

Supplementary Table S1. The analysed metabolites using ¹H-NMR-based lipid/metabolomics.

Metabolites	Unit	Description of the metabolites
Total-C	mmol/L	Total cholesterol
non-HDL-C	mmol/L	Total cholesterol minus HDL-C
Remnant-C	mmol/L	Remnant cholesterol (non-HDL, non-LDL -cholesterol)
VLDL-C	mmol/L	VLDL cholesterol
Clinical LDL-C	mmol/L	Clinical LDL cholesterol
LDL-C	mmol/L	LDL cholesterol
HDL-C	mmol/L	HDL cholesterol
Total-TG	mmol/L	Total triglycerides
VLDL-TG	mmol/L	Triglycerides in VLDL
LDL-TG	mmol/L	Triglycerides in LDL
HDL-TG	mmol/L	Triglycerides in HDL
Total-PL	mmol/L	Total phospholipids in lipoprotein particles
VLDL-PL	mmol/L	Phospholipids in VLDL
LDL-PL	mmol/L	Phospholipids in LDL
HDL-PL	mmol/L	Phospholipids in HDL
Total-CE	mmol/L	Total esterified cholesterol
VLDL-CE	mmol/L	Cholesteryl esters in VLDL
LDL-CE	mmol/L	Cholesteryl esters in LDL
HDL-CE	mmol/L	Cholesteryl esters in HDL
Total-FC	mmol/L	Total free cholesterol
VLDL-FC	mmol/L	Free cholesterol in VLDL
LDL-FC	mmol/L	Free cholesterol in LDL
HDL-FC	mmol/L	Free cholesterol in HDL
Total-L	mmol/L	Total lipids in lipoprotein particles
VLDL-L	mmol/L	Total lipids in VLDL
LDL-L	mmol/L	Total lipids in LDL
HDL-L	mmol/L	Total lipids in HDL
Total-P	mmol/L	Total concentration of lipoprotein particles
VLDL-P	mmol/L	Concentration of VLDL particles
LDL-P	mmol/L	Concentration of LDL particles
HDL-P	mmol/L	Concentration of HDL particles
VLDL size	nm	Average diameter for VLDL particles
LDL size	nm	Average diameter for LDL particles
HDL size	nm	Average diameter for HDL particles
Phosphoglyc	mmol/L	Phosphoglycerides
TG/PG	ratio	Ratio of triglycerides to phosphoglycerides
Cholines	mmol/L	Total cholines
Phosphatidylc	mmol/L	Phosphatidylcholines
Sphingomyelins	mmol/L	Sphingomyelins
ApoB	g/L	Apolipoprotein B
ApoA1	g/L	Apolipoprotein A1
ApoB/ApoA1	ratio	Ratio of apolipoprotein B to apolipoprotein A1
Total-FA	mmol/L	Total fatty acids
Unsaturation	degree	Degree of unsaturation
Omega-3	mmol/L	Omega-3 fatty acids
Omega-6	mmol/L	Omega-6 fatty acids
PUFA	mmol/L	Polyunsaturated fatty acids
MUFA	mmol/L	Monounsaturated fatty acids
SFA	mmol/L	Saturated fatty acids
LA	mmol/L	Linoleic acid
DHA	mmol/L	Docosahexaenoic acid
Omega-3 %	%	Ratio of omega-3 fatty acids to total fatty acids
Omega-6 %	%	Ratio of omega-6 fatty acids to total fatty acids
PUFA %	%	Ratio of polyunsaturated fatty acids to total fatty acids
MUFA %	%	Ratio of monounsaturated fatty acids to total fatty acids
SFA %	%	Ratio of saturated fatty acids to total fatty acids
LA %	%	Ratio of linoleic acid to total fatty acids
DHA %	%	Ratio of docosahexaenoic acid to total fatty acids
PUFA/MUFA	ratio	Ratio of polyunsaturated fatty acids to monounsaturated fatty acids
Omega-6/Omega-3	ratio	Ratio of omega-6 fatty acids to omega-3 fatty acids
Ala	mmol/L	Alanine

