Plasma Derived Proteins and Enzymes

Lipoproteins

There are five main classifications of lipoproteins. However, the “good and bad” terminology normally refers to High Density Lipoproteins (HDL) and Low Density Lipoproteins (LDL) respectively. Lipoproteins differ in their content of proteins and lipids. The higher the ratio of protein to lipid content the higher the density. In general, the higher the density of a lipoprotein particle the smaller its size and molecular mass. Low HDL (<35 mg/dL), may be associated with increased risk of coronary atherosclerosis, conversely high levels of HDL (>55 mg/dL) appear to have a protective affect. High LDL levels have been shown to correlate with coronary atherosclerosis. A normal fasting individual has LDL concentrations ranging from 200-300 mg/dL.

Lipoprotein(a) is similar in structure to LDL. However, it contains an additional protein, apolipoprotein(a) (apo-(a)), covalently bound to apo-B. Apo-(a) has been found to have a high sequence homology with plasminogen. It contains variable amounts of repeating kringle regions and more than 40 isoforms with a MW range of 400-700 kDa. Its function is thought to be related to triglyceride metabolism and possibly thrombotic and atherogenic pathways.

High density lipoproteins are the smallest of the lipoproteins (6-12.5 nm) (MW 175-500 kDa) and most dense (~1.21). HDL contains several types of apolipoproteins including apo-AI, II, & IV, apo-C-II, III, and apo-E. HDL contains ~55% protein, 3-15% triglycerides, 26-46% phospholipids, 15-30% cholesteryl esters and 2-10% cholesterol. HDL is produced as a protein rich particle in the liver and intestine, and serves as a circulating source of Apo-C-II and Apo-E proteins. The HDL protein particle accumulates cholesteryl esters by the esterification of cholesterol by lecithin-cholesterol acyl-transferase (LCAT). LCAT is activated by apo-AI on HDL. HDL can acquire cholesterol from cell membranes and can transfer cholesteryl esters to VLDL and LDL via transferase activity in apo-D. HDL can return to the liver where cholesterol is removed by reverse cholesterol transport, thus serving as a scavenger to free cholesterol. The liver can then excrete excess cholesterol in the form of bile acids. In a normal fasting individual, HDL concentrations range from 1.0-2.0 g/L.

Plasma and Blood Related Proteins

Chylomicrons are the largest (1000 nm) and least dense (<0.95) of the lipoproteins. Very low density lipoproteins are the next step down from chylomicrons in terms of size and lipid content. They are approximately 25-90 nm in size (MW 6-27 million Da), with a density of ~0.98. They contain 5-12% protein, 50-55% triglycerides, 18-20% phospholipids, 12-15% cholesteryl esters and 8-10% cholesterol. VLDL also contains several types of apolipoproteins including apo-B100, apo-CII, II, and III and apo-E. VLDL also obtains apo-CII and apo-E from plasma HDL.

VLDL assembly in the liver involves the early association of lipids with apo-B100 mediated by microsomal triglyceride transfer proteins while apo-B100 is translocated to the lumen of the ER. Lipoprotein lipase also removes triglycerides from VLDL in the same way as from chylomicrons. Intermediate density lipoproteins are smaller than VLDL (40 nm) and more dense (~1.0). They contain the same apolipoproteins as VLDL. They are composed of 10-12% protein, 24-30% triglycerides, 25-27% phospholipids, 32-35% cholesteryl esters and 8-10% cholesterol. IDLs are derived from triglyceride depletion of VLDL. IDLs can be taken up by the liver for reprocessing, or upon further triglyceride depletion, become LDL. Low density lipoproteins are smaller than IDL (26 nm) (MW approximately 3.5 million Da) and more dense (~1.04). They contain the apolipoprotein apo-B100. LDL contains 10-15% triglycerides, 20-28% phospholipids, 37-48% cholesteryl esters and 8-10% cholesterol. LDL and HDL transport both dietary and endogenous cholesterol in the plasma. LDL is the main transporter of cholesterol and cholesteryl esters and makes up more than half of the total lipoprotein in plasma. LDL is absorbed by the liver and other tissues via receptor mediated endocytosis. The cytoplasmic domain of the LDL receptor facilitates the formation of coated pits; receptor-rich regions of the membrane. The ligand binding domain of the receptor recognizes apo-B100 on LDL, resulting in the formation of a clathrin-coated vesicle. ATP-dependent proton pumps lower the pH inside the vesicle resulting in dissociation of LDL from its receptor. After loss of the clathrin coat the vesicles fuse with lysosomes, resulting in peptide and cholesteryl ester enzymatic hydrolysis. The LDL receptor can be recycled to the cell membrane. Insulin, triiodothyronine and dexamethasone have shown to be involved with the regulation of LDL receptor mediated uptake.
Apolipoprotein Composition of Lipoproteins

