Effects of amount of dietary triglycerides on postprandial serum vitamin A in heathly adults. P Borel [1], C Dubois [2], A Forget [1], M Armand [2], P Grolier [1], H Portugal [3], AM Pauli [3], PM Bernard [4], V Azais-Braesco [1], D Lairon [2] ([1] *INRA, Unité Vitamines, Laboratoire de Nutrition et Sécurité Alimentaire, Jouy-en-Josas;* [2] *Unité 130-INSERM, 18, avenue Mozart, 13009 Marseille;* [3] *Laboratoire Central d'Analyse, Hôpital Sainte-Marguerite, Marseille;* [4] *Service de Médecine Interne et Endocrinologie, Hôpital Sainte-Marguerite, 13000 Marseille, France)*

Absorption of fat-soluble vitamins is generally claimed to be dependent on the amount of dietary fat and this has been established for tocopherol and β-carotene. Nevertheless, no definite evidence has been established for vitamin A. Thus, the aim of this study was to evaluate the importance of the amount of dietary triglyceride on the blood postprandial vitamin A response in healthy human subjects. Eight young healthy males participated in the study. The meals consisted of commercially available food and contained 50 000 IU vitamin A (as retinyl palmitate) and different amounts of triglycerides (0, 15, 30, 40 g as sunflower oil). Fasting blood samples were obtained before the meal and postprandial blood samples were taken every hour for 7 h. Serum was separated and chylomicrons remnants (CMR) were isolated by ultracentrifugation. Triglycerides were determined by an enzymatic procedure. Retinol and retinyl esters (palmitate/oleate, stearate, linoleate) were determined using reverse-phase HPLC with UV detection. In the presence of dietary fat, CMR triglycerides rose postprandially and areas under the curve (AUC) for serum and CMR triglycerides were positively correlated (r = 0.57, $p < 0.01$) with the amount of fat in the meal. Postprandial serum retinol levels were not significantly affected by the test-meals. AUCs for serum and CMR retinyl stearate were not significantly affected by the amount of dietary triglyceride. In contrast AUCs for CMR retinyl palmitate/oleate and retinyl linoleate were positively correlated (r = 0.47, $p < 0.01$ and r = 0.60, $p <$ 0.001) with the amount of fat in the meal. The results obtained show that increasing the dietary triglyceride intake in healthy humans could enhance vitamin A serum postprandial response: the AUC for CMR retinyl esters increased from around 3 (IU/ml serum)•h for the fat-free test-meal to around 8 (IU/ml serum)•h for the 40 g triglyceride test-meal. Moreover, among the 3 retinyl esters checked retinyl linoleate seemed to be the best marker of vitamin A absorption since the AUCs of the other retinyl esters plateaued when dietary triglycerides increased even though AUCs for retinyl linoleate keep on increasing. Finally retinyl linoleate seems to be a better marker of triglyceride rich lipoproteins of intestinal origin than retinyl palmitate, because, unlike retinyl palmitate, there was no detectable retinyl linoleate in fasting serum, and the AUCs for CMR triglycerides and the AUCs for CMR retinyl linoleate were well correlated (r = 0.46, $p < 0.01$).

II. Lipid metabolism

Effects of dietary milk fat on lipid synthesis and fatty-acid deposition in swine. M Camara, J Mourot, C Février (*INRA, Station de Recherches Porcines, 35590 Saint-Gilles, France*)

It is know that dietary fat influences both the amount and the extent of lipid metabolism in pig. The relationship between fat intake and the fatty-acid composition of the adipose tissue is well established. However, to date, few studies have been devoted to the effects of dietary fatty acids provided at a constant level on the body composition of swine. Only the amount of dietary lipids was examined, disregarding the energy intake. The induction of fatty acids from animal sources into pigs should lead to the deposition of saturated fatty acids, which have better technological properties. However, the available data do not allow any conclusion about the lipid synthesis and the extent of adipose tissues.

Twenty-eight Large White x Pietrain crossbred pigs, averaging 75 kg (initial) to 108 kg (final) live weight, were allotted into 2 similar groups. They were fed diets containing the same level of energy and lipids from goats' milk (LC) or cows' milk (LV) (both 20% of the dry matter intake), in addition to fortified barley. The fat-diet contents were different for different fatty acids: C18: 1.4 and 2.5% C10: 2.4 and 7.7%; C16: 37.3 and 33.4 expressed as percentage of total fatty acids for LV and respectively LC. Feed intake and growth performance were similar in the 2 groups. The percentages of body fat were 22 and 22.4%; the lipid contents were 69.7 and 71.9% in the subcutaneous fat and 1.74 and 1.82% in the longissimus dorsi muscle for LV and LC, respectively.

