

Lipidomic profiling analysis of human plasma from subjects with hypercholesterolemia to evaluate the intake of yellow yeast rice fermented by *Aspergillus terreus* DSMK01

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Table S1. Clinical characteristics in baseline and post-supplementation of 58 subjects

Parameter	Placebo group (n = 27)		YYR group (n = 31)		<i>p</i> -value ^a	<i>p</i> -value ^b
	0 week	8 weeks	0 week	8 weeks		
Age (years)	55.70 ± 1.62		55.06 ± 1.17			
Sex (men/women)	7/20		6/25			
BMI (kg/m ²)	23.50 ± 0.38	23.55 ± 0.40	24.19 ± 0.46	24.33 ± 0.48	0.153	0.265
Weight (kg)	60.36 ± 1.37	60.47 ± 1.37	61.46 ± 1.38	61.80 ± 1.44	0.165	0.657
Waist circumference (cm)	81.89 ± 1.30	81.43 ± 1.24	82.43 ± 1.30	82.34 ± 1.37	0.681	0.809
Triglyceride (mg/dL)	121.56 ± 11.95	115.07 ± 9.77	124.71 ± 10.15	125.35 ± 10.85	0.776	0.346
TC (mg/dL)	231.74 ± 4.61	232.96 ± 6.11	225.87 ± 4.82	193.16 ± 4.51	<0.001	<0.001
LDL-C(mg/dL)	159.89 ± 4.33	159.52 ± 5.17	155.94 ± 4.40	122.71 ± 3.61	<0.001	<0.001
HDL-C (mg/dL)	55.22 ± 2.02	56.93 ± 2.49	50.16 ± 2.15	50.55 ± 1.87	0.411	0.054
ApoA1 (mg/dL)	142.59 ± 4.65	147.27 ± 5.05	136.94 ± 4.23	143.28 ± 4.38	0.037	0.564
ApoB (mg/dL)	123.84 ± 3.37	122.18 ± 3.76	124.86 ± 3.50	103.75 ± 3.70	<0.001	<0.001
ApoB/ApoA1 ratio	0.90 ± 0.21	0.86 ± 0.20	0.94 ± 0.24	0.75 ± 0.21	<0.001	0.026

Data are shown as the means ± standard deviations. *p*-value^a was calculated from the Wilcoxon rank signed tests. 8 weeks comparing to 0 week in YYR group. *p*-value^b was calculated from Mann–Whitney *U*-tests. 8 weeks of YYR group comparing to 8 weeks of placebo group. Plasma concentrations of triglyceride, TC, LDL-C, HDL-C, ApoA1 and ApoB were determined at weeks 0 and 8 using an automatic analyzer (Hitachi 7600, Hitachi High-Technologies, Tokyo, Japan). Abbreviations: TC, total cholesterol; LDL-C, low density lipoprotein cholesterol; HDL, high density lipoprotein cholesterol; ApoA1, apolipoprotein A1; ApoB, apolipoprotein B.

Table S2. Identified lipid metabolites with significantly different concentrations between the placebo and YYR groups.

Classification	Lipids	Ret. Time	<i>m/z</i>	Ion species	Placebo 0 week	Placebo 8 week	YYR 0 week	YYR 8 week	Placebo fold change	YYR fold change	<i>p</i> -values ^c
Free Fatty Acids	FFA(10:1)	1.12	171.1417	[M-H] ⁻	1.5±0.3	1.5±0.3	1.5±0.3	1.5±0.4	0.99	1.01	0.984
	FFA(12:0)	1.56	199.1704	[M-H] ⁻	13.7±6.5	13.3±5.5	10.8±3.6	11.0±4.7	0.97	1.03	0.468
	FFA(14:0)	2.32	227.2017	[M-H] ⁻	83.1±28.7	72.1±25.8	70.0±21.8	68.6±27.4	0.87	0.98	0.938
	FFA(14:1)	1.7	225.186	[M-H] ⁻	15.3±7.1	12.9±6.2	12.7±3.7	12.4±5.7	0.84	0.98	0.468
	FFA(16:0)	3.33	255.2318	[M-H] ⁻	1363.3±302.7	1229.0±261.3	1272.8±222.8	1258.4±271.9	0.90	0.99	0.906
	FFA(16:1)	2.47	253.2172	[M-H] ⁻	270.7±150.2	218.5±110	227.9±91.2	224.3±106.0	0.81	0.98	0.969
	FFA(16:2)	1.95	251.2005	[M-H] ⁻	3.7±1.8	3.1±1.3	3.5±1.3	3.4±1.3	0.83	0.97	0.875
	FFA(17:0)	3.89	269.2475	[M-H] ⁻	25.2±8.3	22±7.8	23.2±10.8	21.7±8.0	0.88	0.94	0.695
	FFA(18:0)	4.48	283.2636	[M-H] ⁻	900.6±155.8	852.8±122.7	874.9±125.3	855.0±145.6	0.95	0.98	0.531
	FFA(18:1)	3.5	281.2463	[M-H] ⁻	1838.1±519.7	1625.6±528.1	1710.5±478.6	1686.4±519.2	0.88	0.99	0.754
	FFA(18:2)	2.74	279.2313	[M-H] ⁻	1113.2±362.5	976.8±317.6	1022.9±330.4	1013.3±331.7	0.88	0.99	0.860
	FFA(18:3)	2.17	277.2167	[M-H] ⁻	198.3±128.5	148.6±69.7	163.0±85.0	150.5±62.7	0.75	0.92	0.845
	FFA(18:4)	1.8	275.2012	[M-H] ⁻	3.5±2.2	2.8±1.3	3.0±1.5	2.9±1.5	0.80	0.96	0.875
	FFA(20:0)	5.62	311.2918	[M-H] ⁻	11.0±2.0	10.2±1.7	10.7±1.5	10.2±1.6	0.93	0.95	0.170
	FFA(20:1)	4.59	309.2781	[M-H] ⁻	35.6±15.7	30.9±15.3	32.6±16.2	30.3±12.8	0.87	0.93	0.814
	FFA(20:2)	3.71	307.2609	[M-H] ⁻	26.2±12.1	22.2±10.7	22.2±9.4	21.1±7.6	0.85	0.95	0.799
	FFA(20:3)	3.09	305.2471	[M-H] ⁻	27.6±13.5	22.5±9.1	22.2±8.1	21.6±7.6	0.82	0.97	0.814
	FFA(20:4)	2.63	303.2303	[M-H] ⁻	78.1±29.0	66.3±23.2	68.9±19.4	70.8±23.4	0.85	1.03	0.531
	FFA(20:5)	2.08	301.2152	[M-H] ⁻	23.5±15.4	20.5±11.9	23.6±14.5	21.2±11.7	0.87	0.90	0.433
	FFA(22:0)	6.78	339.3226	[M-H] ⁻	6.1±1.5	5.7±0.7	6.0±1.2	5.9±0.9	0.93	0.98	0.769
	FFA(22:1)	5.7	337.3087	[M-H] ⁻	3.6±1.2	3.5±1.4	3.7±1.9	3.5±1.7	0.96	0.96	0.638
	FFA(22:2)	4.8	335.2944	[M-H] ⁻	1.1±0.4	0.9±0.3	0.9±0.3	0.9±0.3	0.85	0.97	0.681
	FFA(22:3)	4.06	333.2805	[M-H] ⁻	0.8±0.4	0.7±0.2	0.7±0.2	0.7±0.2	0.84	1.01	0.829
	FFA(22:4)	3.43	331.261	[M-H] ⁻	14.3±5.9	12.1±4.7	12.1±4.5	11.9±4.1	0.85	0.98	0.829
	FFA(22:5)	2.8	329.2472	[M-H] ⁻	33.9±17.5	28.6±14.3	31.0±13.5	28.9±11.5	0.84	0.93	0.695
	FFA(22:6)	2.39	327.2327	[M-H] ⁻	155.0±74.8	138.1±70.4	145.8±66.4	135.8±53.7	0.89	0.93	0.638