<table>
<thead>
<tr>
<th>Lipoprotein</th>
<th>Chylo-micron</th>
<th>VLDL</th>
<th>IDL</th>
<th>LDL</th>
<th>HDL</th>
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<tr>
<td>Apo-AI (28KD)</td>
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<td>Apo-AII (17.4KD)</td>
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<td>Apo(a) (300-800KD)</td>
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</table>

Apolipoprotein A-I from human plasma

Apo A-I

≥85% (SDS-PAGE), buffered aqueous solution

Apo-AI comprises ~70% of the protein moiety in HDL. It is a single polypeptide chain consisting of 245 amino acids with glutamic acid as the C-terminal residue and aspartic acid as the N-terminal residue. The molecular weight is reported to be 28.3 kDa. The protein is made up of one major isoform (pl 5.6) and two minor isoforms (pl 5.53 and 5.46). Apo-AI shows a high content of α-helix structure. The amphipathic regions in the α-helix structure seem to be responsible for lipid binding capacity. In aqueous solution, Apo-AI shows self-association with minor conformation change. Apo-AI activates lecithin-cholesterol acyltransferase, which is responsible for cholesterol esterification in plasma.

Apo-AI levels in normal plasma are 90–130 mg/dl. Apo-AI levels may be inversely related to the risk of coronary disease. Major protein component in high density lipoprotein (HDL)

Solution in 10 mM ammonium bicarbonate. mol wt 28.3 kDa

A0722-5MG 0.5 mg
A0722-1MG 1 mg

Apolipoprotein A-II from human plasma

Apo A-II

>95% (SDS-PAGE), buffered aqueous solution

Unlike Apo A-I, Apo A-II possesses no activating properties for lectin-cholesterol acyltransferase (LCAT). Furthermore, it was found that Apo A-II inhibits the activation of LCAT by Apo A-I. Apo A-II constitutes approximately 20% of the protein moiety of high density lipoprotein (HDL).

Forms dimers in aqueous solutions with an association constant of 5 x 10⁴ M⁻¹. The association is accompanied by an enhancement of ~35% in a α-helical content.

Solution in 10 mM ammonium bicarbonate. mol wt 17.38 kDa

A0972-5MG 0.5 mg
A0972-1MG 1 mg

Apolipoprotein B from human plasma

~95%, lyophilized powder

Apo-B levels correlate with the risk of coronary disease. Apo-B exists in human plasma in two isoforms, Apo-B48 and Apo-B100. Apo-B100 is the major physiological ligand for the LDL receptor. Apo-B100 is a large monomeric protein, containing 4536 amino acids (MW 515 kDa). Apo-B100 is synthesized in the liver and is required for the assembly of VLDL. It does not interchange between lipoprotein particles, as do the other apolipoproteins, and it is found in IDL and LDL after the removal of the Apo-A, E, and C. Apo-B48 is present in chylomicrons and their remnants. It is essential for the intestinal absorption of dietary lipids. Apo-B48 is synthesized in the small intestine. It comprises approximately half of the N-terminal region of Apo-B100 and is the result of posttranscriptional mRNA editing by a stop codon in the intestine not found in the liver. The concentration of Apo-B in normal plasma is ~90 mg/dL.

Lyophilized from buffer containing 10 mM sodium deoxycholate, 0.05 M sodium carbonate, and 0.05 M sodium chloride, pH 10.0 Delipidated with sodium deoxycholate.

Solution in 10 mM ammonium bicarbonate. mol wt 513 kDa

A0722-5MG 0.5 mg
A0722-1MG 1 mg

Apolipoprotein B amide fragment 3358-3372

Thr-Arg-Leu-Thr-Arg-Lys-Leu-Ala-Thr-Ala-Leu-NH₂  C₇₄H₁₄₁N₂₇O₁₈ FW 1697.08 ≥97% (HPLC) Anti-proliferative peptide

A4183-250UG 250 μg
A4183-1MG 1 mg

A4183-250UG 250 μg
A4183-1MG 1 mg
Apolipoprotein C-I from human plasma

- >95% (SDS-PAGE), lyophilized powder
- Interferes directly with fatty acid uptake and is the major plasma inhibitor of cholesterol ester transfer protein.
- Very low density lipoprotein.
- Lyophilized from 10 mM NH₄HCO₃ pH 7.5
- Solution in 0.7 M ammonium bicarbonate.
- Mol wt ~34 kDa
- A7785-50UG
- 100 μg

Apolipoprotein C-II from human plasma

- >95% (SDS-PAGE)
- Activates lipoprotein lipase
- Average mol wt 8.8 kDa
- A7910-50UG
- 50 μg

