

Chronic caloric restriction partially protects against age-related alteration in serum metabolome

Jennifer M. De Guzman¹, Ginger Ku¹, Ryan Fahey¹, Yun-Hee Youm², Ignatius Kass⁴, Donald K. Ingram³, Vishwa Deep Dixit², and Indu Kheterpal^{1*}

¹Protein Structural Biology and Proteomics and Metabolomics Core, ²Immunobiology Laboratory, and ³Nutritional Neuroscience and Aging, Pennington Biomedical Research Center, Louisiana State University System, Baton Rouge LA; ⁴Waters Corporation, Beverly, MA

***Corresponding Author:** Indu Kheterpal, PhD

Protein Structural Biology

Pennington Biomedical Research Center

Louisiana State University System

6400 Perkins Road

Baton Rouge, LA 70808, USA

Phone: 225-763-2534

Fax: 225-763-0274

E-mail: Indu.Kheterpal@pbrc.edu

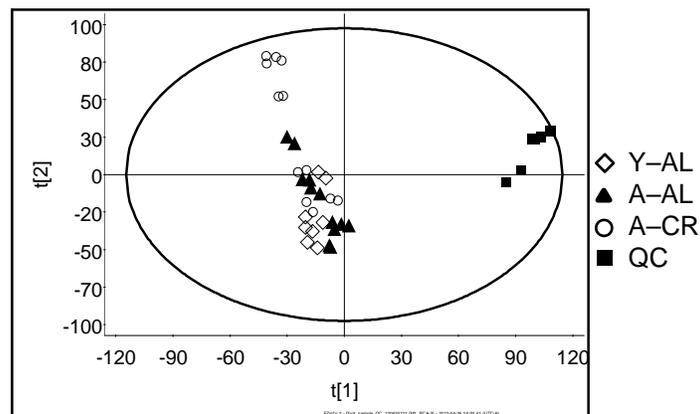


Fig. S-1 PCA score scatter plot of the three animal groups and quality control (QC) samples.

Supplementary Table 1

Table S-1 List of identified metabolites exhibiting differential levels among Y-AL, A-AL, and A-CR groups.

Number	[M+H] ⁺	Retention time (min)	Assignment	Identification
1	166.087 ^{a,c}	0.32	Phenylalanine *	METLIN
2	240.102 ^a	13.95	Hydroxyacetylaminofluorene *	MMCD
3	263.238 ^a	14.33	C ₁₈ H ₃₁ O *	METLIN
4	265.254 ^a	14.8	Octadecadienal *	METLIN
5	279.234 ^{a,c}	14.65	Linolenic acid **	METLIN
6	279.234 ^{a,c}	15.01	Linolenic acid **	METLIN
7	283.265 ^a	14.8	C ₁₈ H ₃₅ O ₂ *	METLIN
8	302.307 ^a	12.67	Sphinganine **	m/z 95.1, 284.3; METLIN
9	323.258 ^a	14.73	C ₂₀ H ₃₅ O ₃ *	METLIN
10	326.308 ^{a,c}	14.34	Oleoyl ethanolamide **	METLIN
11	331.264 ^a	13.84	Docosapentaenoic acid *	Standard; MassTRIX (Biosynthesis of unsaturated fatty acids)
12	337.275 ^a	13.06	Pregnane derivative (C ₂₁ H ₃₆ O ₃) **	KEGG
13	337.275 ^a	14.32	Pregnane derivative (C ₂₁ H ₃₆ O ₃) **	KEGG
14	343.196 ^c	14.62	Tripeptide (C ₁₅ H ₂₇ N ₄ O ₅) *	METLIN
15	351.290 ^a	15.23	12,15-epoxy-13,14-dimethyleicosa-12,14-dienoic acid *	METLIN
16	357.276 ^a	14.9	C ₂₄ H ₃₇ O ₂ **	METLIN
17	357.277 ^c	12.53	Tetracosahexaenoic acid *	METLIN; Mass fragment analysis
18	357.301 ^a	14.8	MG(18:0) *	METLIN
19	359.220 ^a	12.81	C ₂₂ H ₃₁ O ₄ *	METLIN
20	370.296 ^a	12.22	Cis-5-tetradecenoylcarnitine *	m/z 85, 144.1, 209.2, 311.2; METLIN
21	372.311 ^{a,c}	12.57	Tetradecanoyl carnitine *	m/z 85, 144.1, 313.2; METLIN
22	374.254 ^a	14.33	Tripeptide consisting of Ala, Lys, and Arg **	METLIN