Metabolites	Unit	Description of the metabolites
Gln	mmol/L	Glutamine
Gly	mmol/L	Glycine
His	mmol/L	Histidine
Total BCAA	mmol/L	Total concentration of branched-chain amino acids (leucine + isoleucine + valine)
Ile	mmol/L	Isoleucine
Leu	mmol/L	Leucine
Val	mmol/L	Valine
Phe	mmol/L	Phenylalanine
Tyr	mmol/L	Tyrosine
Glucose	mmol/L	Glucose
Lactate	mmol/L	Lactate
Pyruvate	mmol/L	Pyruvate
Citrate	mmol/L	Citrate
Glycerol	mmol/L	Glycerol
bOHbutyrate	mmol/L	3-Hydroxybutyrate
Acetate	mmol/L	Acetate
Acetoacetate	mmol/L	Acetoacetate
Acetone	mmol/L	Acetone
Creatinine	μmol/l	Creatinine
Albumin	g/L	Albumin
GlycA	mmol/L	Glycoprotein acetyls
XXL-VLDL-P	mmol/L	Concentration of chylomicrons and extremely large VLDL particles
XXL-VLDL-L	mmol/L	Total lipids in chylomicrons and extremely large VLDL
XXL-VLDL-PL	mmol/L	Phospholipids in chylomicrons and extremely large VLDL
XXL-VLDL-C	mmol/L	Cholesterol in chylomicrons and extremely large VLDL
XXL-VLDL-CE	mmol/L	Cholesteryl esters in chylomicrons and extremely large VLDL
XXL-VLDL-FC	mmol/L	Free cholesterol in chylomicrons and extremely large VLDL
XXL-VLDL-TG	mmol/L	Triglycerides in chylomicrons and extremely large VLDL
XL-VLDL-P	mmol/L	Concentration of very large VLDL particles
XL-VLDL-L	mmol/L	Total lipids in very large VLDL
XL-VLDL-PL	mmol/L	Phospholipids in very large VLDL
XL-VLDL-C	mmol/L	Cholesterol in very large VLDL
XL-VLDL-CE	mmol/L	Cholesteryl esters in very large VLDL
XL-VLDL-FC	mmol/L	Free cholesterol in very large VLDL
XL-VLDL-TG	mmol/L	Triglycerides in very large VLDL
L-VLDL-P	mmol/L	Concentration of large VLDL particles
L-VLDL-L	mmol/L	Total lipids in large VLDL
L-VLDL-PL	mmol/L	Phospholipids in large VLDL
L-VLDL-C	mmol/L	Cholesterol in large VLDL
L-VLDL-CE	mmol/L	Cholesteryl esters in large VLDL
L-VLDL-FC	mmol/L	Free cholesterol in large VLDL
L-VLDL-TG	mmol/L	Triglycerides in large VLDL
M-VLDL-P	mmol/L	Concentration of medium VLDL particles
M-VLDL-L	mmol/L	Total lipids in medium VLDL
M-VLDL-PL	mmol/L	Phospholipids in medium VLDL
M-VLDL-C	mmol/L	Cholesterol in medium VLDL
M-VLDL-CE	mmol/L	Cholesteryl esters in medium VLDL
M-VLDL-FC	mmol/L	Free cholesterol in medium VLDL
M-VLDL-TG	mmol/L	Triglycerides in medium VLDL
S-VLDL-P	mmol/L	Concentration of small VLDL particles
S-VLDL-L	mmol/L	Total lipids in small VLDL
S-VLDL-PL	mmol/L	Phospholipids in small VLDL
S-VLDL-C	mmol/L	Cholesterol in small VLDL
S-VLDL-CE	mmol/L	Cholesteryl esters in small VLDL
S-VLDL-FC	mmol/L	Free cholesterol in small VLDL
S-VLDL-TG	mmol/L	Triglycerides in small VLDL
XS-VLDL-P	mmol/L	Concentration of very small VLDL particles
XS-VLDL-L	mmol/L	Total lipids in very small VLDL
XS-VLDL-PL	mmol/L	Phospholipids in very small VLDL
XS-VLDL-C	mmol/L	Cholesterol in very small VLDL
XS-VLDL-CE	mmol/L	Cholesteryl esters in very small VLDL
XS-VLDL-FC	mmol/L	Free cholesterol in very small VLDL

