

Supplementary Table 1. Relevant correlations of fatty acids and anthropometric and metabolic parameters in group of **231** men with hyperlipidemia

	BMI	Fat mass	TAG	NEFA	HDL-C	apoB	insulin	HOMA-IR	Glucose
14:0 ^a	0.063 ¹	0.012	0.099	0.022	-0.006	-0.014	-0.005	-0.005	-0.049
16:0	-0.055	0.062	0.002	0.084	0.091	0.111	-0.112	-0.085	0.094
16:1n-7	0.139*	0.046	0.214***	0.337***	0.043	-0.13	0.015	0.023	0.023
16:1n-9	-0.161*	-0.013	-0.202***	0.062	0.110	-0.084	-0.145*	-0.151*	-0.050
18:0	0.143*	0.125	0.199***	0.133*	-0.188***	-0.086	0.161*	0.169**	0.071
18:1n-7	-0.068	-0.068	-0.114	0.291***	-0.043	-0.203**	-0.183**	-0.196**	-0.111
18:1n-9	-0.025	0.017	0.070	0.299***	-0.007	-0.308***	-0.043	-0.065	-0.133*
18:2n-6	-0.103	-0.037	-0.108	-0.216**	0.008	0.043	-0.059	-0.060	0.075
18:3n-6	0.011	0.095	0.079	-0.077	0.071	-0.105	0.089	0.082	-0.024
18:3n-3	-0.102	-0.024	-0.073	-0.009	0.025	-0.199**	-0.055	-0.087	-0.121
20:1n-9	-0.087	-0.100	-0.155*	0.204**	-0.129*	-0.164*	-0.179**	-0.155*	-0.064
20:3n-6	0.202**	0.132	0.136*	0.083	-0.183**	0.004	0.173**	0.169**	0.019
20:4n-6	0.078	0.013	-0.050	-0.070	0.046	0.072	0.045	0.057	0.031
20:5n-3	0.027	-0.021	0.097	-0.115	0.139*	0.158*	0.031	0.033	-0.116
22:4n-6	-0.018	-0.147*	-0.049	0.044	-0.020	-0.057	0.011	-0.015	-0.157*
22:5n-6	-0.004	-0.195**	0.047	-0.030	-0.022	0.038	0.021	-0.015	-0.136*
22:6n-3	0.056	-0.070	0.073	-0.130*	0.027	0.171**	-0.003	-0.010	-0.053
ΣSFA	0.057	0.157*	0.113	0.147*	-0.049	0.118	0.038	0.043	0.117
ΣMUFA	0.015	0.005	0.055	0.328***	-0.007	-0.310***	-0.063	-0.082	-0.124
ΣPUFAn-6	-0.024	-0.038	-0.147*	-0.263***	-0.007	0.091	0.042	0.043	0.081
ΣPUFAn-3	0.047	-0.074	0.073	-0.134*	0.052	0.167**	-0.010	0.017	-0.094
D9D16	0.169**	0.034	0.239***	0.338***	-0.024	-0.146*	0.026	0.034	0.014
D9D18	-0.090	-0.075	-0.036	0.195**	0.078	-0.217**	-0.128	0.147*	-0.147*
D6Dn6	0.046	0.102	0.104	-0.018	0.054	-0.112	0.109	0.107	-0.029
ELOVL2/5 n3	-0.039	-0.151*	-0.050	0.082	-0.077	-0.052	-0.063	-0.073	0.028
ELOVL2/5 n6	-0.053	-0.166*	-0.021	0.114	0.002	-0.091	-0.034	-0.077	-0.186**
ELOVL5	-0.144*	-0.074	-0.253***	-0.114	-0.087	-0.003	-0.112	-0.114	-0.023

¹ The Spearman's rank order coefficients between the respective parameters for the whole group (n = 231); * - p < 0.05, ** - p < 0.01; *** - p < 0.001; ^a – shorthand notation for FA: carbon number: double bond number, n – position of carbon with first double bond from methyl end; Σ – the sum; SFA – saturated fatty acids; MUFA – monounsaturated fatty acids; PUFA – polyunsaturated fatty acids

The estimated activity (D9D18) index correlated negatively with insulin, HOMA-IR, apoB, and uric acid, which are known as markers of insulin resistance, while index D9D16 correlated positively with apoB, triacylglycerols, and BMI, showing an opposite relation to insulin resistance. This probably could be related to possible positive association of POA with insulin resistance in this set of patients.

Moreover, proportion of cVA correlated negatively with insulin, HOMA-IR, apolipoprotein B, showing that in our set of mostly obese patients with hyperlipidemia, cVA in plasma PL may function to improve insulin sensitivity. In contrast, POA correlated rather differently both with anthropometric parameters and markers of glucose and lipid homeostasis. Its proportion in plasma PL correlated positively with BMI, WHCR, fat mass and triacylglycerols.