Lipogenic enzyme activities of the backfat were lower in LV than in LC: acetyl CoA carboxylase: 0.09 and 0.14 nmol HCO_3^-/min/mg protein ($p < 0.07$); malic enzyme: 7.95 and 8.96 mmol NADPH/min/mg protein ($p < 0.08$); and glucose-6-phosphodehydrogenase: 1.34 and 1.51 mmol NADPH/min/mg protein ($p < 0.11$). For the intramuscular fat from the longissimus dorsi muscle, activities were identical between the 2 groups. The increase of lipid synthesis obtained could be explain by the amount of short-chain fatty acids which are in a higher proportion in the goats' than in the cows' milk, without any modification in the rate of lipid deposition. However, the data presented did not take account for C/4 which is high in goats' milk; this supports our hypothesis.

The effect of dietary fat on the fatty-acid composition of the adipose tissue has been demonstrated further. In addition, the fat tissues have a satisfactory technological fitness because the rates of C18:2 and C16: 0 were 7% and 30% for the 2 diets respectively and lead to a lower risk of oxidation of the unsaturated fatty acids. Thus, the milk fat could be included in pig diet improve the qualities of the meat without any great change of body fat.

Effect of dietary linoleic acid on pig carcass composition and lipogenesis. J Mourot, A Mounier, P Peiniau (*INRA, Station de Recherches Porcines, 35590 Saint-Gilles, France*)

Fatty-acid composition of pig adipose tissue is affected by dietary fat. The energy value of the diet is frequently increased by supplement of dietary lipid to improve the feed–conversion ratio. Highly unsaturated vegetable fats are used in the diet for economic reasons. A high level of unsaturated fatty acids may lead to increased risks of lipid oxidation and rancid meat. It appears that high levels of unsaturated fat in the diet can also increase carcass fatness.

The aim of the present study was to investigate the effect of dietary linoleic acid on lipogenesis activity. Thirty-six Large White castrated male pigs (35 and 100 kg liveweight) were fed diets containing 4% total lipids inclucing 3 levels of pure linoleic acid, 1,5%, 2.0% and 2.5 %. The elevation in dietary linoleic acid increases carcass fatness ($P < 0.01$). At slaughter, the C18:2 content of backfat increased with the level of dietary linoleic acid ($P < 0.001$).

Table I. Effect of dietary linoleic on acetyl CoA carboxylase activities (nmol HCO_3^-/ min/g tissue). (J Mourot *et al*)

	Acetyl CoA carboxylase activity (nmol HCO_3^-)		
	Backfat	*Leaf fat*	*Ham*
C18:2 (%)			
1.5	2.21	4.07	2.87
2.0	3.16	4.84	4.13
2.5	3.69	5.34	4.69
RDS [1]	0.94	1.52	1.86
Effect	$P < 0.03$	NS	$P < 0.06$

Lipogenesis activity was stimulated by dietary linoleic acid. Acetyl-coenzyme A carboxylase activity increased significantly in subcutaneous adipose tissues (table I). Malic enzyme and glucose-6-phosphate dehydrogenase activities increased significantly in subcutaneous adipose tissues and leaf fat, whereas no significant effect was observed in the intramuscular fat. The elevation of fat synthesis activity can explain the increased carcass fatness of pigs fed diets containing high levels of unsaturated fat.

Thus excess unsaturated fatty acids compares with the needs of the animal increases the carcass fatness in perhaps 2 ways: a direct deposit and/or a stimulation of the lipid synthesis. Dietary linoleic acid also decreases the technological qualities of fatty tissues. This utilization in the diet is negated in all attempts to control and decrease the development of subcutaneous adipose tissue.

Low-protein diets containing hydrogenated coconut or salmon oils affect hepatic and very low density lipoprotein fatty-acid compositions in growing rats. M Bouziane, J Prost, J Belleville (*Unité de Nutrition Cellulaire et Métabolique, Université de Bourgogne, Faculté des Sciences*