Electronic Supplementary Material (ESI) for Food & Function.

Lycopene ameliorates skin aging by regulating of the insulin resistance pathway and activating SIRT1

Jing Li[a,c,‡], Xin Zeng[b,c,‡], Xiaolong Yang[a,*] and Hong Ding[c,*]

[a]School of Pharmaceutical Sciences, South-Central Minzu University, Wuhan, P. R. China, yxl19830915@163.com, +8615223022976

[b]Nanchong Key Laboratory of Individualized Drug Therapy, Department of Pharmacy, The Second Clinical Medical College of North Sichuan Medical College, Nanchong Central Hospital, Nanchong, China

[c]Key Laboratory of Combinatorial Biosynthesis and Drug Discovery, Ministry of Education, Wuhan University School of Pharmaceutical Sciences, Wuhan University, Wuhan, 430000, Hubei, P. R. China, dinghong1106@whu.edu.cn, +8613659870301

[‡]These authors contributed equally.

Liquid chromatography

The chromatography was performed on a Thermo fisher U3000 UPLC system (Thermo Fisher Scientific, USA). A Waters Acquity UHPLC HSS T3 column (2.1 mm × 100 mm, 1.8 m) was used for sample separation with a flow rate of 0.2 mL/min and at a column temperature of 40◦. The mobile phases were consisted of (A) 0.1% formic acid aqueous solution and (B) acetonitrile, and the gradient elution was optimized as follows: 0~2 min, 98% A; 2~3 min, 2~35% A; 3~17 min, 65~30% A; 17~18 min, 30% A; 18~29 min, 30%~2% A; 29~31 min, 2% A; 31~33 min, 2~98% A; 33~35 min, 98% A. The injection volume was set to 2 L. Detection wavelength was set at 360 nm.

Mass spectrometry

Mass spectrometry analysis was performed on a Thermo ScientificTM Q Exactive hybrid quadrupole-orbitrap high resolution accurate mass spectrometer (Thermo Fisher Scientific, USA) equipped with a heated electrospray ionization (HESI) source in both positive and negative ion modes. The full scan mode range was set to 100–1500 m/z full MS and the resolution was set to 35,000. The Scan mode was Full Scan/dd-MS2; capillary temperature 320 ◦C; probe heater temperature 300 ◦C; spray voltage 3.5 kVfor (-)-ESI and 2.5 kV for (+)-ESI. All the raw files were processed by Xcalibur 3.2 and Compound Discover 2.1 (CD). The compounds characterized by CD were fished by searching mz Cloud database, Chemspider and Pubchem compound.

Figure S1 Rat model of D-gal-induced skin aging and treatment with Ly. (n = 6 per group).

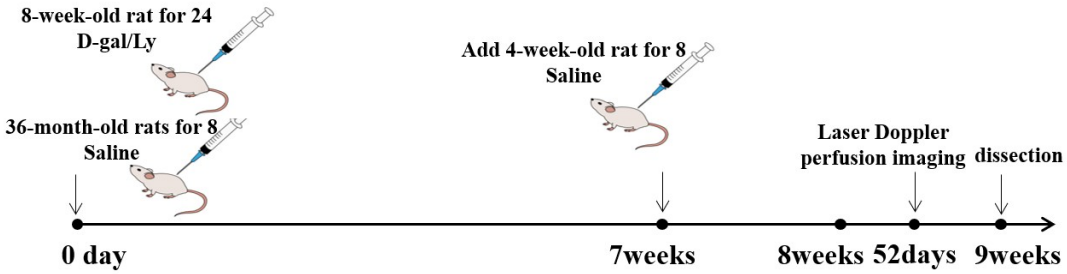

Figure S2 OD value of different concentrations of Ly on PRSF cells. *, # and Δ indicate that the OD values between lycopene group and control group at different

time points were significantly different, $p < 0.05$. (n = 6 per group).

