

Insoluble non-starch polysaccharides fed as oat hulls reduce protein fermentation in the large intestine of newly-weaned pigs

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A less than optimal amount of fermentable carbohydrates and excessive undigested nitrogen (N) entering the large intestine (LI) of newly-weaned pigs has been postulated as a cause of post-weaning diarrhoea (PWD). This is because the microbiota in the LI generate biogenic amines that have been implicated in the aetiology of PWD (Porter and Kenworthy, 1969; Bolduan *et al.*, 1988; Aumaitre *et al.*, 1995). The purpose of this study was to observe whether adding insoluble non-starch polysaccharides (NSP) (20 g oat hulls kg⁻¹) reduced the potential negative effects of more protein than carbohydrate entering the LI on PWD and digestibility.

Forty-eight weaned male pigs (Large White X Landrace) weighing 5.5 kg ± 0.05 (SEM) were fed either (1) extruded rice plus an animal protein supplement (whey powder, meat and bone meal, blood meal, fish meal; RAP) or (2) diet (1) with 20 g oat hulls kg⁻¹ (RAPOH). The pigs were offered their respective experimental diet *ad libitum* for three weeks. Titanium dioxide (TiO₂) was added as an inert marker for estimation of the coefficient of total tract apparent digestibility. The diets contained 700 g and 680 g/kg extruded rice, respectively, and contained similar concentrations of calculated digestible energy (14.4 MJ/kg) and available lysine (0.80 g/MJ DE). The diets did not contain antibiotics and ZnO. Occurrence of diarrhoea was visually assessed three times daily. Pigs showing clinical diarrhoea were injected with Trisoprim-480 (trimethoprim 80 mg/ml, sulfadiazine 400 mg/ml; 1.5 ml/30 kg body weight) until clinical signs disappeared. Blood samples were taken from the jugular vein on days 7 and 14 for urea and creatinine analyses. Faecal 'grab' samples were collected from each pen on day 7 and 14 of the experiment for estimation of dry matter, energy digestibility and biogenic amines content. The ANOVA analysis and Chi-Square test were used for statistical analyses.

Table 1. Effect of oat hulls on PWD, digestibility and plasma and faecal metabolites in weaner pigs fed extruded rice and animal protein-based diets.

	RAP	RAPOH	Pooled mean	s.e.m.	Significance
Incidence of diarrhoea (No. of pigs)	9 (6)	2 (2)			0.083
No. of antibiotic treatments	21	6			
DM digestibility (%)	90.2	87.2	88.7	0.40	0.001
GE digestibility (%)	89.3	86.7	88.0	0.40	0.001
DE (MJ/kg DM)	17.0	16.5	16.7	0.07	0.001
Plasma urea (mmol/L)	3.5	2.6	3.03	0.16	0.016
Plasma creatinine (µmol/L)	74.1	76.4	75.2	1.38	0.498
Total biogenic amines (mg/kg)	431	292	362	60	0.257

Oat hulls decreased the number of pigs with PWD and the number of antibiotic treatments. Due to the dilution effect of oat hulls, the digestibilities of DM and GE were significantly decreased ($P < 0.001$). Oat hull inclusion decreased plasma urea concentration ($P = 0.016$) suggesting a decrease in ammonia production in the LI. This decrease was also supported by a decrease in the biogenic amines concentration, albeit not statistically significant due to the high variation between animals ($SEM = 60$). The results suggest that insoluble NSP in a highly digestible carbohydrate diet based on extruded rice for weaner pigs reduces PWD, although reductions in digestibility were also noted. The protective effect of oat hulls was most likely due to the modification of the intestinal microbiota away from a predominantly protein fermenting populations to a biota having more saccharolytic bacteria.

The Rice Sub-program of the Rural Industries Research and Development Corporation is thanked for funding this research.

References

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