

been on a diet, 82.1% eat vegetables less than once a day. Of those who smoke, 62.5% eat fruit less than once a day. All the women who have a body mass index > 25 eat vegetables less than once a day and 45.5% do not have breakfast. Among those who do not have breakfast, 83.8% eat vegetables less than once a day. The group of women from North Africa was too small for statistical analysis.

In conclusion, the dietary habits of these underprivileged women are characterized by disturbances of their dietary rhythms and dietary balance. Bad eating habits are more common among those who smoke, have already followed a diet or are overweight.

#### **Effects of nutrition education on magnesium intake during pregnancy.**

JM Lecerf<sup>1</sup>, C Pavy<sup>2</sup>, M Delcroix<sup>2</sup> (<sup>1</sup> *Institut Pasteur de Lille, service de nutrition, 1, rue du Professeur-Calmette, 59019 Lille cedex;* <sup>2</sup> *Hôpital Saint-Philibert, 59160 Lomme, France*)

Magnesium deficiency during pregnancy can be induced by an inadequate intake and can have some maternal or fetal outcomes. It was decided to assess the magnesium intake of pregnant women and to increase this amount through nutrition education.

A group of 30 randomly selected pregnant French women in their second trimester of pregnancy were given a dietary inquiry on a week-day and on a week-end-day (24 h recall) and a food frequency questionnaire about magnesium-rich foods, in order to evaluate their initial magnesium intakes. Advice and information were given simultaneously about magnesium in the diet. Three weeks later a new dietary intake questionnaire was given on 2 d. A third and second food frequency record were given 3 weeks later at 6 weeks.

The mean magnesium intake was initially (Q1) 280 ± 93 mg/d (recommended dietary allowances 480 mg/d). Three weeks after having received the nutritional advice the mean magnesium intake (Q2) was 325 ± 88 mg/d and at 6 weeks (Q3) it was 317 ± 102 mg/d. The difference was significant between Q1 and Q2 ( $p < 0.01$ ) and Q1 and Q3 ( $p < 0.05$ ) but there was no difference between Q2 and Q3. Simultaneously the caloric intake did not increase significantly, the carbohydrate intake increased and the lipid intake decreased. At 3 weeks, 21 women increased their magnesium consumption and 20 at 6 weeks. Among those who increased their magnesium consumption, the mean intake increased from 256 ± 79 mg/d to 340 ± 92 mg/d and then to 361 ± 105 mg/d. The food frequency record for the whole group of women revealed that 21 increased their intake of cooked vegetables, 15 raw vegetables and 19 bread. A greater number ate legumes, wholemeal bread, and fewer boiled foods.

In conclusion, the magnesium intake of the investigated pregnant women was insufficient and increased significantly after they received a nutrition education. It remained, however, lower than recommended dietary allowances.

## **DIET AND DIGESTION**

#### **Characterization of dietary fat emulsification in the digestive tract of healthy human subjects.**

M Armand<sup>1</sup>, P Borel<sup>1</sup>, C Dubois<sup>1</sup>, M Senft<sup>1</sup>, J Peyrot<sup>2</sup>, J Salducci<sup>2</sup>, H Lafont<sup>1</sup>, D Lairon<sup>1</sup> (<sup>1</sup> *Unité 130-INSERM, 18, avenue Mozart, 13009 Marseille;* <sup>2</sup> *CHU Nord, service d'hépatogastro-entérologie, 13015 Marseille, France*)

Fat emulsification plays a key role in dietary fat digestion by creating a lipid-water interface and thus allowing an interaction between soluble lipases and insoluble fat.

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<sup>2</sup>/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<sup>3</sup> 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