lifespin

LipoPRO

Overview

The assessment of a patient`s comprehensive lipoprotein profile gives insights in cardiovascular health and risk for e.g. diabetes, metabolic syndrom or stroke.

Regulatory Status

RESEARCH USE ONLY (RUO): The RUO-Test contains no medical diagnosis and does not replace the medical diagnosis of a physician.

Method

lifespin Lipo*PRO* V 2.0.0 based on nuclear magnetic resonance (NMR) data.

Test Parameter

Main Lipid Parameters

- Total Cholesterol
- Total Triglycerides
- LDL-Cholesterol
- HDL-Cholesterol
- Apo-A1 / A2
- Apo-B100

Particle Concentrations

- *Lipoprotein Main Fraction*
  - Non-HDL particle number
  - LDL-p
  - IDL-p
  - VLDL-p
  - HDL-p
  - Chylomicrons-p
- *HDL-Subfraction*
  - HDL-1-p to HDL-4-p
- *LDL-Subfraction*
  - LDL-1-p to LDL-6-p

Particle Sizes

- Mean diameter of Chylomicrons
- Mean diameter of VLDL particles
  - Mean diameter of VLDL-1 to VLDL-5 particles
- Mean diameter of LDL particles
  - Mean diameter of LDL-1 to LDL-6 particles
- Mean diameter of HDL particles
  - Mean diameter of HDL-1 to HDL-4 particles

Parameter Ratios

- LDL-Cholesterol/ HDL-Cholesterol
- Apo-B100 / Apo-A
- Free LDL-Cholesterol / LDL-Cholesterol
- Free HDL-Cholesterol / HDL-Cholesterol

Concentrations in Main & Subfractions

- *Cholesterol in*
  - HDL
  - LDL
  - IDL
  - VLDL
  - Chylomircrons
  - LDL-1 to LDL-6
  - HDL-1 to HDL-4
  - VLDL-1 to VLDL-5
- *Free Cholesterol in*
  - HDL
  - LDL
  - IDL
  - VLDL
  - Chylomicrons
  - LDL-1 to LDL-6
  - HDL-1 to HDL-4
  - VLDL-1 to VLDL-5
- *Esterified Cholesterol in*
  - HDL
  - LDL
  - IDL
  - VLDL
  - Chylomicrons
  - LDL-1 to LDL-6
  - HDL-1 to HDL-4
  - VLDL-1 to VLDL-5
- *Triglycerides in*
  - HDL
  - LDL
  - IDL
  - VLDL
  - Chylomicrons
  - LDL-1 to LDL-6
  - HDL-1 to HDL-4
  - VLDL-1 to VLDL-5
- *Phospolipids in*
  - HDL
  - LDL
  - IDL
  - VLDL
  - Chylomicrons
  - LDL-1 to LDL-6
  - HDL-1 to HDL-4
  - VLDL-1 to VLDL-5
- *Apo-A1/A2 in*
  - HDL
- *Apo-B100 in*
  - LDL
  - IDL
  - VLDL
  - Chylomicrons

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Specimen Type

Matrix:
Human blood serum.

Specimen Requirements

Patient Preparation:
Before blood sampling patients should be fasting for 8 hours.

Collection Container / Tube:
Sarstedt S-Monovette (red top). Serum gel barrier tubes are not acceptable.

Specimen Volume: 1 mL.

Specimen Minimum Volume: 0.5 mL.

Collection instruction:

- Allow isopropyl alcohol (from phlebotomy site prep) to dry thoroughly before venipuncture.
- Centrifuge and aliquot serum into an appropriate plastic vial.

Storage Instruction:
Send-in-Services:
Keep frozen and temperature-guided shipment on dry ice.

Reject Due To

- Specimen other than serum
- Improper labeling
- Serum collected using gel barrier tube
- Specimen received in inappropriate container
- Gross hemolysis
- Gross lipemia
- Gross icterus
- Precipitation

Method Description

The analysis software “lifespin Lipo*PRO* V1.0.0.cloud” is used for the quantification of lipoprotein particles in serum based on NMR data.