	FFA(24:0)	8.2	367.3524	[M-H] ⁻	9.3±3.2	8.7±2.1	8.9±3.0	8.6±2.0	0.93	0.97	0.666
	FFA(26:0)	10.02	395.3867	[M-H] ⁻	2.9±0.9	2.7±0.8	2.9±1.2	2.8±0.9	0.93	0.98	0.739
Lyso species	LysoPC(14:0)	2.16	468.3065	[M+H] ⁺	28.1±9.4	27.7±8.9	25.7±7.1	25.5±7.4	0.98	0.99	0.984
	LysoPC(16:0)	3.13	496.3391	[M+H] ⁺	3171.4±684.9	3176.5±480.8	3266.4±534.2	3260.6±528.8	1.00	1.00	0.784
	LysoPC(16:1)	2.3	494.3216	[M+H] ⁺	59.2±17.4	56.8±16.1	57.9±18.3	61.2±16.7	0.96	1.06	0.399
	LysoPC(17:0)	3.66	510.3533	[M+H] ⁺	29.8±9.0	27.4±5.6	30.2±7.1	29.7±6.7	0.92	0.98	0.739
	LysoPC(17:1)	2.81	508.3381	[M+H] ⁺	7.5±2.0	7.3±1.7	7.6±1.6	7.7±1.7	0.97	1.01	0.531
	LysoPC(18:0)	4.23	524.3694	[M+H] ⁺	1194.8±274.9	1106.9±188.4	1197.7±237.9	1145.2±227.7	0.93	0.96	0.299
	LysoPC(18:1)	3.25	522.3545	[M+H] ⁺	516.5±146.5	534.4±108.1	507.1±125.3	562.8±144.4	1.03	1.11	0.009
	LysoPC(18:2)	2.55	520.3375	[M+H] ⁺	917.0±278.6	1068.7±341.0	915.5±259.9	956.7±307.7	1.17	1.05	0.570
	LysoPC(18:3)	1.94	576.3313	[M+CH ₃ COO] ⁻	4.9±2.1	4.5±1.9	4.3±1.8	4.8±2	0.92	1.11	0.081
	LysoPC(20:0)	5.28	552.4048	[M+H] ⁺	7.2±2.1	7.3±2.2	7.5±1.7	7.4±2.1	1.01	0.99	0.468
	LysoPC(20:1)	4.25	550.3838	[M+H] ⁺	10.5±2.3	10.7±2.4	11.3±2.7	11.6±3.8	1.02	1.03	0.481
	LysoPC(20:2)	3.48	548.3704	[M+H] ⁺	11.3±2.3	11.6±2.5	10.5±1.8	11.3±2.6	1.03	1.07	0.085
	LysoPC(20:3)	2.86	546.3553	[M+H] ⁺	59.0±19.3	60.0±14.0	51.8±13.9	58.3±14.6	1.02	1.12	0.040
	LysoPC(20:4)	2.44	544.339	[M+H] ⁺	12.7±3.6	13.4±3.9	12.5±4.5	14.2±4.6	1.05	1.14	0.008
	LysoPC(20:5)	1.95	542.3235	[M+H] ⁺	34.6±16.0	36.6±18.0	36.3±15.5	40.0±21.1	1.06	1.10	0.256
	LysoPC(22:0)	6.3	580.431	[M+H] ⁺	1.6±0.7	1.7±0.7	1.7±0.5	1.6±0.6	1.06	0.93	0.131
	LysoPC(22:1)	5.3	578.4163	[M+H] ⁺	1.3±0.8	1.4±0.9	1.7±1.3	1.6±1.6	1.09	0.96	0.710
	LysoPC(22:5)	2.59	570.3562	[M+H] ⁺	14.2±4.1	13.7±3.5	14.3±4.1	14.3±4.5	0.97	1.00	0.710
	LysoPC(22:6)	2.31	538.3402	[M+H] ⁺	80.6±31.2	78.2±27.2	81.9±24.6	83.7±30.6	0.97	1.02	0.922
	LysoPC(24:0)	7.32	666.4568	[M+CH ₃ COO] ⁻	1.2±0.4	1.2±0.3	1.2±0.3	1.2±0.4	0.96	1.00	0.318
	LysoPE(16:0)	3.25	454.2912	[M+H] ⁺	20.3±5.4	20.8±5.9	21.4±5.9	21.7±5.2	1.02	1.02	0.264
	LysoPE(18:0)	4.37	482.2928	[M+H] ⁺	29.4±7.3	29.5±6.0	29.7±5.6	30.1±5.4	1.00	1.01	0.378
	LysoPE(18:1)	3.25	478.2911	[M+H] ⁺	6.9±3.2	8.1±3.7	6.9±3.6	7.9±3.1	1.18	1.14	0.036
	LysoPE(18:2)	2.65	478.2928	[M+H] ⁺	35.9±14.7	39.3±17.6	32.7±11.8	33.4±12.3	1.09	1.02	0.710
	LysoPE(20:4)	2.54	502.2881	[M+H] ⁺	15.0±5.7	16.1±4.8	13.9±5.1	15.9±5.4	1.07	1.15	0.009
	LysoPE(20:5)	2.05	500.2751	[M+H] ⁺	3.9±1.5	3.9±1.7	4.0±1.5	4.1±1.9	1.02	1.02	0.531
	LysoPE(22:6)	2.4	526.2928	[M+H] ⁺	40.6±9.6	40.0±10.3	40.5±10.0	40.8±11.0	0.98	1.01	0.938

