Communication no. 14

Fatty acid metabolism in liver slices: a comparison between the rat and preruminant calf. B. Graulet, D. Gruffat, D. Durand, D. Bauchart (Laboratoire croissance et métabolismes des herbivores, Inra, Theix, 63122 Saint-Genès-Champanelle, France)

Preruminant calves receive a milk replacer rich in lipids which are largely utilised as energy substrates for growth. In parallel to their catabolism or storage in peripheral tissues, dietary fatty acids (FA) are also taken up by the liver and subsequently oxidised or esterified. However, the bovine liver is characterised by a low ability to secrete triacylglycerols (TG) as part of very-low density lipoproteins (VLDL) when compared to other mammalian species such as the rat (Pullen et al., J. Anim. Sci. 68 (1990) 1395–1399).The present experiment was conducted to determine the relative importance of the oxidative pathway in the hepatic metabolism of FA in the calf compared to that in the rat.

Three 15-d-old male calves were adapted to a conventional milk diet containing 22.4 % of DM as beef tallow. Three 6-week-old rats were given a standard mixed chow diet. Liver biopsies were taken on fed animals under general anesthesia, cut into slices and incubated for 7 h (37 °C, atmosphere 95 % O_2–5 % CO_2 saturated with water) in a medium containing 0.8 mmol·L^{-1} [^{14}C]oleate (4 Ci/mol). Intensities of oleate oxidation (in CO_2, trapped in hyamine hydroxyde and in perchloric acid soluble products, ASP), and of oleate secretion as part of lipids in VLDL particles (purified by ultracentrifugal flotation) were measured after 7 h of labelling (to allow a significant labelling of secreted TG). Values expressed in nmol of oleate per g of fresh liver were means ± SE. Statistical analyses were carried out by using the ANOVA method with the GLM procedure of SAS.

Oleate incorporation in liver slices was linear with time, between 3 and 7 h of culture for both species. After 7 h of labelling, it was 2.3 times higher in rat than in calf slices (1 016 ± 113 versus 447 ± 200, respectively, $P < 0.01$). Similarly, complete oxidation of oleate into CO_2 was 2.8 times higher (36.3 ± 6.5 versus 13.0 ± 4.2, $P < 0.001$) and partial catabolism of oleate to ASP was 2.1 times higher (167 ± 29 versus 81 ± 27, $P < 0.001$) in rat than in calf slices. Subsequently, the oleate oxidation rate averaged 20 % of the oleate incorporated by the hepatocytes in both species. After 7 h of labelling, rats secreted 7.22 ± 2.35 nmol of oleate into the lipids of VLDL, whereas calves only secreted 0.90 ± 0.29 nmol ($P < 0.001$) which represent 0.71 and 0.20 % of oleate incorporated by hepatocytes, respectively. The low amounts of VLDL produced by calf liver slices compared to rat ones do not seem to be a consequence of a competition between oxidation and esterification of FA. Among possible explanations, the low VLDL secretion rate observed in liver slices of calves is probably linked to a low apolipoprotein B synthesis or to a low TG availability for VLDL assembly in the endoplasmic reticulum owing to their storage in the cytosolic pool and/or an insufficient microsomal TG protein transfer activity.

Communication no. 15

Effect of genetic and nutritional factors on Δ9 desaturase activity in hepatic and adipose tissues in the pig. M. Kouba[a,b], J. Mourot[b], P. Peiniau[b] ([a] Ecole nationale supérieure agronomique de Rennes, 65, rue de Saint-Brieuc, 35042 Rennes cedex, France; [b] Station de recherches porcines, Inra, 35590 Saint-Gilles, France)

Oleic acid is produced in mammalian cells through desaturation of stearoyl-CoA by Δ9-desaturase. The Δ9-desaturase activity appears to be an important determinant of cell contents in stearic and oleic acids, which are the most abundant fatty acids in pig tissues. We report here the effects of different factors on Δ9-desaturase activity mea-

sured in microsomes extracted from hepatic and adipose tissues of the pig. The activity was determined by measuring the conversion of [^{14}C]stearic acid to [^{14}C]oleic acid as described earlier (Kouba et al., Comp. Biochem. Physiol. 118 (1998) 509–514).

A first experiment compared Δ9-desaturase activity in subcutaneous adipose tissue (SAT) and the liver of Large White and Meishan pigs from 20 to 60 kg body weight (BW). The results confirmed that adipose tissue is the main site of Δ9-desaturation in the pig, the activity being 6- to 7-fold higher than in the liver. The activity of Δ9-desaturase did not vary significantly with BW, neither in SAT nor in the liver. The activity was slightly higher in the liver of Meishan than in that of Large White pigs (4.6 versus 3.9 nmol oleic acid formed/h·mg^{-1} protein). It was much higher in SAT of Large White than in Meishan pigs ($P < 0.001$), even though the percentage of oleate in total fatty acids was higher in SAT of the latter (47 versus 45 %). These results suggest that the higher oleate percentage in Meishan adipose tissue could result from a higher Δ9-desaturase activity at a younger age.

A second experiment compared a high linoleic acid diet (diet M, containing 4 % maize oil) with a high saturated fatty acid diet (diet T, containing 4 % beef tallow) for Δ9-desaturase activity in SAT of 100 kg BW pigs. Animals were allocated to diet M or T from 40 to 100 kg BW. The M diet led to a decrease in Δ9-desaturase activity (20.9 versus 28.7 nmol oleic acid formed/h·mg^{-1} protein) and to a lower monounsaturated fatty acid percentage in SAT (37 versus 46 %). These results suggest that Δ9-desaturase could be involved in the regulation of deposition of oleic acid in SAT of pigs given an n-6 PUFA-rich diet and hence could influence the quality of pig adipose tissues.

Further research is needed to study fatty acid desaturation processes during the early growth of Large White and Meishan pigs and the different factors involved in the regulation of the Δ9-desaturase activity.

Communication no. 16

Relationships between de novo lipogenesis and tissue lipid content in muscle, perirenal fat and liver in the rabbit; effects of age and dietary fatty acids.

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Rabbit meat is widely consumed in France (2.7 kg/year/inhab) and Poland (0.5 kg/year/inhab). However, its development is currently hampered because rabbit meat is often considered to be insufficiently tasty and juicy owing to a low fat content in the muscles. A better understanding of lipid partitioning between the different tissues is needed for a better control of lipid deposition in muscle. Lipid deposition proceeds from fatty acids that are either obtained from circulating triglycerides or synthesised de novo. The aim of this study was to investigate the relationships between de novo lipogenesis and final lipid content in *longissimus lumborum* muscle, as compared with perirenal fat and liver. In the first experiment, the effect of age was studied in 49 rabbits fed a commercial diet and slaughtered at different stages, from weaning to sexual maturity ($n = 7$ in each stage). In the second experiment, the effect of nutrition was studied in two groups of fifteen 11-week-old rabbits fed fat-supplemented diets (3.6 % dry matter) containing either medium-chain fatty acids (C10:0 + coconut oil) or long-chain fatty acids (sunflower oil). De novo lipogenesis was assessed by in vitro measurements of specific activities of selected lipogenic enzymes. In both experiments, the activity of acetyl-CoA-carboxylase, which is considered as the rate-limiting enzyme for lipogenesis, was related to the tissue lipid content, i.e. very low in muscle, intermediate in liver and high in perirenal fat. Furthermore, the age-related increase in intramuscular lipids was closely related ($P < 0.001$) to that of the lipogenic