Supplementary Table 1 The biochemical index analysis of control, YHS and YCHT groups

Index / Group	ALT (U/L)	AST (U/L)	ALP (U/L)	D-Bili (μmol/L)	T-Bili (μmol/L)
Control	96.81 ±1.37×E	165.78 ±3.72×E	96.99 ±5.14	1.90 ±0.44	1.97 ±0.11
YHS	214.35 ±6.81×E**	320.89 ±2.13×E**	225.35 ±9.69×E**	3.62 ±0.25**	3.80 ±0.16**
YCHT	105.12 ±2.23×E##	240.50 ±7.64×E #	96.07 ±4.36##	2.29 ±1.18#	2.45 ±1.18#

Index / Group	γ-GT (U/gprot)	TBA (μmol/L)	T-SOD (U/mgprot)	MDA (nmol/mgprot)	GSH-Px (μmol/L)
Control	8.34 ±1.17	5.58 ±1.09	23.07 ±2.79	102.49 ±4.01	217.29 ±2.33×E
YHS	11.02 ±1.96*	8.72 ±0.98**	20.93 ±2.31	212.37 ±7.50×E-**	117.63 ±2.95×E**
YCHT	8.46 ±0.80#	6.31 ±1.85#	21.51 ±3.81	97.98 ±7.22##	213.70 ±6.94×E#

The clinical biochemical index analysis results are expressed as mean±SD，n=12
*P<0.05, **P<0.01, control vs YHS; #P<0.05, ##P<0.01, YHS vs YCHT

Supplementary Table. 2 Identification and trends of serum potential biomarkers in YHS mice

NO	Rt (min)	m/z determined	m/z calculated	Error （mDa）	Ion form	Molecular Formula	Metabolite Name	Trend	T'TEST
1	8.73	772.5930	771.5778	0.2	$[M+H]^+$	$C_{43}H_{82}NO_8P$	PC(15:0/20:2(11Z,14Z))	↓	$1.594\times E^{-3}$
2	0.60	130.0499	129.0426	0.5	$[M+H]^+$	$C_5H_7NO_3$	Pyroglutamic acid	↓	$1.654\times E^{-2}$
3	2.20	249.1251	248.1161	2.9	$[M+H]^+$	$C_{13}H_{16}N_2O_3$	6-Hydroxymelatonin	↑	$4.540\times E^{-5}$
4	6.25	546.3539	545.3481	-2.8	$[M+H]^+$	$C_{28}H_{52}NO_7P$	LysoPC(20:3(5Z,8Z,11Z))	↓	$1.466\times E^{-6}$
5	8.19	512.5064	511.4964	3.1	$[M+H]^+$	$C_{32}H_{65}NO_3$	Cer(d18:0/14:0)	↓	$6.952\times E^{-9}$
6	8.78	719.5690	718.5536	-1.4	$[M+H]^+$	$C_{47}H_{74}O_5$	DG(22:4(7Z,10Z,13Z,16Z)/22:5(4Z,7Z,10Z,13Z,16Z)/0:0)	↓	$1.981\times E^{-2}$
7	1.98	194.0794	193.0739	-0.1	$[M+H]^+$	$C_{10}H_{11}NO_3$	Phenylacetylglycine	↑	$4.578\times E^{-3}$
8	2.23	411.2492	410.2433	-3.4	$[M+H]^+$	$C_{19}H_{39}O_7P$	LPA(0:0/16:0)	↑	$4.933\times E^{-2}$
9	2.69	121.0649	120.0575	0.9	$[M+H]^+$	C_8H_8O	Phenylacetaldehyde	↑	$4.446\times E^{-3}$
10	3.06	136.0761	135.0684	2.7	$[M+H]^+$	C_8H_9NO	2-Phenylacetamide	↑	$2.989\times E^{-2}$
11	8.31	556.5300	555.5227	0.1	$[M+H]^+$	$C_{34}H_{69}NO_4$	Cer(t18:0/16:0)	↑	$5.923\times E^{-3}$
12	8.89	770.5690	769.5622	-0.5	$[M+H]^+$	$C_{43}H_{80}NO_8P$	PC(15:0/20:3(5Z,8Z,11Z))	↓	$1.618\times E^{-2}$
13	2.25	758.5692	757.5622	-0.3	$[M+H]^+$	$C_{42}H_{80}NO_8P$	PC(14:0/20:2(11Z,14Z))	↑	$3.516\times E^{-3}$
14	5.46	224.0562	223.0481	3.9	$[M+H]^+$	$C_{10}H_9NO_5$	4-(2-Amino-3-hydroxyphenyl)-2,4-dioxobutanoic acid	↑	$2.124\times E^{-7}$
15	6.99	538.3877	537.3794	1.9	$[M+H]^+$	$C_{27}H_{56}NO_7P$	LysoPE(0:0/22:0)	↓	$1.504\times E^{-2}$
16	1.72	209.0939	208.0848	-1.5	$[M+H]^+$	$C_{10}H_{12}N_2O_3$	Formyl-5-hydroxykynurenamine	↑	$3.473\times E^{-4}$
17	2.32	185.0827	184.0736	2.9	$[M+H]^+$	$C_9H_{12}O_4$	Vanylglycol	↑	$2.157\times E^{-3}$
18	8.34	802.6350	801.6248	4.6	$[M+H]^+$	$C_{45}H_{88}NO_8P$	PC(15:0/22:1(13Z))	↓	$1.049\times E^{-3}$
19	1.90	163.0383	164.0473	1.6	[M-H]-	$C_9H_8O_3$	Phenylpyruvic acid	↑	$3.070\times E^{-4}$
20	1.98	193.0349	194.0427	-2.6	[M-H]-	$C_6H_{10}O_7$	D-Glucuronic acid	↑	$4.211\times E^{-2}$
21	8.49	790.5418	791.5465	3.2	[M-H]-	$C_{45}H_{78}NO_8P$	PC(15:0/22:6(4Z,7Z,10Z,13Z,16Z,19Z))	↑	$4.768\times E^{-2}$
22	6.19	480.3096	481.3168	0.1	[M-H]-	$C_{23}H_{48}NO_7P$	LysoPC(15:0)	↓	$1.101\times E^{-2}$