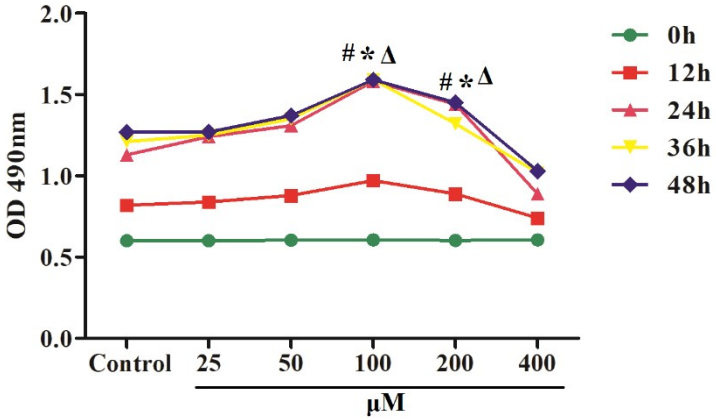

Figure S3 PCA score plots based on LC-MS data of PRSFs. (n = 6 per group).

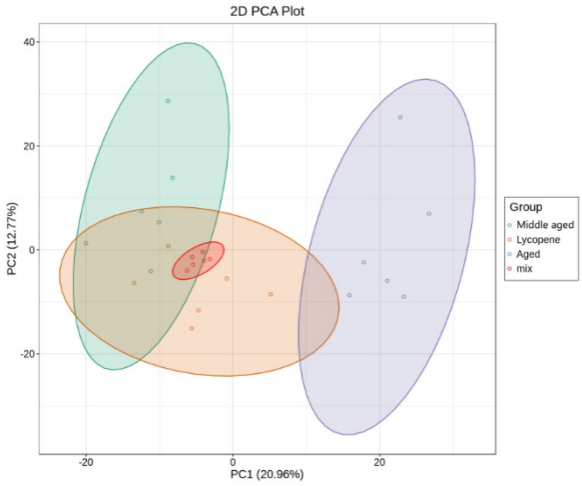

Table S1 Differential metabolites of middle aged group and aged group. (n = 6 per group).

Index	Compounds	Formula	VIP	p_value	Fold_Change	Log2FC	Type
MW0103710	Uridine-diphosphate-N-acetylglucosamine	C17H27N3O17P2	1.96382	0.00003	0.41054	-1.28441	down
MEDN0204	Pyruvic Acid	C3H4O3	1.99223	0	0.27524	-1.86122	down
MW0110979	D-erythro-N-stearoylsphingosine	C18H37NO2	1.6687	0.00476	2.02272	1.0163	up
MW0110759	2S-Amino-4E-octadecene-1,3S-diol	C18H37NO2	1.87161	0.00004	2.09012	1.06358	up
MEDP1617	L-(+)-Gulose	C6H12O6	1.66912	0.0008	0.48674	-1.03877	down
MEDP1592	Cytidine 5'-Diphosphocholine	C14H26N4O11P2	1.93809	0	2.17672	1.12215	up
MEDP1857	Eicosanoyl-EA	C22H45NO2	1.52748	0.01465	2.42809	1.27982	up
MW0141815	1-O-Palmitoyl-2-O-acetyl-sn-glycero-3-phosphorylcholine	C26H52NO8P	1.58956	0.00938	2.20579	1.14129	up
MW0141803	1-O-(cis-9-Octadecenyl)-2-O-acetyl-sn-glycero-3-phosphocholine	C28H56NO7P	1.69897	0.0008	0.39789	-1.32957	down
MEDL02308	Nicotinic Acid Adenine Dinucleotide	C21H27N7O14P2	1.7351	0.00428	2.40087	1.26356	up
MW0158347	Tyr Ala Arg Asp Glu	C27H40N8O11	1.94841	0	3.25117	1.70096	up
MEDL01737	5-Aminoimidazole ribonucleotide	C8H14N3O7P	1.7364	0.00104	2.56425	1.35854	up
MW0151906	Janthitrem C	C37H47NO4	1.72535	0.0003	0.45522	-1.13537	down
MW0016182	Bexarotene	C24H28O2	1.70764	0.00319	5.1466	2.36362	up
MW0157725	Thr Lys Gln Lys	C21H41N7O7	1.78884	0.00048	0.46624	-1.10086	down
MW0014872	5α-Androstane-3,17-dione	C19H28O2	1.95925	0	0.27434	-1.86598	down
MW0145814	Asn Leu Pro Ala Lys	C24H43N7O7	1.59786	0.00891	0.3118	-1.68131	down
MW0168719	Allopurinol; LC-ESI-QTOF; MS2; $[M+H]^+$; CE	C5H4N4O	1.56379	0.00569	2.1183	1.08291	up
MW0109005	Orlistat	C29H53NO5	1.73742	0.00361	0.14917	-2.74493	down
MW0152565	Leu Val Lys Arg	C23H46N8O5	1.51516	0.0048	0.49612	-1.01124	down