Metabolites	Unit	Description of the metabolites
XS-VLDL-TG	mmol/L	Triglycerides in very small VLDL
IDL-P	mmol/L	Concentration of IDL particles
IDL-L	mmol/L	Total lipids in IDL
IDL-PL	mmol/L	Phospholipids in IDL
IDL-C	mmol/L	Cholesterol in IDL
IDL-CE	mmol/L	Cholesteryl esters in IDL
IDL-FC	mmol/L	Free cholesterol in IDL
IDL-TG	mmol/L	Triglycerides in IDL
L-LDL-P	mmol/L	Concentration of large LDL particles
L-LDL-L	mmol/L	Total lipids in large LDL
L-LDL-PL	mmol/L	Phospholipids in large LDL
L-LDL-C	mmol/L	Cholesterol in large LDL
L-LDL-CE	mmol/L	Cholesteryl esters in large LDL
L-LDL-FC	mmol/L	Free cholesterol in large LDL
L-LDL-TG	mmol/L	Triglycerides in large LDL
M-LDL-P	mmol/L	Concentration of medium LDL particles
M-LDL-L	mmol/L	Total lipids in medium LDL
M-LDL-PL	mmol/L	Phospholipids in medium LDL
M-LDL-C	mmol/L	Cholesterol in medium LDL
M-LDL-CE	mmol/L	Cholesteryl esters in medium LDL
M-LDL-FC	mmol/L	Free cholesterol in medium LDL
M-LDL-TG	mmol/L	Triglycerides in medium LDL
S-LDL-P	mmol/L	Concentration of small LDL particles
S-LDL-L	mmol/L	Total lipids in small LDL
S-LDL-PL	mmol/L	Phospholipids in small LDL
S-LDL-C	mmol/L	Cholesterol in small LDL
S-LDL-CE	mmol/L	Cholesteryl esters in small LDL
S-LDL-FC	mmol/L	Free cholesterol in small LDL
S-LDL-TG	mmol/L	Triglycerides in small LDL
XL-HDL-P	mmol/L	Concentration of very large HDL particles
XL-HDL-L	mmol/L	Total lipids in very large HDL
XL-HDL-PL	mmol/L	Phospholipids in very large HDL
XL-HDL-C	mmol/L	Cholesterol in very large HDL
XL-HDL-CE	mmol/L	Cholesteryl esters in very large HDL
XL-HDL-FC	mmol/L	Free cholesterol in very large HDL
XL-HDL-TG	mmol/L	Triglycerides in very large HDL
L-HDL-P	mmol/L	Concentration of large HDL particles
L-HDL-L	mmol/L	Total lipids in large HDL
L-HDL-PL	mmol/L	Phospholipids in large HDL
L-HDL-C	mmol/L	Cholesterol in large HDL
L-HDL-CE	mmol/L	Cholesteryl esters in large HDL
L-HDL-FC	mmol/L	Free cholesterol in large HDL
L-HDL-TG	mmol/L	Triglycerides in large HDL
M-HDL-P	mmol/L	Concentration of medium HDL particles
M-HDL-L	mmol/L	Total lipids in medium HDL
M-HDL-PL	mmol/L	Phospholipids in medium HDL
M-HDL-C	mmol/L	Cholesterol in medium HDL
M-HDL-CE	mmol/L	Cholesteryl esters in medium HDL
M-HDL-FC	mmol/L	Free cholesterol in medium HDL
M-HDL-TG	mmol/L	Triglycerides in medium HDL
S-HDL-P	mmol/L	Concentration of small HDL particles
S-HDL-L	mmol/L	Total lipids in small HDL
S-HDL-PL	mmol/L	Phospholipids in small HDL
S-HDL-C	mmol/L	Cholesterol in small HDL
S-HDL-CE	mmol/L	Cholesteryl esters in small HDL
S-HDL-FC	mmol/L	Free cholesterol in small HDL
S-HDL-TG	mmol/L	Triglycerides in small HDL
XXL-VLDL-PL %	%	Phospholipids to total lipids ratio in chylomicrons and extremely large VLDL
XXL-VLDL-C %	%	Cholesterol to total lipids ratio in chylomicrons and extremely large VLDL
XXL-VLDL-CE %	%	Cholesteryl esters to total lipids ratio in chylomicrons and extremely large VLDL
XXL-VLDL-FC %	%	Free cholesterol to total lipids ratio in chylomicrons and extremely large VLDL
XXL-VLDL-TG %	%	Triglycerides to total lipids ratio in chylomicrons and extremely large VLDL
XL-VLDL-PL %	%	Phospholipids to total lipids ratio in very large VLDL