Glycerophospholipids	PC(28:0)	7.84	678.504	[M+CH3COO] ⁻	16.4±5.1	18.9±9.5	14.8±4.5	14.0±3.3	1.15	0.94	0.505
	PC(30:0)	9.46	706.5362	[M+CH3COO] ⁻	153.2±39.3	156.5±59.3	134.6±36.9	121.8±32.4	1.02	0.90	0.203
	PC(30:2)	8.07	702.5584	[M+CH3COO] ⁻	216.2±39.7	208.7±33.8	209.8±29.8	201.8±38.5	0.96	0.96	0.104
	PC(31:1)	10.65	718.5895	[M+CH3COO] ⁻	20.8±4.4	21.2±4.9	20.0±3.1	19.6±3.2	1.02	0.98	0.544
	PC(32:0)	11.07	792.5722	[M+CH3COO] ⁻	497.8±59.9	503.7±80.8	488.7±61.4	457.3±64.1	1.01	0.94	0.020
	PC(32:1)	9.3	790.5585	[M+CH3COO] ⁻	525.0±208.4	482.7±204.8	463.1±207.0	459.8±196.1	0.92	0.99	0.710
	PC(32:2)	8.04	788.5326	[M+CH3COO] ⁻	144.7±43.5	145.1±48.5	130.7±43.7	118.7±37.6	1.00	0.91	0.164
	PC(32:3)	7.15	786.5282	[M+CH3COO] ⁻	4.5±2.6	3.5±1.7	3.8±2.4	3.1±1.6	0.78	0.82	0.196
	PC(33:0)	12.14	748.5877	[M+CH3COO] ⁻	16.1±5.5	14.4±5.1	13.9±4.1	13.2±3.2	0.90	0.95	0.481
	PC(34:0)	13.31	820.5971	[M+CH3COO] ⁻	129.7±14.8	130.2±15.9	132.5±18.9	123.7±17.0	1.00	0.93	0.007
	PC(34:1)	11.17	818.5878	[M+CH3COO] ⁻	7317.4±1933.6	6992.3±1407.5	6814.1±1866.0	6844.3±1492.6	0.96	1.00	0.710
	PC(34:2)	9.69	816.5641	[M+CH3COO] ⁻	20936.0±1961.6	21262.0±1970.3	20616.2±1455.1	20282.7±1769.3	1.02	0.98	0.281
	PC(34:3)	8.79	814.5539	[M+CH3COO] ⁻	171.7±58.9	164.8±50.4	161.5±55.1	156.7±44.8	0.96	0.97	0.710
	PC(34:4)	7.25	812.5328	[M+CH3COO] ⁻	40.5±12.6	40.5±14.8	37.3±13.3	37.7±14.1	1.00	1.01	0.610
	PC(34:5)	6.99	810.51	[M+CH3COO] ⁻	7.2±3.2	7.8±5.4	7.3±4.0	6.8±3.5	1.08	0.93	0.399
	PC(36:0)	14.28	790.628	[M+CH3COO] ⁻	14.6±2.7	14.0±2.0	15.5±3.3	14.0±1.9	0.96	0.91	0.010
	PC(36:1)	13.28	846.5961	[M+CH3COO] ⁻	1508.1±412.2	1426.6±280.1	1435.7±255.0	1468.6±375.6	0.95	1.02	0.570
	PC(36:2)	11.66	844.5977	[M+CH3COO] ⁻	8198.1±1668.5	8017.0±1880.6	7748.1±1376.3	7194.0±1435.7	0.98	0.93	0.034
	PC(36:3)	9.76	842.5693	[M+CH3COO] ⁻	2363.1±683.5	2251.6±530.5	2067.0±568.6	2111.3±606.6	0.95	1.02	0.754
	PC(36:4)	9.43	840.5741	[M+CH3COO] ⁻	6963.8±1580.1	6923.9±1606.6	6663.9±1905.4	7269.2±1908.7	0.99	1.09	0.010
	PC(36:5)	8.32	838.5597	[M+CH3COO] ⁻	9.6±1.6	10.3±2.4	9.3±1.8	8.9±1.7	1.07	0.97	0.531
	PC(36:6)	7.5	836.5398	[M+CH3COO] ⁻	8.1±3.8	8.1±4.7	8.3±3.8	8.3±4.2	1.01	1.00	0.906
	PC(38:0)	14.27	816.6463	[M+CH3COO] ⁻	37.5±8.8	37.5±14.5	39.6±10.6	36.6±13.3	1.00	0.92	0.136
	PC(38:2)	13.67	814.6319	[M+CH3COO] ⁻	221.3±40.3	207.9±31.7	203.3±26.9	198.5±29.8	0.94	0.98	0.710
	PC(38:3)	12.67	812.617	[M+CH3COO] ⁻	955.1±282.7	887.1±203.9	879.8±296.1	855.6±301.1	0.93	0.97	0.445
	PC(38:4)	11.75	810.6013	[M+CH3COO] ⁻	2828.1±538.4	2717.9±537.1	2769.9±603.1	2984±631.3	0.96	1.08	0.024
	PC(38:5)	9.82	808.583	[M+CH3COO] ⁻	1318.0±181.1	1243.9±216.4	1326.7±224.2	1274.6±209.7	0.94	0.96	0.308
	PC(38:6)	9.28	806.5677	[M+CH3COO] ⁻	6598.3±2021.8	6319.2±1974	7396.8±1903.4	6500.0±1825.2	0.96	0.88	0.010
	PC(38:7)	7.56	804.5512	[M+CH3COO] ⁻	28.7±10.3	32.2±14.2	30.4±14.3	27.1±10.7	1.12	0.89	0.240