Limitations

In case of pathological Triglyceride values, the precision of LDL-Cholesterol-value might be effected.
The parameter values can also be impaired if the blood is heavily contaminated with non- or-naturally occuring substances.

Expected Turnaround Time

Send-in-Services
The processing of the order begins at the earliest with the arrival of the sample material relevant for the analyses and the associated information. Time of analyses, capacities and delivery times by arrangement (in General: up to 200 Samples in 3 working days).

Performing Laboratory Location
Regensburg, Germany

Software as a Service (SaaS)
Human samples measured on an inhouse NMR spectrometer qualified by lifespin can be processed via cloud solution. (turnaround time is 500 samples in less than 25 minutes).

Performing Laboratory Location
Customer Site

Useful for

Overall assessment of the current status of cardiovascular health

According to the World Health Organization, cardiovascular disease is one of the most common causes of death worldwide. Approximately one third of all deaths are caused by cardiovascular disease.
Evaluation of lipoprotein particles has been used to support management of cardiovascular disease (CVD) risk for over 15 years, and lipoprotein subclass analysis has become a valuable tool to help clinicians better stratify patients at risk.

The lifespin LipoPRO-test is used to help assess the risk for CVD in patients based on traditional or emerging risk factors such as quantification of the number and size of lipoprotein particles.

If both standard and emerging lipid parameters such as number and size rated green, no hint of coronary artery disease is indicated.
If the parameters are rated orange or red, closer or further considerations are recommended.

According to peer reviewed literature lipoprotein sublasses hint to the following health conditions:

- When LDL-Cholesterol is normal and LDL-P is elevated (lipid discordance) CVD risk tracks with levels of LDL-P. LDL-P is more strongly associated with risk for CVD events and atherosclerosis than LDL-C.

- LDL-P can identify patients with intermediate risk for CVD events. For intermediate-risk patients, LDL-P provides additional insight to CVD risk over above standard risk factors.

- HDL-P is inversely associated with CVD risk. HDL-P is associated with reduced CVD risk, with or without statin therapy.

- Lipid fraction, including small LDL-P, LDL Size, Large HDL-P, HDL Size, Large VLDL-P, and VLDL Size, are correlated with risks of metabolomic syndrome, diabetes, coronary artery disease and stroke.

Relevant Ranges

Parameter	Reference Ranges [mg/dL]	Result
Cholesterol	<200	Desirable
	200-239	Borderline High
	>239	High
LDL-Cholesterol	<70	Best for people who have coronary artery disease.
	<100	Optimal for people at risk of coronary artery disease or who have diabets.
	100-129	Near Optimal if there is no coronary artery disease. High if there is coronary disease.
	129-159	Borderline High if there is no coronary artery disease. High if there is coronary disease.
	159-189	High if there is no coronary artery disease. Very high if there is coronary disease.
	>189	Very High
HDL-Cholesterol	<40	Poor
	40-59	Better
	>59	Best
Triglyceride	<150	Desirable
	150-199	Borderline High
	199-499	High
	>499	Very High

The used relevant ranges are sexspecific clinical references from the guideline of Mayo Clinic, USA.

Reference Ranges*

Parameter	Reference Ranges (f) mg/dL	Reference Ranges (m) mg/dL	Reference Ranges (a) mg/dL
Apo-A1	147.2-269.3	125.7-240.8	130.4-262.1
Apo-A2	31.4-54.5	27.1-49.7	29.1-53.1
Apo-B100	48.7-162.2	47.7-179.1	48.1-170.6

Ratios

Parameter	Reference Ranges (f)	Reference Ranges (m)	Reference Ranges (a)
LDL-Chol/HDL-Chol	0.716-3.333	0.824-4.768	0.756-4.469
Apo-B100/Apo-A1	0.220-0.926	0.250-1.181	0.232-1.118
Free LDL-Chol/LDL-Chol	0.207-0.208	0.207-0.208	0.207-0.208
Free-HDL-Chol/HDL-Chol	0.151-0.166	0.153-0.176	0.152-0.174