23	379.282 ^a	14.8	C ₂₃ H ₃₉ O ₄ **	METLIN
24	391.359 ^a	15.28	Hexacosatrienoic acid *	METLIN
25	399.326 ^{a,b}	14.43	C ₂₇ H ₄₃ O ₂ *	METLIN
26	400.343 ^{a,c}	13.17	Palmitoyl carnitine *	Standard; METLIN; MassTRIX (Fatty acid metabolism)
27	415.322 ^{a,c}	14.32	Vitamin D3 derivative (C ₂₇ H ₄₃ O ₃)*	METLIN
28	417.336 ^{a,b,c}	13.62	7 α -dihydroxy-4-cholesten-3-one *	METLIN; MassTRIX (endocrine and other factor-regulated calcium reabsorption, primary bile acid biosynthesis, steroid biosynthesis, and mineral absorption); Mass fragment analysis (MassLynx)
29	417.336 ^{a,c}	14.38	Sterol lipid (C ₂₇ H ₄₅ O ₃) *	METLIN
30	419.349 ^{a,c}	14.83	Sterol lipid (C ₂₇ H ₄₇ O ₃) *	METLIN
31	424.343 ^a	12.94	Linoleyl or Linoelaidyl carnitine *	m/z 85, 144.1; METLIN
32	426.359 ^{a,c}	13.28	Oleoyl carnitine *	Standard
33	431.189 ^a	13.33	Tripeptide consisting of Trp, Pro, and Glu **	METLIN
34	435.348 ^{a,c}	14.38	Sterol lipid (C ₂₇ H ₄₇ O ₄) *	METLIN; MassTRIX (primary bile acid biosynthesis)
35	442.351 ^{a,c}	12.74	3-hydroxy-octadecenoyl carnitine *	HMDB
36	448.343 ^a	12.93	2-docosanamidoethanesulfonic acid **	METLIN
37	457.368 ^{a,c}	15.26	Vitamin D3 derivative (C ₃₀ H ₄₉ O ₃) *	METLIN
38	460.271 ^c	12.21	17-phenyl trinor Prostaglandin E2 serinol amide *	m/z 91.1; METLIN
39	460.282 ^a	13.06	BW A868C *	METLIN
40	465.357 ^{a,c}	14.5	C ₂₈ H ₄₉ O ₅ *	METLIN
41	473.199 ^a	12.94	Tripeptide consisting of His, Met, and Trp *	METLIN
42	475.342 ^{a,c}	14.5	18-acetoxy-1 α ,25-dihydroxyvitamin D3 *	m/z 121.1, 159.1; METLIN
43	475.34 ^{a,c}	14.37	18-acetoxy-1 α ,25-dihydroxyvitamin D3 *	METLIN
44	476.279 ^a	12.69	LysoPE(18:3) *	m/z 335.3, 458.3; METLIN
45	477.357 ^{a,c}	14.83	1 α ,25-dihydroxy-2 β -(2-hydroxyethoxy)vitamin D3 *	METLIN

