Although it is believed to be important, fat emulsification has rarely been studied in the human digestive tract. In a recent study (Armand *et al* (1994) *Am J Physiol* 266, G372-G381) we studied fat emulsification in the stomach in healthy humans. Our objective in this study was to compare the extent of fat emulsification in the stomach and duodenum, and to determine the influence of lipolysis by gastric and pancreatic lipases.

Six fasting adult male subjects were fitted with naso-gastric and naso-duodenal tubes under X-ray control and received intragastrically a coarsely (median diameter: 45 μm) emulsified 400 mL test-meal containing olive oil (70 g), eggs (1 whole and 1 white), sucrose (70 g), PEG (2 g) and sodium chloride (150 mM). The gastric and duodenal aspirates were collected 1, 2, 3 and 4 h after feeding in order to measure the fat emulsion droplet size, using a particle-sizer, the gastric and pancreatic lipase activities (pH-stat) and to analyse the different lipid classes present (thin layer chromatography and densitometry).

In the stomach, the fat globule median diameter decreased (17.2 *vs* 45 μm) at 1 h as a result of a partial hydrolysis of lipids (12%) by gastric lipase (11 410–43 905 units/L) demonstrating, as in our last study, that fat emulsification can occur in the gastric environment.

In the duodenum, most notably after 1 h digestion, the fat droplet size decreased (19.6 *vs* 45.0 μm) as a result of the disappearance of the large fat droplets (60–100 μm) and the generation of small fat particles (1–6 μm). Consequently, the emulsion specific surface area increased (2.10 *vs* 0.82 m^2/g fat). At 2, 3 and 4 h, the emulsion particle-size pattern (*ie* 34.3, 46.3 and 27.6 μm, respectively) was very similar to that observed in the stomach, *ie* 37.9, 52.4 and 41.6 μm, respectively. Lipid hydrolysis catalyzed by pancreatic lipase (1 210–1 440 x 10^3 units/L) was about 4-fold higher in the duodenum as compared to the stomach (45%, $p < 0.05$).

In conclusion, the present data indicate for the first time that most dietary lipids are present in the duodenum in the form of emulsified droplets in the range 1–50 μm in healthy human subjects, and that there is no marked difference in the extent of emulsification during digestion between the stomach and the duodenum.

Effect of concentrate nature on energy metabolism and milk composition in dairy cows. O Colin-Schoellen, M Marie, S Jurjanz, F Laurent *(INRA-ENSAIA, Laboratoire de sciences animales, 2, av de la Forêt-de-Haye, BP 172, 54505 Vandœuvre-lès-Nancy, France)*

An inversion design was used to study the influence of the concentrate nature (starchy or fibrous) on the energy metabolism and milk composition in dairy cows. Thirty-six cows received in turn 1 of 2 concentrates during 2 periods of 6 weeks each. A complete diet consisting of maize silage, straw, wheat, sugar-beet pulp, corn gluten feed, soybean meal and a mixture of formaldehyde treated soybean and rapeseed meal (50:50) was given *ad libitum* in the following ratios: 60.5:9.6:18.6:0:0:9.1:2.7 for the 'starch' treatment and 53.5:9.3:0:19.0:7.3:10.9:0 for the 'fibre' treatment. The 2 diets had similar energy values (*ie* 1.57 Mcal/kg DM) and crude protein content (*ie* 14.2%). Blood samples were taken from 12 cows 0, 0.5, 1, 2, 4 and 6 h after they were given the diet, and rumen samples from 24 cows 0, 2 and 6 h (8 cows for each time) during the last week of each period.

The proportion of butyric acid in the rumen volatile fatty acids (VFA), the concentrations of plasma insulin and non-esterified fatty acids, the true protein content of the milk, and the milk yield did not change with diet. The rumen VFA had on average

higher proportions of propionic acid for the starchy concentrate (*ie* 28.8 *vs* 26.8%), but this difference was not significant. The proportion of acetic acid was significantly higher for the fibre concentrate (*ie* 52.4 *vs* 49.6%, $p < 0.05$). For the starchy diet, glycemia was, on average, higher (+0.02 g/l, $p < 0.05$). The β-OH butyrate content for the starchy diet was also higher from 4 h after the meal. These responses to the nature of the concentrate indicate some modifications of the energy metabolism and a reorientation of nutrient utilization. Indeed, the body weight gain was higher for the starchy diet (+11.2 kg, $p < 0.01$) and the fat content of milk was lower (33.8 *vs* 37.0 g/kg, $p < 0.05$).

Thus, the incorporation of grains into the diet of dairy cows appears to modify the milk composition in a way which conforms to the present desires of the dairy industry.

***In vivo* and *in vitro* fermentation of resistant starch and lactulose by human colonic microflora.** J Doré [1], M Durand [1], L d'Agay-Abensour [2], P Pochart [2], B Flourié [2], A Bernalier [1], M Champ [3], JC Rambaud [2] *([1] INRA, 78350 Jouy-en-Josas; [2] INSERM, hôpital Saint-Lazare, 75010 Paris; [3] INRA, 44026 Nantes, France)*

The hydrogen produced during the intracolonic fermentation of carbohydrates is excreted in breath, flatus or reutilized by microorganisms. In this study, the fermentation of retrograded high amylose corn starch by the human colonic microflora was compared with that of lactulose using *in vivo* gas production measurements, fecal microbial counts and *in vitro* comparisons of fermentation pathways.

Six healthy volunteers (3 methane- and 3 non-methane-excretors) ingested twice a day for 2 weeks during 2 periods, randomly ordered and separated by a washout period of at least 2 weeks, either 10 g lactulose, or 20 g resistant starch. On days 1, 7 and 14 of each period, H_2 and CH_4 were monitored in breath and flatus for 8 h following ingestion of the test carbohydrate, and stools were recovered and processed for microbial enumeration of total anaerobes, and H_2 utilizing methanogens, sulfate reducers and acetogens.

Three adaptation experiments (12 d) were also performed using a semi-continuous *in vitro* incubation system. Four 1 l vessels were inoculated with human fecal homogenates (100 g/l) collected either from a high, low or non-CH_4 excretor, and fed resistant starch or lactulose (5 g twice daily).

Whatever the status towards CH_4 excretion, the resistant starch tended to give lower total H_2 excretions than lactulose *in vivo*. The difference was highly significant on day 1 for CH_4 excretors and day 14 for non-CH_4 excretors. The total H_2 excretion tended to decrease further during adaptation in methane excretors and to increase in non-methane excretors, especially with lactulose.

Similarly *in vitro,* a 30% lower gas volume was observed with resistant starch, although the CH_4 production was stimulated. The latter parameters, together with the H_2 recoveries, were the only ones affected by the status of the donor towards methane excretion. Starch feeding led to stable pH (6.5) and ATP concentrations during the day, while with lactulose the pH dropped below 5.5 and the ATP concentrations increased sharply within 2 h post-feeding. The fermentation patterns of resistant starch and lactulose were different (lower butyrate and higher medium and branched chain fatty acid proportions with starch). The calculations of H_2 recoveries *in vitro* indicated that lactulose favored reductive acetogenesis as compared with resistant starch. Although the H_2 produced during *in vivo* intracolonic resistant starch fermentation appeared to be reutilized by hydrogen transfer, inter-individual variations in fecal microbial group counts did not allow the obser-