

10. Dietary particle size and gelling affect digesta transit behaviour through the stomach of pigs

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Physicochemical properties of feed ingredients influence digesta transit behaviour and thereby nutrient digestion but are not included in current feed evaluation systems. We investigated the effects of particle size and gelling properties of fibre-rich ingredients on digesta transit behaviour in the proximal and distal stomach of pigs. We hypothesized that particle size reduction and increased gelation would reduce gastric segregation of liquids, solids, and fibres. Twenty-four boars (52 kg body weight at start) were allocated to one of four diets; two contained wheat straw (150 g/kg), either coarsely chopped (20 mm; coarse) or ground through a hammer mill passing a 1-mm sieve (fine); two contained wheat bran (270 g/kg) with or without pectin addition (100 g/kg). Upon sacrifice and in steady state, mean retention time (MRT) was quantified using Co-EDTA as tracer for liquids, TiO₂ for solids, and Cr-mordanted wheat straw or -bran for fibres. A general linear mixed model, with dietary treatment as fixed effect, was used. Compared with coarse straw, fine straw reduced digesta fresh weight (-371 g, $P < 0.05$), MRT of liquids, solids and fibres (-35, -153 and -263 min, $P < 0.05$), and reduced digesta pH in the proximal stomach by 0.8 units ($P < 0.10$). In the distal stomach, fine straw reduced digesta fresh weight (-243 g, $P < 0.05$), MRT of liquids and solids (-13 and -64 min, $P < 0.10$), and MRT of fibres (-280 min, $P < 0.05$). Pectin addition to the wheat bran diet reduced MRT of solids and fibres (-137 and -216 min, $P < 0.05$) in the proximal stomach. In the distal stomach, pectin addition reduced MRT of fibres (-200 min, $P < 0.05$), however, MRT of liquids was increased (+13 min, $P < 0.05$). In conclusion, particle size reduction and increased gelation strongly influenced gastric mixing and sieving, reducing separation of liquids, solids and fibres in the proximal and distal stomach of pigs.