PC(40:1)	12.1	844.6555	[M+CH ₃ COO] ⁻	517.5±34.9	503.0±30.0	508.2±33.5	505.4±38.5	0.97	0.99	0.481
PC(40:2)	10.6	842.6378	[M+CH ₃ COO] ⁻	183.1±34.5	176.6±30.0	166.6±31.2	170.7±35.3	0.96	1.02	0.505
PC(40:3)	9.78	840.6205	[M+CH ₃ COO] ⁻	384.5±39.1	379.4±41.5	385.5±45.0	398±41.8	0.99	1.03	0.126
PC(40:4)	8.67	838.6028	[M+CH ₃ COO] ⁻	214.1±77.2	214.6±101.8	224.3±85.3	215.2±90.2	1.00	0.96	0.784
PC(40:5)	11.82	836.6161	[M+CH ₃ COO] ⁻	285.0±66.5	251.1±70.5	291.4±92.3	260.7±84.6	0.88	0.89	0.164
PC(40:6)	11.2	834.6013	[M+CH ₃ COO] ⁻	1537.8±482.4	1401.4±365.5	1724.3±495.4	1510.1±426.2	0.91	0.88	0.026
PC(40:7)	8.87	832.5831	[M+CH ₃ COO] ⁻	34.0±8.0	33.9±6.8	31.4±8.1	30.5±7.2	1.00	0.97	0.176
PC(40:8)	8.1	830.5689	[M+CH ₃ COO] ⁻	40.1±8.2	42.2±10.0	42.0±9.0	39.2±9.2	1.05	0.93	0.784
PC(42:10)	7.81	854.5693	[M+CH ₃ COO] ⁻	11.4±2.3	12.1±2.9	11.9±2.0	11.3±1.9	1.06	0.95	0.136
PC(42:5)	13.43	864.6532	[M+CH ₃ COO] ⁻	8.2±2.5	7.6±2.4	7.6±2.6	6.6±1.7	0.94	0.87	0.022
PC(42:9)	8.79	856.5845	[M+CH ₃ COO] ⁻	5.2±1.3	5.5±1.7	4.9±1.6	4.7±1.5	1.06	0.96	0.784
PC p-(36:1)	13.33	772.6209	[M+CH ₃ COO] ⁻	37.4±9.5	39.3±13.8	33.0±9.3	33.4±8.7	1.05	1.01	0.769
PE(34:1)	12.04	718.5362	[M-H] ⁻	10.4±4.2	10.6±4.5	10.5±6.0	11.4±5.4	1.02	1.08	0.117
PE(34:2)	10.43	716.5353	[M-H] ⁻	11.9±2.5	11.6±2.8	11.4±3.0	11.2±2.9	0.97	0.98	0.695
PE(36:1)	13.78	746.5677	[M-H] ⁻	16.9±7.4	18.7±13.7	17.7±8.3	19.3±8.9	1.11	1.09	0.078
PE(36:2)	12.56	744.5532	[M-H] ⁻	142.9±31.1	143.3±39.6	137.9±27.8	135.3±31.2	1.00	0.98	0.754
PE(36:3)	10.51	742.5421	[M-H] ⁻	17.7±5.5	19.7±12	16.5±6.4	17.5±6.2	1.11	1.06	0.096
PE(36:4)	10.13	740.5226	[M-H] ⁻	48.6±12.2	46.7±12.6	49.0±19.4	51.1±14.7	0.96	1.04	0.189
PE(36:5)	8.95	738.5065	[M-H] ⁻	6.9±2.6	6.7±3.0	7.4±3.6	7.5±3.9	0.97	1.01	0.799
PE(38:2)	10.63	772.582	[M-H] ⁻	115.6±40.5	108.5±44.4	110±39.1	103.5±34.7	0.94	0.94	0.378
PE(38:3)	13.08	770.606	[M-H] ⁻	52.3±13.3	49.8±11.7	46.3±10.2	46.9±8.5	0.95	1.01	0.378
PE(38:4)	11.72	768.5498	[M-H] ⁻	90.4±22.0	89.4±22.2	91.4±29.8	97.2±20.6	0.99	1.06	0.063
PE(38:5)	10.2	766.5371	[M-H] ⁻	32±5.2	31.2±5.3	32.1±8.0	34.2±6.1	0.97	1.06	0.033
PE(38:6)	9.69	764.5206	[M-H] ⁻	89.9±18.9	84.8±24.2	95.8±36.2	100.8±31.9	0.94	1.05	0.347
PE(40:5)	11.6	794.6053	[M-H] ⁻	14.8±2.6	15.7±5.1	14.2±2.8	13.4±2.1	1.06	0.94	0.108
PE(40:6)	11.2	790.5159	[M-H] ⁻	171.6±50.8	169.8±64.3	173.3±72.8	190.6±74.1	0.99	1.10	0.122
PE(40:7)	9.42	788.5183	[M-H] ⁻	16.6±4.1	17.4±4.8	16.1±5.7	20.0±4.7	1.05	1.25	0.000
PE o-38:5	13.22	752.5593	[M-H] ⁻	174.2±55.3	197.3±106.6	176±73.6	177.8±66.8	1.13	1.01	0.769
PE o-(36:2)	14.15	730.5702	[M-H] ⁻	19.0±6.1	21.2±8.3	18.6±6.1	18±3.9	1.11	0.97	0.652