Supplementary Table 2. Multivariate linear regression models for insulin and HOMA-IR

INSULIN, multivariate linear regression model				
	β -Estimate	Std. Error	t value	P-value
(Intercept)	19.2012	4.0051	4.794	<0.001
18:1n-7c	-3.7783	2.6942	-1.402	0.162
16:1n-9c	-25.8606	19.8301	-1.304	0.194
16:1n-7c	-4.1124	3.2708	-1.257	0.21
18:1n-9c	0.4824	0.3933	1.226	0.222
20:1n-9c	-10.3167	17.8672	-0.577	0.564
Backward stepwise analysis:				
	β -Estimate	Std. Error	t value	P-value
(Intercept)	17.516	2.52	6.95	4.53E-11
18:1n-7c	-3.952	1.611	-2.453	0.015
HOMA-IR, multivariate linear regression model				
	β -Estimate	Std. Error	t value	P-value
(Intercept)	4.75979	0.94981	5.011	1.25E-06
18:1n-7c	-1.14779	0.63893	-1.796	0.074
16:1n-9c	-5.87984	4.70267	-1.25	0.213
16:1n-7c	-0.63538	0.77566	-0.819	0.414
18:1n-9c	0.08075	0.09327	0.866	0.388
20:1n-9c	-0.7303	4.23717	-0.172	0.863
Backward stepwise analysis:				
	β -Estimate	Std. Error	t value	P-value
(Intercept)	4.2593	0.5908	7.21	9.96E-12
18:1n-7c	-1.041	0.3776	-2.757	0.00635

We used multivariate linear regression including all studied MUFA (18:1n-7c, 16:1n-9, 16:1n-7c, 18:1n-9c, 20:1n-9c) as predictors of values of insulin resistance (insulin and HOMA-IR) as sensitivity analysis. According to backward stepwise analysis, only association with PL 18:1n-7c remained significant (for insulin, $p = 0.015$ and for HOMA-IR, $p = 0.006$).

Supplementary Table 3. Comparison of control group and men with hyperlipidemia – Basic data

	Control group (n=50)	Men hyperlipidemia (n=231)
Age (years)	57.0 [39.3-69.0] ¹	51.0 [42.0 - 60.0]
Hypertension [n (%)]	26/50 (52.0 %)	142/231 (61.5 %)
Smokers [n (%)]	17/50 (34.0 %)	78/231 (33.8 %)
BMI (kg.m ⁻²)	26.4 [23.2–31.6]	28.5 [26.01–30.8]
Waist (cm)	92 [87–105.75]	101 [95–108] * ^a
WHCR (ratio)	0.95 [0.91 – 1.00]	0.99 [0.95 - 1.03] **
Fat mass (kg)	23.72 [18.49 - 33.24]	25.55 [20.1–32.25]
Systolic blood pressure (mmHg)	130 [120–140]	130 [125–140]
Diastolic blood pressure (mmHg)	84 [80–90]	85 [80–90]
Total plasma cholesterol (mmol/L)	4.35 [3.88–4.63]	5.89 [5.18 - 6.83] ***
Triacylglycerols (mmol/L)	1.01 [0.83 - 1.31]	2.16 [1.60 - 3.36] ***
HDL-cholesterol (mmol/L)	1.31 [1.05 - 1.51]	1.20 [1.01 - 1.44]
LDL-cholesterol (mmol/L)	2.46 [2.1,2.74]	3.38 [2.94 - 4.03] ***
Non-HDL-cholesterol (mmol/L)	2.89 [2.56 - 3.22]	4.66 [3.96–5.62] ***
Apolipoprotein B (g/L)	0.77 [0.70–0.91]	1.23 [1.05 - 1.50] ***
Apolipoprotein A-I (g/L)	1.37 [1.19 - 1.51]	1.33 [1.18 - 1.48]
f-Glucose (mmol/L)	4.95 [4.7–5.3]	5.1 [4.7–5.7] *
Insulin (mU/L)	9.48 [5.03 - 14.15]	9.27 [6.69–13.61]
HOMA-IR (index)	2.13 [1.07 - 3.24]	2.07 [1.57 - 3.21]
NEFA (mmol/L)	0.46 [0.36 - 0.60]	0.52 [0.35 - 0.72]
Uric acid (umol/L)	331 [286 - 370]	364 [319 - 418] **

¹ Data are given in median [25th-75th percentile] format; ^at-test with Benjamini-Hochberg correction for multiple comparison: * - p < 0.05, ** - p < 0.01, *** - p < 0.001;

A group of 231 men with hyperlipidemia were consecutive untreated patients who were referred to our lipid clinic for treatment. A smaller control group consisted of men with normal levels of plasma lipids, without impaired glucose tolerance, also not treated with hypolipidemic drugs, antidiabetic drugs, PUFA supplements or antioxidants.

