T7 (–1.86; $P < 0.01$) and T15 (–1.42; $P < 0.01$) which confirmed the low capacity of the liver to secrete TG-rich lipoproteins [Bauchart *et al* (1989), *op cit*]. Hepatic production of low density lipoproteins ($1.026 < d < 1.060$ g/ml) was observed, but was not significant at T2 (0.29), T7 (1.78) and T15 (3.43).

Hepatic metabolism of high density lipoproteins (HDL) varied according to the size and density of the particles. With the light HDL (HDLl, $1.060 < d < 1.090$ g/ml), a net uptake was noted at T2 (–2.33; $P < 0.05$), but a net production was measured at T7 (+ 1.99; NS) and T15 (+8.02; $P < 0.01$). Conversely, a net production of heavy HDL (HDLh, $1.091 < d < 1.180$ g/ml) was noted at T2 (1.25; NS) and a net uptake was observed at T7 (–4.60; $P < 0.01$) and T15 (–7.0; $P < 0.01$). These results clearly indicate that the liver converts HDLh to HDLl during high triglyceridemia (T7 and T15) either by lipid transfer from TG-rich lipoproteins and/or by the increased lecithin/cholesterol acyl transferase (LCAT) activity associated with hypertriglyceridemia.

In vivo hepatic secretion of very low density lipoproteins in the growing turkey and chicken treated with an anti-lipoprotein lipase serum. M Kouba [1], D Hermier [2] ([1] *INRA-ENSA, Laboratoire de Biochimie, 65, rue de Saint-Brieuc, 35000 Rennes,* [2] *INRA-SRA Nouzilly, 37380 Monnaie, France*)

Previous results from our laboratory showed that the very low adiposity in turkeys compared to chickens may be related to a much lower hepatic lipogenesis in turkeys [Kouba *et al* (1992), *Br Poult Sci* 33, 1003-1014; Kouba *et al* (1993) *Comp Biochem Physiol* 105A, 359-362]. Since the liver is the main site of lipogenesis in birds, our results suggest that triglyceride (TG) production by the liver is lower in turkeys than in chickens. Therefore, the *in vivo* hepatic secretion of very low density lipoproteins (VLDL) and TG were measured in birds with a maximum growth rate (8-week-old chickens, 11-week-old turkeys). Both species were reared together and fed *ad libitum* the same diets: a starter diet (12.3 MJ/kg ME, 26% protein and 6.8% lipid) for 4 weeks and a grower diet (12.7 MJ/kg ME, 22.4% protein and 6.8% lipid) from 4 to 11 weeks.

Animals received an injection of an anti-lipoprotein lipase (LPL) serum (1 ml/kg body weight) in order to prevent the hydrolysis of the VLDL-TG and their uptake by peripherial tissues. VLDL were characterized after ultracentrifugation by adding their lipid component concentrations. The *in vivo* inhibition of the LPL activity caused a rapid rise in plasma VLDL concentration (11-fold in both species) and TG concentration (3.5-fold in turkeys, and 6-fold in chickens), and an alteration in VLDL composition. The free cholesterol (FC) and TG contents were higher after blockade (5.4 *vs* 2.7% FC and 69.7 *vs* 62.8% TG in turkeys; 4.2 *vs* 2.4% FC and 78.3 *vs* 68.2% TG in chickens). The cholesteryl ester (CE) and phospholipid (PL) percentages were lower (10.2 *vs* 18.4% CE and 14.7 *vs* 16.3% PL in turkeys; 2.9 *vs* 7.1% CE and 14.6 *vs* 22.3% PL in chickens). In both control and injected groups, plasma concentrations of VLDL, VLDL-TG and total TG were generally lower in turkeys than in chickens. The use of an anti-LPL serum and the determination of the plasma volume by the Evans' blue method made it possible to measure the hepatic secretion rate of VLDL, VLDL-TG and total TG (expressed as mg/h/kg body weight). They were higher ($P < 0.01$ or less) for all parameters in chickens than in turkeys ($m \pm SD$; 54.6 ± 9.6 *vs* 32.9 ± 11.2 for VLDL, 41.9 ± 7.3 *vs* 23.7 ± 9.3 for VLDL-TG and 61.7 ± 6.5 *vs* 31.8 ± 10.5 for total TG).

This study has provided evidence of a positive relationship between hepatic lipogenesis, VLDL secretion and fattening in turkeys and chickens.

Effects of dietary cholesterol and saturated to polyunsaturated fatty-acid ratio on the hererogeneity of LDL and HDL particles in the 1.040–1.090 g/ml interval in the preruminant calf, _Bos_ spp. L Leplaix-Charlat [1], D Durand [1], PM Laplaud [2], D Bauchart [1] ([1] *INRA-Theix, Laboratoire Croissance et Métabolismes des Herbivores, UR Métabolismes Énergétique et Lipidique, 63122 Saint-Genès-Champanelle;* [2] *Laboratoire de Biochimie, Faculté de Médecine et de Pharmacie, 2, rue du Dr-Marcland, 87025 Limoges cedex, France*)

Cattle are considered to be high density lipoprotein (HDL) mammals because they possess HDL

as the predominant lipoprotein class (≥ 80% of total lipoproteins) [Bauchart *et al* (1989) *J Lipid Res* 30, 1499-1513]. Some of the low density lipoproteins (LDL) and HDL present similar densities in the 1.040–1.090 g/ml range. The proportion of LDL and HDL might be subject to marked changes with nutritional state and postnatal development in the preruminant calf [Bauchart (1993) *J Dairy Sci* 76, 3864–3882].