	PE p-(36:1)										
	PE p-40:5	13.12	778.5769	[M-H] ⁻	26.1±8.6	30.7±17.2	26.0±9.5	25.6±6.7	1.18	0.98	0.518
	PI(34:1)	9.25	835.5155	[M-H] ⁻	25.5±8.2	24.5±8.9	25.7±7.8	22.2±7.5	0.96	0.86	0.055
	PI(34:2)	8.03	833.5092	[M-H] ⁻	26.5±7.8	25.5±8.2	27.8±7.2	24.8±8.5	0.96	0.89	0.100
	PI(36:1)	11.25	882.6106	[M-H] ⁻	5.3±1.2	5.2±1.2	5.4±1.0	5.1±1.3	0.97	0.94	0.147
	PI(36:2)	9.72	880.53	[M-H] ⁻	8.0±1.1	7.9±0.9	7.8±0.9	8.5±1.3	0.98	1.09	0.005
	PI(36:3)	8.46	859.5166	[M-H] ⁻	23.3±10.2	21.4±9.7	19.6±7.4	17.3±8.7	0.92	0.88	0.153
	PI(36:4)	7.84	857.5078	[M-H] ⁻	35.9±12.9	33.4±11.3	37.9±13.7	34.4±12.4	0.93	0.91	0.481
	PI(38:3)	10.11	887.557	[M-H] ⁻	66.5±22.2	63.1±18.9	56.7±15.1	56.7±19.5	0.95	1.00	0.724
	PI(38:4)	9.31	885.535	[M-H] ⁻	766.6±115.9	755.6±116.1	775.1±126.9	751.5±116.1	0.99	0.97	0.126
	PI(38:5)	7.92	883.5328	[M-H] ⁻	9.2±2.5	8.9±2.2	9.7±2.5	9.3±3.1	0.96	0.95	0.638
	PI(38:6)	7.54	881.5069	[M-H] ⁻	6.5±1.9	6.2±2.0	8.1±3.5	6.7±2.8	0.95	0.83	0.081
	PI(40:5)	9.39	911.5434	[M-H] ⁻	21.3±4.2	20.4±5.2	22.0±6.6	20.1±5.8	0.96	0.91	0.104
	PI(40:6)	8.98	909.5377	[M-H] ⁻	47.6±14.4	44.2±17.4	55.4±25.2	47.2±24.1	0.93	0.85	0.183
Sphingolipids	Cer(d40:1)	14.8	622.6135	[M+H] ⁺	21.5±4.5	22.8±5.2	21.2±4.2	20.7±4.5	1.06	0.98	0.210
	Cer(d40:3)	14.94	618.617	[M+H] ⁺	19.3±3.8	20.2±5	19.5±4.3	19.6±4.8	1.04	1.00	0.531
	Cer(d42:1)	15.07	650.6424	[M+H] ⁺	67.4±13.8	71.0±17.9	69.2±15.0	68.2±15.2	1.05	0.99	0.290
	Cer(d42:2)	14.57	648.6304	[M+H] ⁺	4.6±0.8	4.8±0.9	4.8±1.0	4.4±0.6	1.04	0.91	0.016
	SM(d30:1)	6.57	647.5094	[M+H] ⁺	12.7±5.5	13.5±6.0	11.6±3.7	10.3±3.0	1.07	0.89	0.071
	SM(d30:2)	5.71	645.4958	[M+H] ⁺	1.8±0.9	1.9±0.9	1.6±0.6	1.5±0.5	1.09	0.90	0.273
	SM(d32:0)	8.46	677.5563	[M+H] ⁺	9.2±2.5	9.5±3.4	8.6±1.9	7.7±1.9	1.04	0.89	0.016
	SM(d32:1)	7.89	675.5426	[M+H] ⁺	302.0±83.7	316.9±105.2	293.2±85.6	270.0±69.2	1.05	0.92	0.011
	SM(d32:2)	6.7	673.5281	[M+H] ⁺	24.8±5.8	24.1±7.2	23.5±5.4	22.5±5.3	0.97	0.96	0.122
	SM(d34:0)	10.36	705.5894	[M+H] ⁺	141.3±26.7	142.5±22.3	140.5±21.7	128.4±26.2	1.01	0.91	0.014
	SM(d34:1)	9.62	703.5726	[M+H] ⁺	3212.4±396.2	3178.9±342.0	3155.3±369.0	2955.3±412.6	0.99	0.94	0.008
	SM(d34:2)	8.06	701.5578	[M+H] ⁺	508.2±79.8	492.9±74.1	494.0±62.0	481.9±86.1	0.97	0.98	0.122
	SM(d36:0)	12.58	733.6223	[M+H] ⁺	21.0±7.7	22.1±10.1	21.6±6.9	20.8±6.7	1.05	0.96	0.337
	SM(d36:1)	11.65	731.6042	[M+H] ⁺	7.5±2.9	7.2±3.1	7.8±3.2	6.6±2.8	0.95	0.84	0.033
	SM(d36:2)	9.79	729.5884	[M+H] ⁺	355.0±72.0	351.2±92.1	346.5±53.9	354.2±76.1	0.99	1.02	0.624