46	478.293 ^a	13.06	LysoPE(18:2) *	m/z 198.1; 216.1, 337.3, 460.3; METLIN
47	494.324 ^c	13.04	LysoPC(16:1) *	m/z 184, 240.1, 476.3; METLIN; MassTRIX (glycerophospholipid metabolism)
48	494.325 ^b	12.71	LysoPC(16:1) *	m/z 184, 240.1, 476.3; METLIN; MassTRIX (glycerophospholipid metabolism)
49	494.325 ^{b,c}	12.85	LysoPC(16:1) *	m/z 184, 240.1, 476.3; METLIN; MassTRIX (glycerophospholipid metabolism)
50	496.378 ^{a,c}	15.49	2-O-methyl PAF C-16 *	m/z 184, 313.2; METLIN
51	500.278 ^a	12.02	LysoPE(20:5) *	m/z 359.3; METLIN; Elemental composition analysis
52	508.339 ^{a,b}	13.2	LysoPC(17:1) *	m/z 184, 240.1, 325.3, 490.3; METLIN
53	516.304 ^b	12.71	Taurocholic Acid **	m/z 462.3; HMDB
54	516.311 ^{b,c}	12.85	LysoPC(18:4) *	m/z 184, 240.1, 498.3; METLIN; MassTRIX (glycerophospholipid metabolism)
55	518.324 ^a	11.75	LysoPC(18:3) *	m/z 104, 166, 184; METLIN
56	519.405 ^{a,c}	15.34	Vitamin D3 derivative (C ₃₂ H ₅₅ O ₅) *	METLIN
57	536.414 ^c	15	11 α -(4-dimethylaminophenyl)-1 α ,25-dihydroxyvitamin D3 **	METLIN
58	542.324 ^{a,c}	12.05	LysoPC(20:5) *	m/z 184, 240.1, 524.3; METLIN; MassTRIX (glycerophospholipid metabolism)
59	542.325 ^a	12.74	LysoPC(20:5) *	m/z 184, 240.1, 524.3; METLIN; MassTRIX (glycerophospholipid metabolism)

60	543.323 ^{a,c}	14.65	Belladonnine *	KEGG
61	544.342 ^a	12.21	LysoPC(20:4) *	m/z 184, 526.3; METLIN
62	548.371 ^a	13.73	LysoPC(O-18:2/2:0) *	METLIN; Mass fragment analysis (MassLynx)
63	552.404 ^a	14.25	LysoPC(20:0) or PC(2:0/O-18:0) *	METLIN
64	570.360 ^a	13.45	LysoPC(22:5) **	m/z 184, 240.1, 258.1, 552.3; METLIN
65	572.373 ^a	13.63	LysoPC(22:4) *	m/z 184, 389.3, 554.3; METLIN
66	575.469 ^{a,c}	15.83	DG (15:0/18:4) *	METLIN
67	606.449 ^a	15.43	LysoPC(24:1) *	m/z 184, 588.4; METLIN; Elemental composition analysis
68	647.512 ^c	15.34	SM(d18:1/12:0) *	m/z 104, 166, 184; METLIN; MassTRIX (sphingolipid metabolism)
69	756.552 ^a	16.39	PC(16:1/18:2) *	m/z 184, 476.3, 494.3, 502.3, 520.3; METLIN
70	818.572 ^a	16.34	PE (C ₄₇ H ₈₁ NO ₈ P) *	METLIN
71	852.575 ^a	15.49	PS (C ₄₇ H ₈₃ NO ₁₀ P) *	Lipidmaps
72	854.568 ^{a,c}	16.03	PC(20:4/22:6) or PC(22:6/20:4) *	m/z 184, 526.3, 550.3; METLIN; MassTRIX (glycerophospholipid metabolism, linoleic acid and alpha-linolenic acid metabolism, and arachidonic acid metabolism)

^a Feature that exhibits differential level between A–CR and Y–AL groups

^b Feature that exhibits differential level between A–AL and Y–AL groups

^c Feature that exhibits differential level between A–AL and A–CR groups

* Mass accuracy is within 0-5 ppm error

** Mass accuracy is within 6-10 ppm error

The identification column includes details on the databases and fragment ions used for identification.

PC: phosphatidylcholine; PE: phosphatidylethanolamine; PS: phosphatidylserine; SM: sphingomyelin; DG: diacylglycerol;

MG: monoacylglycerol

Supplementary Table 2

Table S-2 List of unidentified features exhibiting differential levels among Y-AL, A-AL, and A-CR groups.

