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Involvement of the protein network in the in vitro degradation of starch from spaghetti

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However there certainly exists some direct relationship between diet selection and substrate oxidation during exercise since glucose oxidation before and during exercise was larger in rats with the smallest lipid intake. Therefore, the relationship between diet selection, substrate oxidation and exercise training is certainly complex. A more precise assessment of protein metabolism may be important to better understand this point.

Perprandial changes in gastric wall tension control ingestion in pigs. L Lepionka, CH Malbert (*Station de recherches porcines, Inra, 35590 Saint-Gilles, France*).

Short term control of ingestion remains hypothetical because meal induced fundic relaxation cancels the possible gastric distension. Similarly, experimentally induced wall tension changes modify the sensation of a gastric distension. The aim of this study is to evaluate the characteristics of the ingestive pattern during proximal gastric distensions.

Perprandial isobaric or isovolumic fundic distensions were performed in four awake pigs by using an electronic barostat. Distension values were: 200/7, 250/11, 400/16 and 450/21 (mL/mmHg). Ingestive pattern for 500 g meal was characterized by duration of the meal, food intake rate FIR and no ingestion periods duration. These values were obtained by continuous weighing of the contents of the trough during the meal. No ingestion periods corresponded to FIR values less than $0.5 \text{ g}\cdot\text{sec}^{-1}$. The ingestion period was divided in three equal periods to study the role of gastric filling in the perprandial evolution of FIR.

Meal duration was not significantly different for isovolumic distension vs. control (no distension) (8.9 ± 0.31 vs 8.2 ± 0.45 min, 450 mL vs control). On the contrary, meal duration was significantly shorter for isobaric vs isovolumic distension at

$7/200 \text{ mmHg/mL}$ (8.0 ± 0.28 vs 8.9 ± 0.33 min). This shortening was the consequence of (i) an increased FIR during the second third of meal (57 ± 2.8 vs $51 \pm 2.2 \text{ g}\cdot\text{min}^{-1}$), and (ii) a reduced duration of no ingestion periods (194 ± 23.4 vs 263 ± 28.9 sec). A strictly inverse relationship was observed for higher pressures (10.2 ± 0.37 vs 8.7 ± 0.39 min, 11 mmHg vs 250 mL). The longer meal duration was related to only a reduced FIR during the second third of meal (47 ± 2.3 vs $55 \pm 2.1 \text{ g}\cdot\text{min}^{-1}$).

In conclusion, proprioceptive signals originating from the proximal stomach are responsible for perprandial control of ingestive behaviour in pigs. These stimuli corresponded to intraluminal pressure and wall tension informations.

Involvement of the protein network in the in vitro degradation of starch from spaghetti. A Fardet, C Hoebler, B Bouchet, F Guillon, DJ Gallant, JL Barry (*Human Nutrition Research Center, National Institute for the Agricultural Research, BP 1627, 44316 Nantes cedex 03, France*).

Among the factors responsible for the slow degradation of starch from pasta, the presence of a fine and compact protein network could be a decisive parameter. This work aimed to study by light microscopy and enzymatic treatments the involvement of the protein network in the alpha-amylase susceptibility of starch from spaghetti. Pasta were cooked 10 min, then either cut in 5 mm strands or ground. After 0 or 2 h of incubation with pepsin, spaghetti were incubated 24 h in vitro with either human salivary or pig pancreatic alpha-amylase (HSA and PPA, respectively). Compared to ground spaghetti, starch from intact strands of spaghetti was slowly degraded with both alpha-amylases. When incubated with HSA, starch was progressively removed from the protein network which remained intact.

When incubated with PPA, the strands of spaghetti were solubilized and the starch degradation increased after 1 h of alpha-amylolysis (+ 10% at 24 h) due to the presence of contaminating proteases which partially hydrolysed the protein network (16% at 24 h). The protein network degradation reduced the pathway for the alpha-amylase to access starch. Pre-incubation with pepsin released starch into the incubation medium, only slightly increasing the initial rate of starch degradation (+ 10% at 15 min).

We concluded that the protein network does not constitute a complete physical barrier to alpha-amylase but limits its access to starch by a supposed retarded diffusion rate. The tortuosity and the steric hindrance of the protein matrix may be involved.

Effect of seaweed fibre added in a diet on the physico-chemical characteristics of pig digesta. E Worthington¹, F Guillon¹, C Hoebler¹, M Lahaye¹, B Darcy-Vrillon², P Vaugelade², JL Barry¹ (¹Centre de recherche en nutrition humaine, Inra, 44316 Nantes; ²Unité d'écologie et de physiologie du système digestif, Inra, 78352, Jouy-en-Josas, France).

Seaweed fibres have particular physico-chemical characteristics that are interesting because of their potential application to nutrition.

Two seaweed extracts (*Eucheimia Cotinii*, rich in insoluble carrageenans, EC, and *Palmaria palmata*, rich in low viscous soluble xylan, PP), were studied for their effects on the physico-chemical characteristics of digesta along the whole digestive tract. Twelve Large White pigs (80 kg), adapted for 6 days to a test-diet containing 5% algal fibre or cellulose (Cel, reference fibre), were sacrificed 5 h after meal. Fresh (FM) and dry matter (DM), chemical composition, pH and short chain fatty acid (SCFA) concen-

tration were determined in the digesta. The amount of total dietary fibre and the ratio soluble to insoluble from stomach, ileum and large intestine were determined. The amount of total fibre increased from the stomach to the colon. In the small intestine, the proportion of soluble fractions was high for EC and PP; Cel was found always in insoluble form. EC and Cel were found to be present in distal colon probably due to their poor fermentability. Supplementation of the diet with PP or EC increased the amount of wet digesta while dry matter was unchanged; this rise corresponded to an increase in the water content due to either an osmotic effect of algal fibre (PP in the small intestine), or a greater absorption of water by the fibre (EC) or by microbial mass (PP in the colon). The lowest amount of starch was found in the stomach after ingestion of the diet supplemented with PP, suggesting a more rapid gastric emptying. The SCFA concentration and pH in the large intestine are related to the fermentability of algal fibre. The high fermentation of PP in the caecum increased the concentration of SCFA (126.3 ± 55.7 mmol/g FM) and reduced the pH (6.0 ± 0.7). In contrast, EC was weakly fermented (SCFA: 72.7 ± 14.8 mmol/g FM; pH 7.0 ± 0.4) as was Cel used as the reference fibre (SCFA: 95 ± 22 mmol/g FM; pH 6.9 ± 0.1).

In conclusion, the supplementation of a diet with 5% algal fibre changes the physico-chemical characteristics of the digesta according to the algal fibre properties in the digestive compartment considered. The extent of 5% algal fibre fermentation at different sites of large intestine influences significantly the production of SCFA and consequently the pH of digestive contents.

Hydrogen production in dogs: Lactulose vs meat diet. E Pouteau, H Dumon, M Champ, M Krempf, P Nguyen (Centre de recherche en nutrition humaine, Hôpital Nord, Nantes; Laboratoire de nutrition et