	SM(d36:3)	8.22	727.5729	[M+H] ⁺	7.1±1.9	7.0±2.1	6.9±1.5	7.4±1.8	0.99	1.06	0.170
	SM(d38:0)	13.97	761.6511	[M+H] ⁺	16.7±5.8	17.8±5.9	17.9±5.7	16.6±4.5	1.07	0.93	0.060
	SM(d38:1)	13.6	759.638	[M+H] ⁺	473.5±84.2	496.8±102.3	485.3±89.0	466.3±78.4	1.05	0.96	0.044
	SM(d38:2)	11.61	757.6198	[M+H] ⁺	13.0±4.1	12.3±3.2	12.6±2.8	11.3±2.5	0.95	0.90	0.022
	SM(d40:1)	14.36	787.6655	[M+H] ⁺	1149.6±154.6	1177.5±175.5	1165.4±200.2	1106.0±170.7	1.02	0.95	0.026
	SM(d40:2)	13.63	785.6485	[M+H] ⁺	285.4±81.4	287.2±79.8	293.3±61.6	274.2±58.7	1.01	0.93	0.019
	SM(d40:6)	9.4	777.5806	[M+H] ⁺	9.2±1.8	8.6±1.5	8.6±1.1	7.9±1.2	0.94	0.92	0.002
	SM(d42:1)	14.48	815.701	[M+H] ⁺	885.1±144.4	884.4±149.3	890.5±145.0	855.4±155.0	1.00	0.96	0.071
	SM(d42:2)	14.3	813.6816	[M+H] ⁺	2406.5±456.3	2384.4±363.4	2425.4±354.0	2366.6±412.1	0.99	0.98	0.281
	SM(d44:2)	14.75	841.7181	[M+H] ⁺	21.7±5.8	22.0±4.5	23.6±5.6	22.6±6.2	1.02	0.96	0.318
Glycerolipids	DG(32:0)	14.09	586.538	[M+NH4] ⁺	7.7±3.7	7.4±3.6	7.7±4.7	7.0±4.2	0.96	0.91	0.724
	DG(32:1)	12.93	584.5237	[M+NH4] ⁺	7.1±4.8	6.3±3.6	7.0±5.2	6.2±4.3	0.89	0.88	0.666
	DG(32:2)	11.11	582.5103	[M+NH4] ⁺	2.3±1.5	2.1±1.1	2.4±1.6	2.0±1.1	0.92	0.81	0.299
	DG(34:0)	14.62	614.5723	[M+NH4] ⁺	10.7±2.0	10.7±2.1	11.0±3.0	11.3±2.8	1.00	1.02	0.399
	DG(34:1)	14.1	612.5543	[M+NH4] ⁺	53.6±29.0	50.4±24.2	53.9±26.3	53.9±24.5	0.94	1.00	0.829
	DG(34:2)	13.3	610.541	[M+NH4] ⁺	34.5±15.4	33.2±14.6	35.8±15.5	34.1±11.8	0.96	0.95	0.814
	DG(36:0)	14.99	642.5999	[M+NH4] ⁺	10.8±1.1	11.7±2.5	11.0±1.2	12.4±2.8	1.08	1.13	0.012
	DG(36:1)	14.64	640.5878	[M+NH4] ⁺	15.3±8.5	14.1±5.2	15.1±6.3	15.6±7.3	0.92	1.03	0.652
	DG(36:2)	14.13	638.573	[M+NH4] ⁺	107.7±50.7	103.4±44.5	117.3±48.7	128.6±43.5	0.96	1.10	0.142
	DG(36:3)	13.36	636.5559	[M+NH4] ⁺	117.7±50.3	116.4±51.6	132.6±56.4	139.1±44.3	0.99	1.05	0.468
	DG(38:1)	14.67	668.6116	[M+NH4] ⁺	2.4±0.6	2.4±0.5	2.5±0.5	2.4±0.7	0.98	0.96	0.189
	DG(38:3)	14.25	664.5699	[M+NH4] ⁺	4.6±1.3	4.6±1.3	4.9±1.4	5.0±1.5	0.99	1.02	0.953
	DG(38:5)	12.94	660.5559	[M+NH4] ⁺	10.3±4.7	9.6±3.1	10.0±5.3	11.0±3.8	0.93	1.09	0.016
	DG(40:7)	12.32	684.5508	[M+NH4] ⁺	10.0±6.0	9.8±6.2	11.2±6.4	12.0±8.0	0.97	1.07	0.666
	TG(40:0)	15.2	712.6439	[M+NH4] ⁺	7.0±10.4	9.0±13.1	5.5±3.3	4.8±1.9	1.29	0.88	0.829
	TG(40:1)	15.01	710.6291	[M+NH4] ⁺	3.3±3.7	4.6±7.1	3.2±3.9	2.5±2.6	1.41	0.80	0.938
	TG(42:1)	15.22	738.6587	[M+NH4] ⁺	6.5±5.2	8.9±11.0	6.7±6.2	5.4±4.5	1.36	0.80	0.681
	TG(42:2)	15.01	736.6438	[M+NH4] ⁺	5.3±4.4	7.7±10.2	5.4±4.3	4.8±3.3	1.47	0.88	0.906
	TG(44:1)	15.41	766.6916	[M+NH4] ⁺	13.6±9.7	15.9±15.2	14.0±12.3	11.3±9.8	1.17	0.81	0.570