Metabolites	Unit	Description of the metabolites
XL-VLDL-C %	%	Cholesterol to total lipids ratio in very large VLDL
XL-VLDL-CE %	%	Cholesteryl esters to total lipids ratio in very large VLDL
XL-VLDL-FC %	%	Free cholesterol to total lipids ratio in very large VLDL
XL-VLDL-TG %	%	Triglycerides to total lipids ratio in very large VLDL
L-VLDL-PL %	%	Phospholipids to total lipids ratio in large VLDL
L-VLDL-C %	%	Cholesterol to total lipids ratio in large VLDL
L-VLDL-CE %	%	Cholesteryl esters to total lipids ratio in large VLDL
L-VLDL-FC %	%	Free cholesterol to total lipids ratio in large VLDL
L-VLDL-TG %	%	Triglycerides to total lipids ratio in large VLDL
M-VLDL-PL %	%	Phospholipids to total lipids ratio in medium VLDL
M-VLDL-C %	%	Cholesterol to total lipids ratio in medium VLDL
M-VLDL-CE %	%	Cholesteryl esters to total lipids ratio in medium VLDL
M-VLDL-FC %	%	Free cholesterol to total lipids ratio in medium VLDL
M-VLDL-TG %	%	Triglycerides to total lipids ratio in medium VLDL
S-VLDL-PL %	%	Phospholipids to total lipids ratio in small VLDL
S-VLDL-C %	%	Cholesterol to total lipids ratio in small VLDL
S-VLDL-CE %	%	Cholesteryl esters to total lipids ratio in small VLDL
S-VLDL-FC %	%	Free cholesterol to total lipids ratio in small VLDL
S-VLDL-TG %	%	Triglycerides to total lipids ratio in small VLDL
XS-VLDL-PL %	%	Phospholipids to total lipids ratio in very small VLDL
XS-VLDL-C %	%	Cholesterol to total lipids ratio in very small VLDL
XS-VLDL-CE %	%	Cholesteryl esters to total lipids ratio in very small VLDL
XS-VLDL-FC %	%	Free cholesterol to total lipids ratio in very small VLDL
XS-VLDL-TG %	%	Triglycerides to total lipids ratio in very small VLDL
IDL-PL %	%	Phospholipids to total lipids ratio in IDL
IDL-C %	%	Cholesterol to total lipids ratio in IDL
IDL-CE %	%	Cholesteryl esters to total lipids ratio in IDL
IDL-FC %	%	Free cholesterol to total lipids ratio in IDL
IDL-TG %	%	Triglycerides to total lipids ratio in IDL
L-LDL-PL %	%	Phospholipids to total lipids ratio in large LDL
L-LDL-C %	%	Cholesterol to total lipids ratio in large LDL
L-LDL-CE %	%	Cholesteryl esters to total lipids ratio in large LDL
L-LDL-FC %	%	Free cholesterol to total lipids ratio in large LDL
L-LDL-TG %	%	Triglycerides to total lipids ratio in large LDL
M-LDL-PL %	%	Phospholipids to total lipids ratio in medium LDL
M-LDL-C %	%	Cholesterol to total lipids ratio in medium LDL
M-LDL-CE %	%	Cholesteryl esters to total lipids ratio in medium LDL
M-LDL-FC %	%	Free cholesterol to total lipids ratio in medium LDL
M-LDL-TG %	%	Triglycerides to total lipids ratio in medium LDL
S-LDL-PL %	%	Phospholipids to total lipids ratio in small LDL
S-LDL-C %	%	Cholesterol to total lipids ratio in small LDL
S-LDL-CE %	%	Cholesteryl esters to total lipids ratio in small LDL
S-LDL-FC %	%	Free cholesterol to total lipids ratio in small LDL
S-LDL-TG %	%	Triglycerides to total lipids ratio in small LDL
XL-HDL-PL %	%	Phospholipids to total lipids ratio in very large HDL
XL-HDL-C %	%	Cholesterol to total lipids ratio in very large HDL
XL-HDL-CE %	%	Cholesteryl esters to total lipids ratio in very large HDL
XL-HDL-FC %	%	Free cholesterol to total lipids ratio in very large HDL
XL-HDL-TG %	%	Triglycerides to total lipids ratio in very large HDL
L-HDL-PL %	%	Phospholipids to total lipids ratio in large HDL
L-HDL-C %	%	Cholesterol to total lipids ratio in large HDL
L-HDL-CE %	%	Cholesteryl esters to total lipids ratio in large HDL
L-HDL-FC %	%	Free cholesterol to total lipids ratio in large HDL
L-HDL-TG %	%	Triglycerides to total lipids ratio in large HDL
M-HDL-PL %	%	Phospholipids to total lipids ratio in medium HDL
M-HDL-C %	%	Cholesterol to total lipids ratio in medium HDL
M-HDL-CE %	%	Cholesteryl esters to total lipids ratio in medium HDL
M-HDL-FC %	%	Free cholesterol to total lipids ratio in medium HDL
M-HDL-TG %	%	Triglycerides to total lipids ratio in medium HDL
S-HDL-PL %	%	Phospholipids to total lipids ratio in small HDL
S-HDL-C %	%	Cholesterol to total lipids ratio in small HDL
S-HDL-CE %	%	Cholesteryl esters to total lipids ratio in small HDL
S-HDL-FC %	%	Free cholesterol to total lipids ratio in small HDL
S-HDL-TG %	%	Triglycerides to total lipids ratio in small HDL

