

Communication no. 7

Influence of the nature of cereal on site and extent of starch digestion in steers.

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Current research takes an analytical approach in terms of nutrient flows to improve knowledge of how nutrients determine product quality (milk, carcass). The site of starch digestion modifies the nature and the amount of nutrients delivered to the ruminant, volatile fatty acids in the rumen and in the hindgut and glucose in the small intestine. One way to manipulate starch digestion is by selecting cultivars because the endosperm texture of corn grain affects in situ ruminal starch degradation (Philippeau C., Michalet-Doreau B., *Anim. Feed Sci. Technol.* 68 (1997) 25–30). The aim of our study was to determine the effect of grain source on the site and the extent of starch digestion in the digestive tract. Six Salers steers (initial BW, 320 kg) fitted with simple ruminal, duodenal and ileal cannulas were used in a double 3 × 3 Latin square design experiment. They received diets consisting of 70 % coarsely cracked cereal (wheat, dent and flint corns) supplemented with alfalfa hay and urea and balanced to be isostarchy (47.7 ± 2.3 % of DM). Steers were adapted to their diet for 3 weeks before measurements. Representative samples of duodenal and ileal digesta were composed of 12 spot samples taken over 2 d. Duodenal and ileal flows were determined using two markers (polyethylene glycol and lignin) and were analysed for starch content. Ruminal starch digestibility was greater for wheat than for corn (86.6 and 47.8 %, respectively, SEM = 2.3) which concurred with the results of McCarthy et al. (McCarthy et al., *J. Dairy Sci.* 72 (1989) 2002–2016) and was altered

by the corn genotype (60.8 and 34.8 % for dent and flint corns, respectively) as we showed in in-situ degradation studies. Postruminal digestion varied widely and was divided between the small intestine (SEM = 3.1) and the hindgut (SEM = 4.2); (3.5 versus 5.3 %), (8.9 versus 13.5 %) and (17.6 versus 28.3 %) for wheat, dent and flint corns, respectively. When the proportion of starch digested in the rumen was low, a greater proportion of starch was digested in the lower tract, particularly in the hindgut. The compensation by digestion in the lower tract was not complete as starch digestion in the total tract was 96, 84 and 82 % for wheat, dent and flint corns, respectively, (SEM = 1.6).

In conclusion, the grain source affects the amount and the site of starch digestion. Furthermore, when a large amount of starch escapes from ruminal fermentation, much of it can be digested in the hindgut. This supports the hypothesis of a limiting capacity of the small intestine for starch digestion.

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Influence of the protein source and the antigenicity of soyabean on the morphology and the enzyme activities of the proximal jejunum in preruminant calves.

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Replacing partially skim milk powder (SMP) by soyabean protein in milk replacers increases the rate of gastric emptying and decreases nitrogen digestibility. Moreover, antigenic heated soyabean flour (HSF) is less digestible than non-antigenic, alcohol-treated, soyabean protein concentrate (SPC) and it has been shown to induce immune-mediated gut hypersensitivity reactions in