Apolipoprotein E2 human

- Apo E2
- ≥90% (SDS-PAGE), recombinant, expressed in baculovirus infected SF21 cells, buffered aqueous solution
- Apolipoprotein E2 is a member of the apolipoprotein E family of plasma lipoproteins. It regulates plasma lipid levels by increasing the degradation of particles rich in triglycerides and cholesterol. It binds to LDL receptors, and particles containing apolipoprotein E2 bind amyloid-β protein, the major component of plaques in Alzheimer’s disease, which it delivers to the microglia, the major scavenger cells of brain. Compared to apolipoprotein E3, apolipoprotein E2 is associated with lower plasma LDL levels and may protect against the development of atherosclerosis. Apolipoprotein E2 also appears to be associated with reduced risk for Alzheimer’s disease.
- Human recombinant Apo E2 competes with iodinated human low density lipoprotein for binding to the human Apo B/E (LDL) receptor. Human recombinant Apo E also binds to β-amyloid peptide in a soluble binding assay.
- Solution in 0.7 M ammonium bicarbonate.
- Mol wt ~34 kDa
- R: 36/37/38 S: 26-36
- A2673-50UG
- 50 μg

Apolipoprotein E3 human

- Apo E3
- ≥95% (SDS-PAGE), recombinant, expressed in baculovirus infected SF21 cells, buffered aqueous solution
- Apolipoprotein E3 is a major plasma lipoprotein and the dominant allele of the apolipoprotein E family. It regulates plasma lipid levels by increasing the degradation of particles rich in triglycerides and cholesterol. It binds to LDL receptors and is involved in the development of atherosclerosis. Apo-E-containing particles in plasma and cerebrospinal fluid bind amyloid-β protein, the major component of plaques in Alzheimer’s disease, which it delivers to the microglia, the major scavenger cells of brain.
- Human recombinant Apo E3 competes with iodinated human low density lipoprotein for binding to the human Apo B/E (LDL) receptor. Human recombinant Apo E also binds to β-amyloid peptide in a soluble binding assay.
- Solution in 0.7 M ammonium bicarbonate.
- Mol wt ~34 kDa
- R: 36/37/38 S: 26-36
- A2331-50UG
- 50 μg

Apolipoprotein E4 human

- recombinant, expressed in baculovirus infected Spodoptera frugiperda cells, buffered aqueous solution
- Apolipoprotein E4 is a member of the apolipoprotein E family of plasma lipoproteins. It regulates plasma lipid levels by increasing the degradation of particles rich in triglycerides and cholesterol. It binds to LDL receptors and particles containing apolipoprotein E4 and also binds amyloid-β protein, the major component of plaques in Alzheimer’s disease, which it delivers to the microglia, the major scavenger cells of brain.
- Human recombinant Apo E4 competes with iodinated human low density lipoprotein for binding to the human Apo B/E (LDL) receptor.
- Solution in 0.7 M ammonium bicarbonate.
- A7785-100UG
- 100 μg

Lipoprotein, high density from human plasma

- HDL; High density lipoprotein; α-Lipoprotein
- EC No. 2358241
- >95% (SDS-PAGE), solution
- Solution in 150 mM NaCl, pH 7.4, 0.01% EDTA
- Vial of 10 mg protein
- EC No. 2358241
- R: 23-24/25 S: WET ICE
- L8039-10MG
- 10 mg

Lipoprotein, low density from human plasma

- LDL; β-Lipoprotein; Low density lipoprotein
- EC No. 2944821
- >95% (SDS-PAGE), solution
- Solution in 150 mM NaCl, pH 7.4, and 0.01% EDTA
- Vial of ~10 mg protein (modified Lowry)
- EC No. 2358241
- R: 23-24/25 S: WET ICE
- L8039-10MG
- 10 mg

Lipoprotein, very low density from human plasma

- Pre-β-Lipoprotein; Very low density lipoprotein; VLDL
- EC No. 2944821
- ≥95% (SDS-PAGE), solution
- Solution in 150 mM NaCl, pH 7.4, and 0.01% EDTA
- Vial of ~5 mg protein
- Lyophilized from a solution of 0.15 M NaCl, 0.01% EDTA, pH 7.4
- EC No. 2358241
- R: 23-24/25 S: WET ICE
- L8292-1VL
- 1 vial

Pre-β-Lipoprotein; Very low density lipoprotein; VLDL
- EC No. 2944821
- ≥95% (SDS-PAGE), solution
- Solution in 150 mM NaCl, pH 7.4, and 0.01% EDTA
- Vial of ~5 mg protein
- Lyophilized from a solution of 0.15 M NaCl, 0.01% EDTA, pH 7.4
- EC No. 2358241
- R: 23-24/25 S: WET ICE
- L8292-1VL
- 1 vial