Particle size

Parameter	Reference Ranges (f) nm	Reference Ranges (m) nm	Reference Ranges (a) nm
Chylomicrons	80.370-86.859	80.370-87.235	80.370-87.139
Total VLDL-particle size	34.949-36.199	35.216-37.537	35.053-37.284
VLDL-1 particle size	57,960-63.186	58.262-63.395	57,960-63.309
VLDL-2 particle size	49.446-50.534	50.090-50.589	49.876-50.568
VLDL-3 particle size	42.641-42.862	42.708-42.911	42.666-42.892
VLDL-4 particle size	36.477-36.764	36.539-36.833	36.502-36.801
VLDL-5 particle size	31.579-31.685	31.565-31.746	31.574-31.795
Total LDL-particle size	22.148-22.609	22.104-22.537	22.116-22.571
LDL-1 particle size	24.371-24.455	24.366-24.446	24.369-24.451
LDL-2 particle size	22.938-22.948	22.936-22.945	22.937-22.947
LDL-3 particle size	22.350-22.350	22.350-22.350	22.350-22.350
LDL-4 particle size	21.825-21.834	21.826-21.833	21.826- 21.834
LDL-5 particle size	21.130-21.136	21.135-21.137	21.131-21.137
LDL-6 particle size	19.550-19.635	19.530-19.611	19.537-19.625
Total HDL-particle size	8.644-9.186	8.441-9.078	8.487-9.157
HDL-1 particle size	11.422-11.519	11.427-11.613	11.423-11.581
HDL-2 particle size	10.221-10.228	10.214-10.226	10.216-10.227
HDL-3 particle size	9.612-9.637	9.595-9.636	9.601-9.637
HDL-4 particle size	8.172-8.361	8.130-8.315	8.138-8.351

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Particle number

Parameter	Reference Ranges (f) nmol/L	Reference Ranges (m) nmol/L	Reference Ranges (a) nmol/L
Non-HDL particle number	480-1531	469-1664	475-1605
LDL- particle number	336-1198	334-1169	418-1396
IDL- particle number	30-63	28-69	29-66
VLDL- particle number	17-126	23-189	19-170
HDL- particle number	11648-21160	10027-19011	10428-20563
Chylomicrons-particle number			<1
HDL-1 particle number	840-3165	313-2548	425-2969
HDL-2 particle number	581-1922	318-1544	374-1828
HDL-3 particle number	1056-2677	794-2182	858-2541
HDL-4 particle number	8514-13869	8038-13063	8221-13613
LDL-1 particle number	180-477	171-492	175-484
LDL-2 particle number	61-188	60-199	61-192
LDL-3 particle number	21-73	21-78	21-75
LDL-4 particle number	29-114	30-123	29-118
LDL-5 particle number	24-99	25-107	24-104
LDL-6 particle number	104-406	103-447	103-430
VLDL-1 particle number	<3	<6	<4
VLDL-2 particle number	<6	<11	<9
VLDL-3 particle number	2-17	3-30	2-25
VLDL-4 particle number	8-47	9-73	8-64
VLDL-5 particle number	7-54	9-74	8-69