When comparing the two groups, no significant differences were found in age, BMI, proportion of hypertensives and smokers, systolic and diastolic BP. As expected, significant differences were found in plasma lipid levels (patients with hyperlipidemia differed in significantly higher levels of plasma total cholesterol, triacylglycerols, LDL-C, non-HDL-C, apo B), uric acid and glucose, waist circumference and index values WHCR.

Supplementary Table 4. Plasma phospholipid fatty acids composition in controls and men with hyperlipidemia

	Controls (n=50)	men with hyperlipidemia (n=231)
14:0 ^a	0.24 [0.16 - 0.29] ¹	0.25 [0.20 - 0.31]
16:0	29 [27.68 - 31.43]	29.93 [28.52 - 31.30]
16:1n-9	0.12 [0.12 - 0.14]	0.11 [0.09 - 0.14]
16:1n-7c	0.52 [0.41 - 0.62]	0.55 [0.44 - 0.70]
18:0	14.03 [13.15 - 14.83]	14.26 [13.41 - 15.08]
18:1n-9c	10.72 [9.80 - 11.83]	10.09 [9.13 - 11.22]* ^a
18:1n-7c	1.61 [1.43 - 1.84]	1.53 [1.33 - 1.70]*
18:2n-6cc	22.43 [19.87 - 24.66]	22.00 [20.09 - 23.94]
18:3n-6alc	0.08 [0.07 - 0.13]	0.09 [0.06 - 0.12]
18:3n-3alc	0.20 [0.17 - 0.26]	0.20 [0.16 - 0.25]
20:1n-9c	0.14 [0.11 - 0.17]	0.13 [0.11 - 0.16]
20:2n-6cc	0.46 [0.35 - 1.19]	0.40 [0.32 - 0.52]*
20:3n-6alc	2.96 [2.54 - 3.62]	3.13 [2.65 - 3.58]
20:4n-6alc	11.73 [9.60 - 13.22]	10.51 [9.05 - 12.40]
20:5n-3alc	0.88 [0.68 - 1.25]	0.92 [0.72 - 1.25]
22:4n-6alc	0.32 [0.25 - 0.40]	0.30 [0.23 - 0.36]
22:5n-6alc	0.20 [0.13 - 0.25]	0.18 [0.13 - 0.23]
22:5n-3alc	0.92 [0.71 - 1.09]	0.88 [0.73 - 1.03]
22:6n-3alc	2.86 [1.80 - 3.64]	3.17 [2.38 - 3.98]*
Σ SFA	43.32 [42.14 - 45.48]	44.41 [43.25 - 45.7]*
Σ MUFA	13.33 [12.26 - 14.67]	12.53 [11.31 - 13.69]*
Σ PUFA ⁿ -6	38.14 [36.44 - 39.59]	37.24 [35.07 - 39.11]
Σ PUFA ⁿ -3	5.05 [3.58 - 5.89]	5.31 [4.11 - 6.43]

¹ Data are given in median [25th-75th percentile] format (mol%); ^at-test with Benjamini-Hochberg correction for multiple comparison: * - p < 0.05; only relevant fatty acids are presented; Student's t-test; Benjamini-Hochberg correction; ^a – shorthand notation for FA: carbon number: double bond number, n – position of carbon with first double bond from methyl end; Σ – the sum; SFA – saturated fatty acids; MUFA – monounsaturated fatty acids; PUFA – polyunsaturated fatty acids