TG(44:2)	15.24	764.6766	[M+NH4] ⁺	9.3±6.6	11.9±12.8	9.8±8.9	8.0±6.3	1.27	0.82	0.814
TG(46:0)	15.72	796.7411	[M+NH4] ⁺	14.7±8.9	15.9±10.5	14.0±9.2	11.7±6.7	1.09	0.83	0.695
TG(46:1)	15.55	794.7182	[M+NH4] ⁺	36.4±24.0	40.1±30.6	36.4±28.4	31.3±23.8	1.10	0.86	0.953
TG(46:2)	15.42	792.704	[M+NH4] ⁺	30.3±18.4	34.8±27.1	31.3±22.7	26.8±17.2	1.15	0.86	0.922
TG(46:3)	15.29	790.6903	[M+NH4] ⁺	12.2±7.0	13.3±8.9	12.5±8.4	11.1±6.3	1.09	0.88	0.860
TG(46:4)	15.07	788.6781	[M+NH4] ⁺	4.7±2.2	5.0±2.9	4.7±2.6	4.2±2.0	1.08	0.91	0.710
TG(48:0)	15.84	824.7672	[M+NH4] ⁺	13.8±6.2	14.5±6.6	13.2±6.1	11.8±3.9	1.05	0.89	0.624
TG(48:1)	15.7	822.7536	[M+NH4] ⁺	82.8±49.0	81.4±43.3	79.8±49.4	73.3±44.9	0.98	0.92	0.953
TG(48:2)	15.56	820.7375	[M+NH4] ⁺	99.9±50.5	100.8±45.5	101.4±55.3	93.8±45.7	1.01	0.93	0.953
TG(48:3)	15.4	818.7219	[M+NH4] ⁺	56.4±27.3	58±25.5	58.9±30.6	55.8±23.0	1.03	0.95	0.695
TG(48:4)	15.24	816.7038	[M+NH4] ⁺	21.5±11.5	22.9±12.5	22.3±12.3	21.3±8.6	1.07	0.96	0.710
TG(50:1)	15.83	850.7842	[M+NH4] ⁺	164.1±67.0	163.6±60.8	159.7±63.0	160.2±61.5	1.00	1.00	0.681
TG(50:2)	15.7	848.77	[M+NH4] ⁺	284.2±94.4	281.8±90.7	286.9±100.5	293.7±92.3	0.99	1.02	0.652
TG(50:3)	15.55	846.7538	[M+NH4] ⁺	232.7±66.5	230.9±66.3	244.3±76.8	251.3±63.8	0.99	1.03	0.681
TG(50:4)	15.43	844.7372	[M+NH4] ⁺	107.2±41.1	104.9±34.8	112.9±38.6	116.5±31.5	0.98	1.03	0.724
TG(50:5)	15.3	842.7209	[M+NH4] ⁺	34.5±17.3	32.1±13.5	34.6±15.0	34.8±11.8	0.93	1.01	0.953
TG(50:6)	15.18	840.7095	[M+NH4] ⁺	11.4±5.3	11.0±5.0	11.3±5.4	11±4.2	0.96	0.98	0.906
TG(52:1)	15.93	878.8159	[M+NH4] ⁺	25.0±7.6	26.0±7.3	25.3±7.2	26.4±8.3	1.04	1.04	0.357
TG(52:2)	15.81	876.7979	[M+NH4] ⁺	468.0±126.6	486.8±141.9	504.9±135.2	562.0±113.2	1.04	1.11	0.050
TG(52:3)	15.71	874.7855	[M+NH4] ⁺	730.4±170.3	769.2±219.3	814.5±214.6	884.1±187.4	1.05	1.09	0.126
TG(52:4)	15.58	872.7691	[M+NH4] ⁺	554.2±156.9	567.9±180.6	615.1±175.4	656.7±155.1	1.02	1.07	0.256
TG(52:5)	15.46	870.7513	[M+NH4] ⁺	220.2±75.9	212.2±83.8	235.5±71.6	253.1±65.6	0.96	1.07	0.411
TG(52:6)	15.31	868.7366	[M+NH4] ⁺	65.4±30.6	59.9±27.4	66.3±23.9	71.9±23.2	0.91	1.08	0.399
TG(54:1)	16.04	906.8357	[M+NH4] ⁺	9.8±0.9	10.2±1.2	9.9±0.9	10.5±1.1	1.04	1.07	0.008
TG(54:3)	15.8	902.8189	[M+NH4] ⁺	119.9±31.5	130.9±46.5	134.3±40.9	159.1±40.4	1.09	1.18	0.016
TG(54:4)	15.66	901.8013	[M+NH4] ⁺	24.0±7.6	25.8±11.1	27.5±11.8	28.9±10.0	1.08	1.05	0.724
TG(54:5)	15.57	898.7836	[M+NH4] ⁺	228.6±70.5	247.9±101.8	251.3±74.6	287±75.4	1.08	1.14	0.085
TG(54:6)	15.45	896.7687	[M+NH4] ⁺	199.1±71.6	211.0±95.8	213.4±62.6	238.1±62.7	1.06	1.12	0.224
TG(54:7)	15.31	894.7516	[M+NH4] ⁺	112.4±48.2	113.4±55.9	119.3±41.4	128.5±41.0	1.01	1.08	0.544