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Lipoprotein Main Classes

Parameter	Reference Ranges (f) mg/dL	Reference Ranges (m) mg/dL	Reference Ranges (a) mg/dL
Cholesterol in			
HDL	52.3-123.9	38.6-103.7	41.4-117.8
LDL	70.1-208.5	66.9-221.2	68.5-215.3
IDL	10.5-22.7	10.1-25.0	10.3-23.8
VLDL	4.6-38.4	6.3-63.4	5.1-53.9
Chylomicrons	<1.3	<3.8	<2.7
Esterified Cholesterol in			
HDL	73.5-176.7	53.5-147.0	57.7-167.6
LDL	93.4-277.6	89.2-294.4	91.3-286.7
IDL	14.4-31.1	13.7-34.1	14.0-32.5
VLDL	5.8-48.5	7.9-81.0	6.4-68.4
Chylomicrons	<2	<5.6	<4.0
Phospholipids in			
HDL	73.0-158.6	56.7-103.2	60.9-152.4
LDL	37.7-118.4	36.4-126.4	37.0-122.6
IDL	7.3-15-6	6.9-17.2	7.1-16.4
VLDL	4.2-32.8	5.8-51.8	4.7-45.3
Chylomicrons	<0,1	<0,2	<0.1
Free Cholesterol in			
HDL	8.7-18.8	6.7-16.1	7.2-18.1
LDL	14.5-43.4	13.9-46.0	14.2-44.8
IDL	2.0-4.3	1.9-4.3	1.9-4.5
VLDL	1.1-9.6	1.6-15.3	1.3-13.2
Chylomicrons	<0.2	<0.5	<0.3
Triglycerides in			
HDL	8.1-19.4	6.0-.16.2	6.4-18.4
LDL	11.7-36.7	11.2-39.2	11.4-38.02
IDL	13.8-29.8	13.2-32.7	13.5-31.2
VLDL	21.6-176.2	29.3-290.0	23.7-247.4
Chylomicrons	<6.1	<17.7	<1.3
Apo-A1 in			
HDL	147.2-269.3	125.7-240.8	130.4-262.1
Apo-A2 in			
HDL	31.4-54.5	27.9-49.7	29.1-53.1
Apo-B100 in			
LDL	41.6-139.5	40.6-150.3	40.7-145.6
IDL	4.0-8.6	3.8-9.4	3.9-9.0
VLDL	2.0-14.8	2.7-22.0	2.2-19.9
Chylomicrons			<0.1

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LDL-Subclasses

Parameter	Reference Ranges (f) mg/dL	Reference Ranges (m) mg/dL	Reference Ranges (a) mg/dL
Cholesterol in			
LDL-1	38.3-100.6	36.2-103.9	37.3-102.4
LDL-2	10.4-31.7	10.1-31.7	10.3-32.7
LDL-3	3.2-11.1	3.2-12.0	3.2-11.5
LDL-4	4.1-15.9	4.3-17.2	4.2-16.5
LDL-5	3.0-13.0	2.9-12.7	3.0-12.8
LDL-6	9.8-37.9	9.7-41.7	9.7-40.1
Esterified Cholesterol in			
LDL-1	51.2-134.6	48.5-139.1	49.9-137.0
LDL-2	13.8-42.2	13.5-44.7	13.7-43.1
LDL-3	4.3-14.8	4.4-15.9	4.3-15.2
LDL-4	5.4-21.1	5.7-22.8	5.5-21.8
LDL-5	3.9-16.3	4.0-17.6	4.0-17.1
LDL-6	12.9-50.3	12.8-55.2	12.8-53.1
Phospholipids in			
LDL-1	16.7-43.4	15.8-44.8	16.2-44.2
LDL-2	4.5-13.7	4.4-14.5	4.4-14.0
LDL-3	1.7-6.0	1.7-6.4	1.7-6.1
LDL-4	2.7-10.8	2.9-11.7	2.8-11.1
LDL-5	2.4-10.1	2.5-10.9	2.5-10.6
LDL-6	9.0-35.2	8.9-38.7	8.9-37.1
Free Cholesterol in			
LDL-1	7.8-20.6	7.4-21.3	7.6-20.9
LDL-2	2.2-6.7	2.1-7.1	2.2-6.8
LDL-3	0.7-2.4	0.7-2.5	0.7-2.4
LDL-4	0.9-3.4	0.9-3.7	0.9-3.5
LDL-5	0.6-2.6	0.7-2.8	0.6-2.8
LDL-6	2.1-8.0	2.0-8.8	2.1-8.5
Triglycerides in			
LDL-1	5.1-13.2	4.8-13.6	4.9-13.4
LDL-2	1.3-4.0	1.3-4.3	1.3-4.1
LDL-3	0.5-1.8	0.5-1.9	0.5-1.8
LDL-4	0.8-3.3	0.9-3.6	0.8-3.4
LDL-5	0.8-3.2	0.8-3.4	0.8-3.3
LDL-6	2.9-11.5	2.9-12.6	2.9-12.1