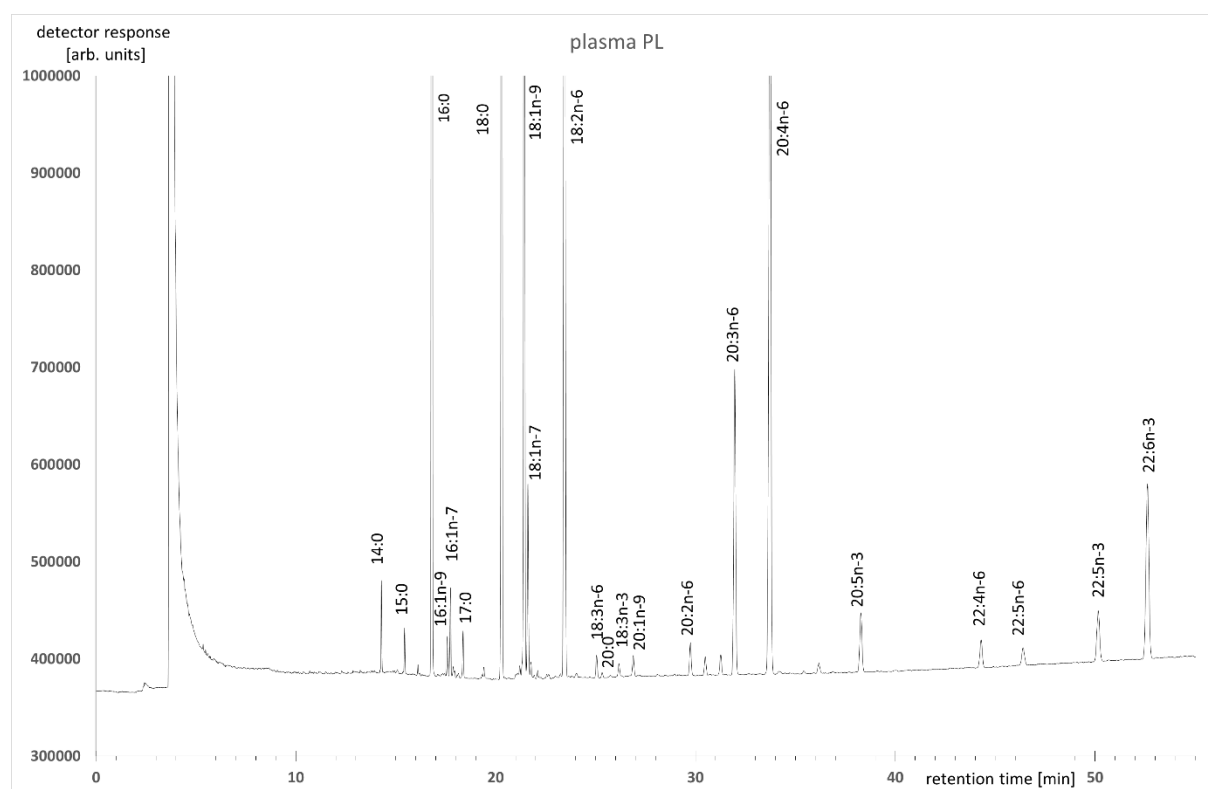
Hyperlipidemic men have lower content of MUFA caused by decreased proportions of 18:1n-9 and 18:1n-7. The increased content of SFA is accompanied by higher concentrations of DGLA and DHA. Furthermore, we observed lower levels of 20:2n-6 (probably connected with higher index for D8 desaturation).

Supplementary Table 5 Names of fatty acids

Shorthand notation	Semisystematic name	Trivial name (common abbreviation)
14:0	tetradecanoic acid	myristic acid (MA)
16:0	hexadecanoic acid	palmitic acid (PA)
16:1n-9c	hexadecenoic acid	hypogeic acid
16:1n-7c	hexadecenoic acid	palmitoleic acid (POA)
18:0	octadecanoic acid	stearic acid (SA)
18:1n-9c	octadecenoic acid	oleic acid (OA)
18:1n-7c	octadecenoic acid	<i>cis</i> -vaccenic acid (cVA)
18:2n-6cc	octadecadienoic acid	linoleic acid (LA)
18:3n-6alc	octadecatrienoic acid	γ -linolenic acid (GLA)
18:3n-3alc	octadecatrienoic acid	α -linolenic acid (ALA)
20:1n-9c	eicosenoic acid	gondoic acid
20:2n-6cc	eicosadienoic acid	eicosadienoic acid
20:3n-6alc	eicosatrienoic acid	dihomo- γ -linolenic acid (DGLA)
20:4n-6alc	eicosatetraenoic acid	arachidonic acid (AA)
20:5n-3alc	eicosapentaenoic acid	eicosapentaenoic acid (EPA)
22:4n-6alc	docosatetraenoic acid	adrenic acid (AdA)
22:5n-6alc	docosapentaenoic acid	Osbond acid
22:5n-3alc	docosapentaenoic acid	docosapentaenoic acid (DPAn-3)
22:6n-3alc	docosahexaenoic acid	docosahexaenoic acid (DHA)
Σ SFA		sum of saturated fatty acids
Σ MUFA		sum of monounsaturated fatty acids
Σ PUFA _{n-6}		sum of polyunsaturated fatty acids n-6
Σ PUFA _{n-3}		sum of polyunsaturated fatty acids n-3

shorthand notation for fatty acid structure C:Nn-x, where C – number of carbon atoms in the molecule, N – number of double bonds, x – position of the first double bond from the methyl end; c – *cis*, alc – all *cis*

Supplementary Figure 1 Plasma phospholipid fatty acid profile – sample chromatogram



In the Supplementary Figure 1, the separation of all relevant fatty acids is presented. Note the baseline separation of critical pairs (16:1n-9 vs. 16:1n-7 and 18:1n-9 vs. 18:1n-7).