↑Compared with control group, the level of metabolites in YHS group were increased
↓Compared with control group, the level of metabolites in YHS group were decreased

Supplementary Table. 3 Relative signal intensities of metabolic biomarkers.

NO	Groups / Biomarkers	Control	YHS	YCHT
1	PC(15:0/20:2(11Z,14Z))	$8.66\times E^{6}$ $\pm 8.80\times E^{5}$	$2.66\times E^{6}$ $\pm 3.18\times E^{5}$ **	$7.83\times E^{6}$ $\pm 1.71\times E^{6}$ ##
2	Pyroglutamic acid	$7.40\times E^{4}$ $\pm 1.38\times E^{4}$	$3.11\times E^{4}$ $\pm 2.01\times E^{3}$ **	$5.10\times E^{4}$ $\pm 7.32\times E^{3}$ ##
3	6-Hydroxymelatonin	$5.99\times E^{3}$ $\pm 2.58\times E^{3}$	$1.28\times E^{4}$ $\pm 3.22\times E^{3}$ **	$9.36\times E^{3}$ $\pm 4.51\times E^{3}$ #
4	LysoPC(20:3(5Z,8Z,11Z))	$1.22\times E^{7}$ $\pm 1.07\times E^{6}$	$2.38\times E^{6}$ $\pm 2.37\times E^{5}$ **	$9.93\times E^{6}$ $\pm 5.14\times E^{5}$ ##
5	Cer(d18:0/14:0)	$8.39\times E^{6}$ $\pm 1.90\times E^{6}$	$3.85\times E^{4}$ $\pm 1.03\times E^{4}$ **	$6.11\times E^{6}$ $\pm 6.11\times E^{5}$ ##
6	DG(22:4(7Z,10Z,13Z,16Z)/22:5(4Z,7Z,10Z,13Z,16Z)/0:0)	$8.64\times E^{5}$ $\pm 1.81\times E^{5}$	$3.72\times E^{5}$ $\pm 1.05\times E^{5}$ **	$4.64\times E^{5}$ $\pm 3.04\times E^{5}$
7	Phenylacetylglycine	$1.78\times E^{3}$ $\pm 1.17\times E^{3}$	$5.27\times E^{3}$ $\pm 1.97\times E^{3}$ **	$2.69\times E^{3}$ $\pm 1.68\times E^{3}$ ##
8	LPA(0:0/16:0)	$1.47\times E^{4}$ $\pm 6.80\times E^{3}$	$7.38\times E^{4}$ $\pm 3.07\times E^{4}$ **	$3.29\times E^{4}$ $\pm 1.67\times E^{4}$ ##
9	Phenylacetaldehyde	$2.20\times E^{3}$ $\pm 1.44\times E^{3}$	$3.99\times E^{3}$ $\pm 1.18\times E^{3}$ *	$2.22\times E^{3}$ $\pm 1.73\times E^{3}$ ##
10	2-Phenylacetamide	$4.03\times E^{2}$ $\pm 1.71\times E^{2}$	$1.51\times E^{3}$ $\pm 2.88\times E^{2}$ **	$1.03\times E^{3}$ $\pm 5.16\times E^{2}$
11	Cer(t18:0/16:0)	$3.39\times E^{4}$ $\pm 1.82\times E^{4}$	$8.80\times E^{5}$ $\pm 3.71\times E^{5}$**	$6.41\times E^{4}$ $\pm 2.99\times E^{4}$ ##