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HDL-Subclasses

Parameter	Reference Ranges (f) mg/dL	Reference Ranges (m) mg/dL	Reference Ranges (a) mg/dL
Cholesterol in			
HDL-1	12.9-47.7	5.3-38.6	6.8-44.9
HDL-2	5.1-16.9	2.8-13.6	3.3-16.1
HDL-3	6.9-17.6	5.1-14.3	5.6-16.6
HDL-4	24.9-42.4	22.7-39.1	23.3-41.5
Esterified Cholesterol in			
HDL-1	19.2-70.6	7.9-57.2	10.1-66.4
HDL-2	7.3-24.3	4.0-19.5	4.7-23.1
HDL-3	9.7-24.9	7.2-20.3	7.9-23.5
HDL-4	33.7-57.7	30.8-53.0	31.5-56.4
Phospholipids in			
HDL-1	12.5-46.3	5.0-37.5	6.4-43.5
HDL-2	6.2-20.6	3.4-16.5	4.0-19.5
HDL-3	9.6-24.4	7.2-19.9	7.8-23.2
HDL-4	40.8-69.2	37.6-64.0	38.5-67.6
Free Cholesterol in			
HDL-1	1.5-5.7	0.6-4.6	0.8-5.4
HDL-2	0.7-2.4	0.4-2.0	0.5-2.3
HDL-3	1.1-2.8	0.8-2.7	0.9-2.6
HDL-4	4.8-8.1	4.4-7.5	4.6-7.9
Triglycerides in			
HDL-1	2.0-7.4	0.8-6.0	1.1-7.0
HDL-2	0.8-2.6	0.4-2.1	0.5-2.8
HDL-3	1.1-2.8	0.8-2.3	0.9-2.7
HDL-4	3.8-6.6	3.5-6.1	3.6-6.5

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VLDL-Subclasses

Parameter	Reference Ranges (f) mg/dL	Reference Ranges (m) mg/dL	Reference Ranges (a) mg/dL
Cholesterol in			
VLDL-1	<3.9	<8.3	<6.4
VLDL-2	0.6-9.2	0.6-9.2	0.4-7.6
VLDL-3	0.8-8.2	1.2-14.0	0.9-11.6
VLDL-4	2.0-12.3	2.5-19.4	2.1-16.8
VLDL-5	1.3-9.7	11.7-13.4	1.4-12.5
Esterified Cholesterol in			
VLDL-1	<5.5	<11.6	<9.0
VLDL-2	0.4-6.7	0.8-12.3	0.6-10.2
VLDL-3	1.0-10.5	1.5-18.0	1.2-14.9
VLDL-4	2.5-15.3	3.1-24.1	2.6-20.8
VLDL-5	1.6-11.5	2.0-15.9	1.7-14.9
Phospholipids in			
VLDL-1	<2.1	<4.4	<3.4
VLDL-2	0.2-3.1	0.4-5.7	0.3-4.7
VLDL-3	0.6-5.7	0.8-9.7	0.6-8.1
VLDL-4	1.9-11.8	2.4-18.5	2.1-16.1
VLDL-5	01.4-10.6	1.9-14.7	1.6-13.7
Free Cholesterol in			
VLDL-1	<0.7	<1.4	<1.1
VLDL-2	0.1-1.0	0.1-1.9	0.1-1.6
VLDL-3	0.2-1.9	0.3-3.3	0.2-2.7
VLDL-4	0.5-3.3	0.7-5.1	0.6-4.4
VLDL-5	0.4-2.8	0.5-3.9	0.4-3.7
Triglycerides in			
VLDL-1	<18.6	<39	<30.3
VLDL-2	1.3-20.8	2.6-38.0	1.8-31.4
VLDL-3	3.6-36.5	5.3-62.4	4.1-51.6
VLDL-4	9.8-60.7	12.2-95.7	10.5-82.6
VLDL-5	5.9-43.4	7.7-60.1	6.5-55.9

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