Number	[M+H] ⁺	Retention time (min)
1	131.005 ^{a,c}	14.33
2	133.035 ^a	0.45
3	150.060 ^c	0.94
4	153.069 ^c	1
5	158.119 ^c	0.45
6	159.068 ^c	0.95
7	197.119 ^{a,c}	14.33
8	209.121 ^{b,c}	11.84
9	245.228 ^a	14.33
10	247.244 ^a	14.8
11	263.24 ^a	14.23
12	290.638 ^a	12.05
13	293.662 ^{a,c}	13.73
14	302.638 ^a	12.04
15	310.167 ^{a,c}	11.45
16	312.113 ^c	0.94
17	314.666 ^a	13.8
18	339.270 ^c	12.53
19	339.290 ^a	14.8
20	341.353 ^a	15.14
21	351.230 ^{a,c}	14.51
22	355.255 ^{a,c}	14.32
23	363.261 ^c	14.8
24	364.270 ^c	15
25	367.229 ^a	13.31
26	376.269 ^a	14.8
27	378.273 ^a	14.32
28	383.189 ^a	13.31
29	389.337 ^{a,c}	14.49
30	422.328 ^a	12.67
31	432.770 ^a	14.23
32	432.781 ^{a,c}	13.94
33	437.285 ^{a,c}	13.85
34	449.198 ^a	13.33
35	454.390 ^a	13.73
36	458.797 ^a	14.32

Number	[M+H] ⁺	Retention time (min)
37	459.221 ^c	14.05
38	464.313 ^a	13.7
39	465.328 ^a	14.28
40	467.154 ^a	10.99
41	473.327 ^{a,c}	14.54
42	473.335 ^{a,c}	14.32
43	473.820 ^a	14.79
44	476.314 ^{b,c}	12.85
45	477.230 ^{a,c}	14.05
46	487.337 ^{a,c}	14.52
47	491.34 ^{a,c}	14.5
48	492.420 ^a	15.24
49	507.345 ^{a,c}	14.65
50	509.364 ^{a,c}	14.31
51	512.336 ^b	11.48
52	513.297 ^b	12.85
53	522.325 ^{a,c}	14.05
54	524.278 ^{a,c}	12.02
55	524.313 ^a	12.74
56	529.391 ^{a,c}	14.85
57	534.314 ^b	12.8
58	536.334 ^a	11.75
59	537.402 ^{a,c}	14.59
60	540.298 ^a	12.72
61	541.387 ^a	15.34
62	541.407 ^a	14.8
63	543.346 ^{a,c}	14.14
64	547.435 ^{a,c}	15.58
65	549.296 ^a	12.78
66	556.350 ^c	14.2
67	560.336 ^{a,c}	12.05
68	561.295 ^a	12.74
69	565.442 ^{a,c}	15.06
70	566.327 ^a	13
71	566.327 ^a	12.81
72	569.419 ^{a,c}	15.57

Number	[M+H] ⁺	Retention time (min)
73	582.319 ^{a,c}	12.05
74	590.391 ^a	13.8
75	597.45 ^{a,c}	15.83
76	602.418 ^b	15.4
77	606.316 ^a	12.04
78	617.474 ^{a,c}	15.6
79	621.436 ^a	15.81
80	628.435 ^a	15.43
81	632.463 ^a	15.53
82	645.433 ^a	15.56
83	647.449 ^a	15.83
84	673.528 ^{a,c}	15.44
85	759.946 ^{b,c}	12.85
86	773.582 ^{a,c}	15.52
87	798.970 ^a	12.96
88	798.971 ^a	13.15
89	805.017 ^{a,c}	14.13
90	821.407 ^a	14.71
91	831.945 ^a	12.74
92	864.592 ^a	15.98
93	894.600 ^a	15.93
94	916.583 ^{a,c}	15.93
95	986.542 ^a	14.71
96	998.626 ^a	13.08

^a Feature that exhibits differential level between A–CR and Y–AL groups

^b Feature that exhibits differential level between A–AL and Y–AL groups

^c Feature that exhibits differential level between A–AL and A–CR groups