12	PC(15:0/20:3(5Z,8Z,11Z))	$1.85\times E^{6}$ $\pm 3.64\times E^{5}$	$3.74\times E^{5}$ $\pm 6.77\times E^{4}$ **	$1.73\times E^{6}$ $\pm 8.89\times E^{5}$ ##
13	PC(14:0/20:2(11Z,14Z))	$2.68\times E^{8}$ $\pm 5.19\times E^{7}$	$4.56\times E^{7}$ $\pm 1.74\times E^{7}$ **	$1.24\times E^{8}$ $\pm 1.16\times E^{8}$ #
14	4-(2-Amino-3-hydroxyphenyl)-2,4-dioxobutanoic acid	$5.37\times E^{4}$ $\pm 4.06\times E^{4}$	$3.03\times E^{5}$ $\pm 1.02\times E^{5}$ **	$1.78\times E^{5}$ $\pm 1.48\times E^{4}$ ##
15	LysoPE(0:0/22:0)	$1.47\times E^{7}$ $\pm 3.14\times E^{6}$	$5.31\times E^{6}$ $\pm 8.74\times E^{5}$ **	$6.04\times E^{6}$ $\pm 5.43\times E^{5}$ #
16	Formyl-5-hydroxykynurenamine	$5.33\times E^{3}$ $\pm 2.68\times E^{3}$	$1.42\times E^{4}$ $\pm 4.48\times E^{3}$ **	$8.43\times E^{3}$ $\pm 3.82\times E^{3}$ ##
17	Vanylglycol	$9.96\times E^{2}$ $\pm 9.53\times E^{2}$	$1.19\times E^{4}$ $\pm 2.98\times E^{3}$ **	$1.69\times E^{3}$ $\pm 1.20\times E^{3}$ ##
18	PC(15:0/22:1(13Z))	$1.90\times E^{4}$ $\pm 6.71\times E^{3}$	$5.99\times E^{3}$ $\pm 2.83\times E^{3}$ **	$1.19\times E^{4}$ $\pm 3.92\times E^{3}$ ##
19	Phenylpyruvic acid	$6.49\times E^{3}$ $\pm 1.46\times E^{3}$	$2.57\times E^{4}$ $\pm 1.70\times E^{4}$ **	$1.36\times E^{4}$ $\pm 6.60\times E^{3}$
20	D-Glucuronic acid	$2.67\times E$ ± 4.62	$1.58\times E^{3}$ $5.06\times E^{2}$ **	$5.04\times E^{2}$ $1.09\times E^{2}$
21	PC(15:0/22:6(4Z,7Z,10Z,13Z,16Z,19Z))	$3.94\times E^{7}$ $\pm 1.02\times E^{7}$	$4.05\times E^{6}$ $\pm 1.07\times E^{6}$ **	$2.90\times E^{7}$ $\pm 4.48\times E^{6}$
22	LysoPC(15:0)	$1.52\times E^{7}$ $\pm 1.10\times E^{7}$	$2.41\times E^{6}$ $\pm 5.21\times E^{5}$ **	$5.25\times E^{6}$ $\pm 4.36\times E^{6}$ #

Data are expressed as mean±SD. YHS group compared with control group: *p < 0.05, **p < 0.01; and YCHT group compared with YHS group: #p < 0.05, ##p < 0.01.