TG(54:8)	15.16	892.7333	[M+NH4] ⁺	38.3±17.5	36.9±19.0	38.8±15.3	42.0±17.1	0.96	1.08	0.531
TG(56:5)	15.78	926.8164	[M+NH4] ⁺	30.5±8.1	30.5±8.4	30.5±6.4	35.3±7.1	1.00	1.16	0.010
TG(56:6)	15.65	924.7967	[M+NH4] ⁺	75.2±19.3	74.8±21.2	77.6±17.1	87.0±18.1	0.99	1.12	0.060
TG(56:7)	15.6	922.7828	[M+NH4] ⁺	129.4±41.8	130.5±45.4	137.9±43.8	148.7±41.0	1.01	1.08	0.308
TG(56:8)	15.47	920.7675	[M+NH4] ⁺	111.0±41.7	113.1±45.6	122.5±49.3	129.5±45.0	1.02	1.06	0.531
TG(56:9)	15.31	918.7524	[M+NH4] ⁺	42.5±16.1	41.6±18.7	45.5±20.4	48.6±20.6	0.98	1.07	0.481
TG(58:9)	15.45	946.7872	[M+NH4] ⁺	34.1±15.1	35.4±17.5	38.8±22.0	40.9±17.3	1.04	1.05	0.468
TG(58:10)	15.32	944.7747	[M+NH4] ⁺	28.8±13.0	28.9±15.4	31.3±17.1	32.9±15.3	1.00	1.05	0.389
TG(60:12)	15.36	968.7707	[M+NH4] ⁺	14.0±9.3	15.0±13.8	14.8±11.1	14.3±9.4	1.07	0.97	0.784

Data are presented as the means ± standard deviations. Intensity was divided by 10⁴. *p*-values were calculated from the Wilcoxon rank signed tests. Abbreviations: FFA, free fatty acid; LysoPC, lysophosphatidylcholine;

LysoPE, lysophosphatidylethanolamine; PC, phosphatidylcholine; PE, phosphatidylethanolamine; PI, phosphatidylinositol; Cer, ceramide; SM, sphingomyelin; DG, diglyceride; TG, triglyceride.

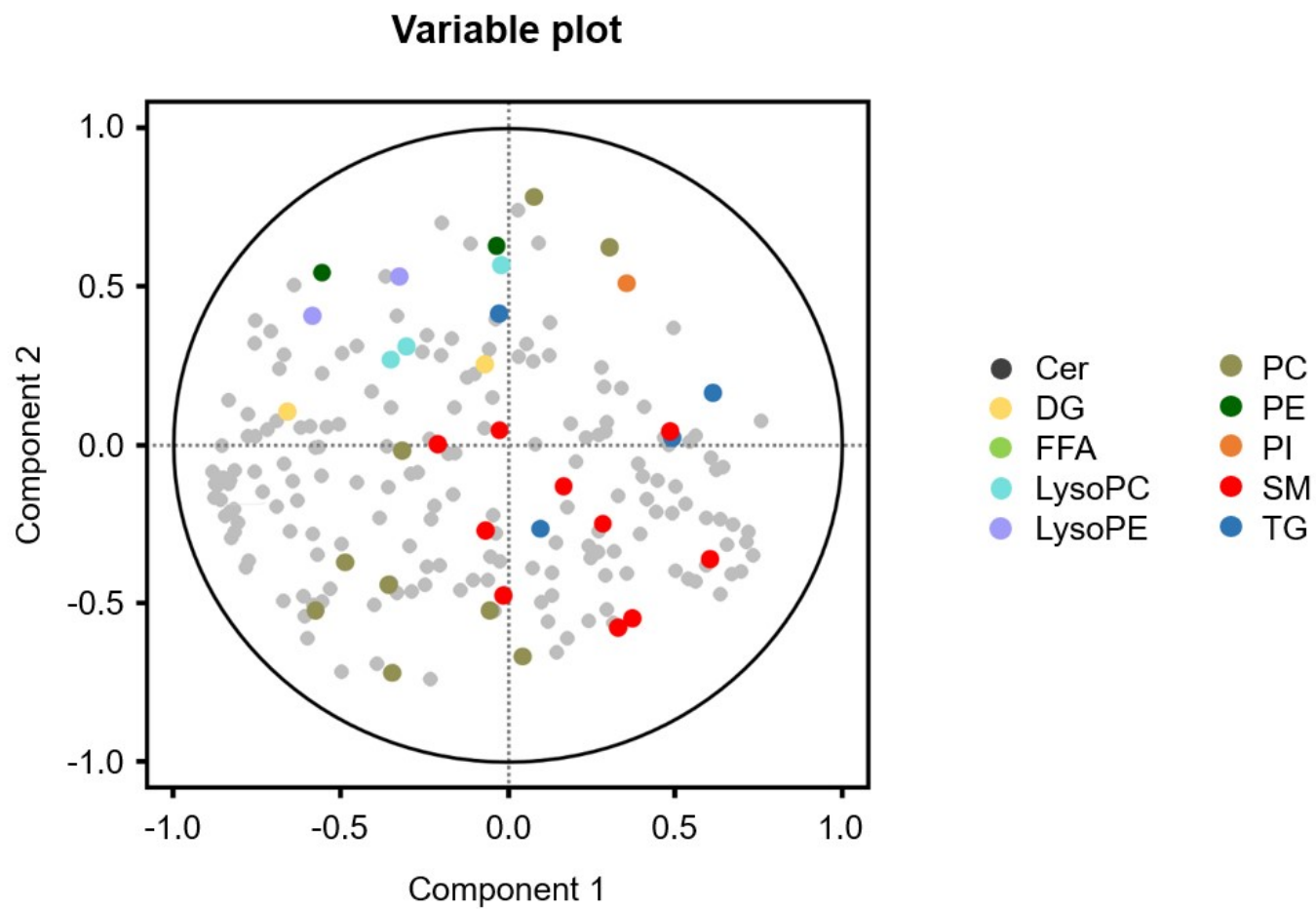


Figure S1. The PCA loading plot of plasma lipid extracts in the YYR groups. The lipid metabolites exhibiting significant differences ($p < 0.05$) in the plasma were presented in the loading plot.