Influence of protein intake associated with coconut or salmon oil on serum, VLDL, LDL and HDL proteins and lipids in the rat. MN Bouziane, J Prost, J Belleville (Université de Bourgogne, Faculté des Sciences Mirande, Unité de Recherche de Nutrition Cellulaire et Métabolique, BP 138, 21004 Dijon Cedex, France)

Fish oils contain high quantities of eicosapentaenoic acid (EPA = 20:5 ω3) and docosahexaenoic acid (22:6 ω3). These ω3 polyunsaturated fatty acids (PUFA) have a protective effects against atherosclerosis by lowering serum triacylglycerols (TG) and cholesterol levels. Protein malnutrition increases essential fatty acid (EFA) requirements. The effects of protein depletion associated with salmon (rich in ω3 PUFA) or coconut oil (poor in EFA) on various serum parameters (proteins, triacylglycerols, phospholipids and total cholesterol) were studied in young Wistar rats.

Over a 28-d period, 4 groups of 6 male Wistar rats were fed 4 different diets: SAC (20% casein + 5% salmon oil), SAd (2% casein + 5% salmon oil), COC (20% casein + 5% coconut oil), COd (2% casein + 5% coconut oil). Blood was removed, plasma VLDL, HDL and LDL fractions were obtained by a single-spin discontinuous gradient. TG, phospholipids (PL) and total cholesterol were evaluated in serum, VLDL, LDL and HDL. VLDL and HDL-apoproteins were separated by SDS-gradient polyacrylamide gel

![Graphs showing protein, triacylglycerols, phospholipids, total cholesterol, VLDL apolipoproteins, and HDL apolipoproteins](image)

**Fig 1.** Values are means ± SE for 6 rats. Classification of the means are performed using Duncan new multiple range test. Means differ significantly if letters are different (P < 0.05).
electrophoresis (2.5 → 20%) and quantified by densitometry after staining.

**Proteins in serum.** VLDL, HDL2-3; TG in serum; PL in VLDL; total cholesterol in LDL-HDL1 and HDL2-3 were lowered in groups SAd and COd, whereas PL were enhanced in HDL2-3. Total cholesterol in serum and VLDL was lower with salmon oil than with coconut oil.

*Apo-VLDL.* Salmon oil decreased apo -B100, -B48 and -AIV, and increased apo-Cs compared with coconut oil. Protein depletion drastically lowered apo -B100 and -B48 values in groups SAd and COd, apo-AIV only in group SAd and apo-E only in group COd.

**Apo-HDL.** Salmon oil increased apo -Cs, -AI, -AIV and -E. Protein depletion lowered apo -AI, -AIV and -E in both depleted groups, apo -Cs and -AIV only in group SAd, whereas apo-Cs were increased in group COd (fig 1).

The composition of VLDL is significantly modified by protein depletion. HDL-apos are less sensitive to protein depletion than VLDL-apos. These changes involve impairment, particularly in TG transport. Protein depletion diminishes EFA availability and therefore might accelerate EFA shortage. Protein depletion lowered VLDL-TG, -apos and -cholesterol, and impaired lipid transport from liver to organs. This impairment is greater with salmon than with coconut oil.