). Briefly, separate urine and faeces collections were amalgamated in original production ratios. Ammonia emissions were determined by microdiffusion. Odour concentrations were determined by olfactometry (Hayes *et al.*, 2004). Experimental data were analysed as a complete randomised design using the GLM procedure of the SAS institute (1985). Contrast statements were used to compare 1) O vs WG, 2) O vs OE and 3) WG vs WGE.

Results Consumption of the O diet significantly decreased dry matter ($P<0.001$) digestibility and increased the urine:faeces N excretion ratio ($P<0.05$) compared with the WG diet. Consumption of the O diet significantly decreased manure ammonia ($P<0.05$) and odour emissions ($P<0.05$) compared with the WG diet.

Table 1 Effect of dietary β -glucan type and enzyme supplementation on nutrient digestibility and manure emissions (LSM \pm sem)

Diet	O	OE	WG	WGE	sem	Contrast 1	Contrast 2	Contrast 3
Dry matter digestibility	0.793	0.788	0.903	0.893	0.006	***	ns	ns
Urine:faeces N excretion	3.0	3.9	4.4	6.1	1.4	*	ns	*
Ammonia 0-240h (mg/g N intake)	71.6	75.4	87.2	87.2	5.1	*	ns	ns
Odour 72h Ou _F /m ³	2366	1993	5212	3461	765.0	*	ns	ns

Contrast 1 (O+OE vs WG+WGE); Contrast 2 (O+WG vs OE+WGE); Contrast 3 (interaction between β -glucans and enzyme)

Discussion and conclusions In the current study, supplementation of oat-derived β -glucans to a wheat-based pig diet did not depress dry matter digestibility to levels comparable with the oat-based diet. This suggests that β -glucan consumption may be increased without depressive implications for nutrient availability, as has been typically observed where β -glucans are offered in an intact form in oats (O'Shea *et al.*, 2009a). However, the supplementation of purified β -glucans to a wheat-based diet was ineffectual in reducing pig manure odour and ammonia emissions to levels comparable with consumption of the oat-based diet, possibly reflecting the role of other fermentable constituents within oats in functionally mitigating these indices of environmental pollution.

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