uptake. These facts argue in favour of the existence in these human intestinal cells of a carrier-mediated transport system for α-linolenic acid and probably other long chain fatty acids as well.

## Chronic ingestion of acetate increases LDL in healty subjects.

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Some authors have hypothesized that the hypocholesterolemic effect of dietary fibers is partly due to their end-products of colonic fermentation, the short chain fatty acids (SCFA), the main anion produced being acetate. To test this hypothesis, a cross-over design versus placebo experiment was drawn. Six healthy men ($25.5 \pm 0.8$ years, BMI = $21.8 \pm 0.4$ kg/m$^2$) took during 4 weeks 100 mmol/day of acetate as capsules or a placebo. At the end of the treatment, plasma lipoproteins (chylomicron, VLDL, IDL, LDL, HDL$_2$ and HDL$_3$) were isolated just before (T0), 2 (T2) and 4 h (T4) after a test meal (1 200 kcal, 48% lipids, 44% glucids, 8% proteins). Each time, plasma lipids and lipid content of lipoprotein particles were measured. Weight, food intake, blood glucose and insulin remained constant throughout the study. No difference between acetate and placebo treatment was observed for plasma triglycerides (TG) and phospholipides (PL). This was related to the lack of change in both level and content of TG-rich lipoproteins (Chylomicrons, VLDL, IDL). On the other hand, before test meal, we observed an increase of plasma cholesterol esters (CE), T0: $207 \pm 16$ vs $179 \pm 14$ mg/dL ($P < 0.003$). This was still found after test meal, T2: $198 \pm 14$ vs $179 \pm 14$ mg/dL (NS), T4: $200 \pm 14$ vs $171 \pm 14$ mg/dL ($P < 0.02$) without any change in free cholesterol (FC). The higher plasma CE levels were due to an increase in LDL particles but not of HDL$_2$ and HDL$_3$. The test meal emphasized the increase in LDL particles, T0: $162 \pm 9$ vs $141 \pm 1$ 1 mg/dL (NS), T2: $166 \pm 10$ vs $145 \pm 10$ mg/dL ($P < 0.03$) and T4: $168 \pm 9$ vs $148 \pm 8$ mg/dL ($P < 0.005$). Acetate seemed to act on a number of LDL particles and also on the increase in their CE content, $45 \pm 1$ vs $41 \pm 3\%$ of the total mass (NS).

In conclusion, we observed an hypercholesterolemic effect of acetate; thus the effect of soluble fibers does not seem to be due to their SCFA production but could be the result of an increase in cholesterol fecal excretion.

## Regional metabolism of acetate in dogs.

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Acetate is mainly produced from colonic fermentation of non digestible substrats, but its endogenous origin and site of utilization remain unclear. Acetate metabolism was studied in peripheral and splanchnic tissues with stable isotope. Dogs were fasted 24 h, after 3 days of meat diet, and no expired hydrogen showed any bacterial fermentation. *Protocol 1*: five dogs were infused intravenously with [1–$^{13}$C] acetate at 2 μmol.kg$^{-1}$.min$^{-1}$ for 200 min. Blood from the carotid artery and from the radial vein were collected. *Protocol 2*: five dogs were infused with [1–$^{13}$C] acetate at 1 μmol.kg$^{-1}$.min$^{-1}$ for 120 min. Blood from the carotid artery, from a radial and the portal veins were sampled. Isotopic enrichments and concentrations of acetate were measured using a gas chromatography / mass spectrometry. The acetate turnover was calculated according to the steady state equation of the isotopic dilution method. *Protocol 1:* concentrations did not differ between arterial and venous plasma ($167 \pm$

21 and 189 ± 22 $\mu$mol.L$^{-1}$, respectively), while arterial isotopic enrichment was higher than the venous one (7.6 ± 0.7 and 2.9 ± 0.7 Atom % Excess, APE). Arterial turnover was lower than the apparent venous turnover (26 ± 3 and 106 ± 24 $\mu$mol.kg$^{-1}$.min$^{-1}$, $P < 0,001$). *Protocol 2:* the concentrations did not differ between arterial (122 ± 26 $\mu$mol.L$^{-1}$), venous (121 ± 29 $\mu$mol.L$^{-1}$) and portal plasma (131 ± 24 $\mu$mol.L$^{-1}$). The isotopic enrichments at the plateau were higher in the artery (4.9 ± 0.6 APE, $P < 0.05$) as compared to venous (1.7 + 0.3 APE) and portal plasma (1.2 ± 0.2 APE). The apparent turnover was higher in venous and portal blood compared to the artery (80 ± 19, 111 ± 20, 23 ± 4 $\mu$mol.kg$^{-1}$.min$^{-1}$, respectively, $P < 0.05$). We conclude that the digestive tract produces acetate in dogs fasted 24 h (fermentation free), and that peripheral tissues yield more acetate than they use it.

## POSTERS

**Validation of a food frequency questionnaire. I. Foods.** M Gerber [1], C Bonifacj [2], J Scali [1], JP Daurès [2] (*[1] Groupe d'épidémiologie métabolique; [2] Unité d'épidémiologie, de biostatistiques et de recherche clinique, IURC, 34000 Montpellier, France).*

Most of the questionnaires for diet assessment conducted in various countries are validated on nutrients. Only two of these studies considered foods [Pietinen et al (1988), *Am J Epidemiol* 128, 655-666; Bingham et al (1994), *Br J Nutr* 72, 619-643]. However, when studying the etiological relationship between nutrition and cancer, foods and dietary habits appeared more consistently associated with reduced or increased risk than specific nutrients. The disappointing results of some intervention studies [the ATBC study group (1994), *N Engl J Med* 330, 1029-1035] also strengthen the importance of foods over nutrients in the rela-

tionship between nutrition and cancer. Besides, our validation study was intended to pilot an investigation on Mediterranean diet, which is known for its large variety of foods. Thus, the objective of this study was to validate the dietary assessment instruments on food quantitative data, since one of our aims is to make food comparisons.

Three different assessment methods were submitted to a sample of volunteers, 150 women and men. Ninety-eight completed the protocol: a weighed dietary record (PETRA) and a 7-day record using a food check-list with a set of photographs at each season of the year, plus a semi-quantitative food-frequency questionnaire with information on socio-demographic and anthropometric data once in the year. Because no dietary assessment method can safely be qualified as a gold standard, the methods were compared two by two to isolate specific components of the validation: measurement method (set of photographs versus weighed records), qualitative and semi-quantitative pattern of consumption (food frequency questionnaire versus estimated 7-day diet record).

Results are presented here for 16 groups of foods. The Spearman correlation coefficients between PETRA and the estimated dietary record ranged from 0.63 for fish and sea-food to 0.90 for wine (mean: 0.76). There was practically no misclassification. For FFQ, the de-attenuated Spearman correlation ranged from 0.19 for fish and sea-food to 0.78 for wine (mean: 0.49). Misclassification occurred for 8% or less of the subjects (except for the groups agrumes and fish-sea-food, 11%).

Because it is possible to identify qualitatively and quantitatively insufficient questions for specific foods, assessment of foods appeared to be more efficient for questionnaire improvement than for nutrient assessment. Besides, validation on foods might be more justified with regard to the next uses of the questionnaire.