In the present study, the effects of dietary cholesterol and the source of dietary fatty acids (tallow *vs* soya bean oil) on the LDL and HDL distribution in the calf plasma were determined.

Twenty-two 4-week-old male calves (65 ± 5 kg body weight) were fed for 17 d: 1) a conventional milk replacer containing triglycerides (23% diet DM) either from tallow (T; 4% of n–6 polyunsaturated fatty acids, PUFA, n = 6) or from soya bean oil (S, 58% of n–6 PUFA, n = 5); or 2) the same diets supplemented with cholesterol (1% diet DM) (TC, n = 6 ; SC, n = 5). Blood samples were collected at peak lipid absorption (7 h after the morning meal) in the jugular vein. LDL and HDL particles in the 1.040–1.090 g/ml interval were isolated by ultracentrifugal flotation and the heterogeneity of these particles was resolved by heparin–sepharose affinity chromatography. Lipoprotein fractions were analyzed as described previously [Bauchart *et al* (1989) *op cit*].

Mean plasma concentrations of lipoproteins in the 1.040–1.090 g/ml interval were 230 (T), 295 (TC), 368 (S) and 539 (SC) mg/dl. These particles presented similar elution characteristics from the heparin–sepharose column exhibiting 3 distinct fractions: fractions I and II corresponding to HDL particles, fraction III to LDL particles. In this density range, the HDL to LDL ratio increased from 6 (T) to 16 and 17 with diets S and TC because of higher amounts of HDL particles, and to 10 with diet SC because of higher amounts of both LDL and HDL particles. Higher amounts of HDL in diets rich in PUFA and/or cholesterol were mainly associated with higher proportions of cholesteryl esters (CE) in the particles: 24% (T), 27% (TC), 28% (S) and 39% (SC). Similar CE enrichment was observed in LDL particles, especially with diet SC. These results emphasize the important role of PUFA: 1) in the incorporation of cholesterol in the LDL and HDL particles *via* the lecithin/cholesterol acyltransferase (LCAT) activity in cattle; and 2) in the stimulation of HDL synthesis since the accumulation of CE-rich HDL (1.040–1.090 g/ml) paralleled the accumulation of total HDL.

Relationship between plasma lipid and lipoprotein profile during pre-overfeeding, energy value of the diet, and differential responsiveness to overfeeding in two strains of geese. D Hermier [1], G Guy [2], R Peresson [1] ([1]*INRA, Station de Recherches Avicoles, 37380 Nouzilly;* [2] *INRA, Station Expérimentale des Palmipèdes à Foie Gras, Artiguères, 40280 Benquet, France*)

In the overfed goose, plasma very low density lipoproteins (VLDL) are poor in triglycerides (TG 30%) which remain stored in the hepatocyte and are partly responsible for the resulting fatty liver [Hermier *et al* (1991) *Lipids* 26, 331-339]. The phase of pre-overfeeding, during which the birds are allowed to feed *ad libitum* a diet containing 2 900 kcal/kg, 20.5% protein and 2.9% fat after a period of food restriction, is probably of major importance for the metabolic changes leading to steatosis. Plasma lipoproteins, prepared by density gradient ultracentrifugation, were compared before and after pre-overfeeding between the Landes strain, which is remarkedly susceptible to liver steatosis, and the Rhine strain which is partly resistant (13 22-week-old male birds from each strain). Before pre-overfeeding, plasma TG concentration was lower in the Landes geese (0.69 *vs* 0.89 g/l), in accordance with the hypothesis that hepatic secretion of TG is impaired in this strain. However, plasma lipoprotein profile (concentration and composition) was typical of the goose and similar in both strains as concerns VLDL, IDL + LDL (intermediate- and low-density lipoproteins, considered as a whole, d 1.013–1.040) and HDL (high-density lipoproteins). After pre-overfeeding, plasma VLDL concentration increased by 35% in both strains, but, as in after overfeeding, they were unusually low in TG, especially in the Landes geese (21% TG in VLDL) compared with the Rhine geese (33%). At the same time, HDL (d 1.052–1.130) concentration decreased by 15% (7 and 6 g/l before and after pre-overfeeding respectively), whereas IDL + LDL did not change significantly (1.20–1.50 g/l), whatever the strain. A parallel experiment has been conducted to measure metabolizable energy of maize, which is the quasi-exclusive dietary component during overfeeding, under conditions of mild overfeeding (3 times the *ad libitum* food intake) in 10 birds from each strain. It showed that both strains have a similar and very efficient utilisation of dietary energy (≈ 3 500 kcal/kg