MW0159691	Chlorofluoromethane	CH2ClF	1.91519	0.00005	2.51628	1.33129	up
MW0145598	Argiopinin I	C36H63N12O6	1.85769	0.00052	0.1146	-3.12534	down
MW0012927	1-O-Hexadecyl-2-O-(4Z,7Z,10Z,13Z,16Z,19Z-docosahexaenoyl)-sn-glyceryl-3-phosphorylcholine	C46H82NO7P	1.78269	0.00282	0.07482	-3.74042	down
MW0150432	Gly Lys Val Lys Lys	C25H50N8O6	1.64761	0.00338	0.39983	-1.32255	down
MW0007213	Formoterol	C19H24N2O4	1.30417	0.03739	0.48697	-1.0381	down
MEDL00424	PAz-PC	C33H64NO10P	1.79232	0.00009	0.46994	-1.08944	down
MW0126582	Spirolide D	C43H65NO7	1.26049	0.03599	0.39821	-1.32841	down
MW0107054	Gly Asn Lys	C12H23N5O5	1.89368	0.00006	8.54349	3.09483	up
MW0144601	Ala His Thr Lys	C19H33N7O6	1.47463	0.01264	2.21714	1.1487	up
MW0110627	1-Palmitoyl-2-thiopalmitoyl phosphatidylcholine	C40H80NO7PS	1.97463	0	0.37495	-1.41523	down

Table S2 Differential metabolites of Ly group and aged group. (n = 6 per group).

Index	Compounds	Formula	VIP	p_value	Fold_Change	Log2FC	Type
MW0103710	Uridine-diphosphate-N-acetylglucosamine	C17H27N3O17P2	1.74826	0.00203	3.76341	1.91204	up
MEDN0153	Adenosine 5'-Monophosphate	C10H14N5O7P	1.41736	0.02511	2.27423	1.18538	up
MEDN0204	Pyruvic Acid	C3H4O3	1.98454	0.00000	3.74298	1.90419	up
MEDP1657	PC(O-16:0/0:0)	C24H52NO6P	1.44729	0.01348	2.32862	1.21948	up
MW0011789	1-(1Z-Hexadecenyl)-sn-glycero-3-phosphocholine	C24H50NO6P	1.45037	0.02106	2.31413	1.21047	up
MW0157725	Thr Lys Gln Lys	C21H41N7O7	1.57029	0.01230	2.49397	1.31845	up
MW0145814	Asn Leu Pro Ala Lys	C24H43N7O7	1.60683	0.00651	3.37396	1.75444	up
MW0139412	Procyanidin A2	C30H24O12	1.68802	0.00312	0.42515	-1.23395	down
MW0139075	N-(4-Methyl-2-oxochromen-7-yl)icosa-5,8,11,14-tetraenamide	C30H39NO3	1.47832	0.00974	0.49779	-1.00639	down
MW0102922	Tributyrin	C15H26O6	1.85096	0.00012	0.46976	-1.09000	down
MW0145598	Argiopinin I	C36H63N12O6	1.36849	0.02345	2.57603	1.36515	up
MW0144601	Ala His Thr Lys	C19H33N7O6	1.54810	0.00530	0.43653	-1.19586	down
MW0109129	Phe Pro Glu	C19H25N3O6	1.24189	0.04415	0.40249	-1.31298	down