Supplementary Table S2. List of metabolite class name and its description.

Metabolite class	Descriptions
Total_C	Total cholesterol
non_HDL_C	Total cholesterol minus HDL-C
Total_TG	Total triglycerides
Phosphatidylc	Phospholipids
ApoB	Apolipoprotein B
ApoA1	Apolipoprotein A1
Total_FA	Total fatty acids
Unsaturation	Unsaturation fatty acids
Omega-3	Omega-3 fatty acids
Omega-6	Omega-6 fatty acids
PUFA	Polyunsaturated fatty acids
MUFA	Monounsaturated fatty acids
SFA	Saturated fatty acids
LA	Linoleic acid
DHA	Docosahexaenoic acid
Creatinine	Creatinine
GlycA	Glycoprotein acetyls
Ala	Alanine
Gln	Glutamine
Gly	Glycine
His	Histidine
Total BCAA	Total concentration of branched-chain amino acids
Ile	Isoleucine
Leu	Leucine
Val	Valine
Phe	Phenylalanine
Tyr	Tyrosine
Glycolysis_total	Glycolysis-related measures; including glucose, lactate, pyruvate, citrate, and glycerol
Ketone_body_total	Total ketone bodies
HDL_size	Average diameter for HDL particles
HDL_P	Concentration of HDL particles
HDL_L	Total lipids in HDL
HDL_PL	Phospholipids in HDL
HDL_C	Cholesterol in HDL
HDL_CE	Cholesteryl esters in HDL
HDL_FC	Free cholesterol in HDL
HDL_TG	Triglycerides in HDL
HDL_XL_particle_prop	The ratio of vary large size HDL particle in total HDL particle
HDL_L_particle_prop	The ratio of large size HDL particle in total HDL particle
HDL_M_particle_prop	The ratio of medium size HDL particle in total HDL particle
HDL_S_particle_prop	The ratio of small size HDL particle in total HDL particle
HDL_PL_prop	The ratio of phospholipids in HDL
HDL_CE_prop	The ratio of cholesteryl esters in HDL
HDL_FC_prop	The ratio of free cholesterol in HDL
HDL_TG_prop	The ratio of triglycerides in HDL
VLDL_size	Average diameter for VLDL particles
VLDL_P	Concentration of VLDL particles
VLDL_L	Total lipids in VLDL
VLDL_PL	Phospholipids in VLDL
VLDL_C	Cholesterol in VLDL
VLDL_CE	Cholesteryl esters in VLDL
VLDL_FC	Free cholesterol in VLDL
VLDL_TG	Triglycerides in VLDL
VLDL_XXL_particle_prop	The ratio of extremely lage size VLDL particle in total VLDL particle
VLDL_XL_particle_prop	The ratio of vary lage size VLDL particle in total VLDL particle
VLDL_L_particle_prop	The ratio of large size VLDL particle in total VLDL particle
VLDL_M_particle_prop	The ratio of medium size VLDL particle in total VLDL particle
VLDL_S_particle_prop	The ratio of small size VLDL particle in total VLDL particle
VLDL_XS_particle_prop	The ratio of vary small size VLDL particle in total VLDL particle
VLDL_PL_prop	The ratio of phospholipids in VLDL
VLDL_CE_prop	The ratio of cholesteryl esters in VLDL
VLDL_FC_prop	The ratio of free cholesterol in VLDL
VLDL_TG_prop	The ratio of triglycerides in VLDL
IDL_concentration_total	Concentration of IDL particles
IDL_lipid_total	Total lipids in IDL
IDL_PL_total	Phospholipids in IDL
IDL_Chol_total	Cholesterol in IDL

Metabolite class	Descriptions
IDL_CE_total	Cholesteryl esters in IDL
IDL_FC_total	Free cholesterol in IDL
IDL_TG_total	Triglycerides in IDL
IDL_PL_prop	The ratio of phospholipids in IDL
IDL_CE_prop	The ratio of cholesteryl esters in IDL
IDL_FC_prop	The ratio of free cholesterol in IDL
IDL_TG_prop	The ratio of triglycerides in IDL
LDL_size	Average diameter for LDL particles
LDL_P	Concentration of LDL particles
LDL_L	Total lipids in LDL
LDL_PL	Phospholipids in LDL
LDL_C	Cholesterol in LDL
Clinical_LDL_C	Clinical LDL cholesterol
LDL_CE	Cholesteryl esters in LDL
LDL_FC	Free cholesterol in LDL
LDL_TG	Triglycerides in LDL
LDL_L_particle_prop	The ratio of large size LDL particle in total LDL particle
LDL_M_particle_prop	The ratio of medium size LDL particle in total LDL particle
LDL_S_particle_prop	The ratio of small size LDL particle in total LDL particle
LDL_PL_prop	The ratio of phospholipids in LDL
LDL_CE_prop	The ratio of cholesteryl esters in LDL
LDL_FC_prop	The ratio of free cholesterol in LDL
LDL_TG_prop	The ratio of triglycerides in LDL

Supplementary Table S3. RA patients receiving csDMARDs alone compared to those receiving bDMARDs or JAKi.

Characteristics	Patients receiving bDMARDs or JAKi (n= 59)	Patients receiving csDMARDs alone (n=6)	p-value
DAS28 at study entry	6.40 (1.04)	5.58 (1.44)	0.079
Age at study entry, years	60.4 (12.6)	57.0 (17.8)	0.548
TC, mg/dl	196.0 (40.9)	222.3 (68.3)	0.164
Triglyceride, mg/dl	96.1 (50.1)	163.5 (143.6)	*0.016
HDL-c, mg/dl	61.5 (15.8)	54.1 (11.7)	0.274
LDL-c, mg/dl	114.2 (35.7)	134.5 (49.6)	0.207
Atherogenic index	3.37 (0.98)	4.32 (1.75)	*0.040
BMI	23.7 (4.1)	26.7 (3.7)	0.092
RA duration, months	84.5 (24.6)	75.2 (46.9)	0.423

* Continuous value are presented as the mean (standard deviation)

* $p < 0.05$, was determined by the student's t-test.

Atherogenic index calculated by TC /HDL-c; BMI: Body mass index; bDMARDs: biologic disease-modifying anti-rheumatic drugs; csDMARDs: conventional synthetic DMARDs; DAS28: Disease activity score for 28-joints; HDL-c: High-density lipoprotein cholesterol; JAKi: Janus kinase inhibitor; LDL-c: Low-density lipoprotein cholesterol; RA: Rheumatoid arthritis; TC: Total cholesterol.