

Supplementary materials

Table 1 MS condition of UPLC/MS

MS condition	ESI(+)(T3)	ESI(-)(T3)	ESI(+)(Hilic)
capillary voltage	3.0 kV	2.5 kV	3.0 kV
Sampling cone	30.0 kV	35.0 kV	20.0 kV
Extraction cone	4.0 kV	4.0 kV	4.0 kV
Source temp.	100°C	110°C	100°C
Desolvation temp.	400°C	450°C	400°C
Cone gas	30.0 L/h	20.0 L/h	45.0 L/h
Desolvation gas	800.0 L/h	800.0 L/h	800.0 L/h
Collision energy	6.0V	6.0 V	6.0V
Mass range	50-1500 Da	50-1500Da	50-1500 Da
Scan rate	0.2 sec	0.2 sec	0.2 sec

Data collection	MSE centroid with lock mass applied	MSE centroid with lock mass applied	MSE centroid with lock mass applied
LockSprayTM	556.2771 m/z	554.2615 m/z	556.2771 m/z

Table 2 The total compounds identified in GG and LXSS

NO .	R.T.(min)	m/z	Ion mode	Elemental composition	Identification results	GG group	13-year- LXSS group	15-year- LXSS group	20-year- LXSS group	VI P
1	3.47	203.05 37	[M+Na] ⁺	C ₆ H ₁₁ O ₆ Na	Fructose	0.75±0.1602	0.39±0.0384 **	0.24±0.0186 **▲▲	0.19±0.0284 **▲▲#	1.0 3
2	0.77	179.05 52	[M-H] ⁻	C ₆ H ₁₂ O ₆	Myo-Inositol	1.44±0.1081	1.77±0.1260 **	1.83±0.0633 **	2.47±0.2901 **▲▲##	1.1 5
3	5.35	365.10 59	[M+Na] ⁺	C ₁₂ H ₂₂ O ₁₁ Na	Maltose	19.07±3.3072	16.42±2.749 7	11.95±0.558 1 **▲▲	11.58±2.131 2 **▲▲	1.0 2
4	5.78	343.12 47	[M+H] ⁺	C ₁₂ H ₂₂ O ₁₁	Melibiose	0.30±0.0836	0.38±0.0836	0.49±0.1047 **▲▲	1.45±0.1210 **▲▲##	1.5 8
5	5.15	343.12 39	[M+H] ⁺	C ₁₂ H ₂₂ O ₁₁	Sucrose	7.64±0.8627	5.02±0.1675 **	4.70±0.2719 **	2.41±0.1149 **▲▲##	1.1 6
6	0.90	665.21 25	[M-H] ⁻	C ₂₄ H ₄₂ O ₂₁	Stachyose	0.67±0.1984	0.86±0.0744	1.76±0.2140 **▲▲	0.62±0.1663 ▲##	1.0 6
7	0.82	193.03 43	[M-H] ⁻	C ₆ H ₉ O ₇	Glucuronic acid	0.86±0.1618	1.11±0.2077 *	1.06±0.1715	1.03±0.0866	1.3 4

8	0.89	503.16 05	[M-H] ⁻	C ₁₈ H ₃₂ O ₁₆	Raffinose	5.40±0.3809	6.92±0.2585 **	7.43±0.6979 **	5.94±0.3360 ▲▲##	1.0 2
9	0.89	133.01 35	[M-H] ⁻	C ₄ H ₆ O ₅	Malic acid	69.11±7.3838	74.88±8.639 2	85.68±11.39 01 **▲	103.69±2.71 9 **▲▲##	1.0 1
10	2.07	115.00 20	[M-H] ⁻	C ₄ H ₄ O ₄	Fumaric acid	0.58±0.1375	0.34±0.0614 **	0.29±0.0635 **	0.21±0.0235 **▲	1.0 7
11	1.80	191.01 91	[M-H] ⁻	C ₆ H ₈ O ₇	Citric acid	34.60±1.9364	40.05±1.279 5 **	49.30±2.792 0 **▲▲	46.60±1.936 4 **▲▲#	1.1 0
12	2.39	117.01 84	[M-H] ⁻	C ₄ H ₆ O ₄	Succinic acid	0.69±0.1061	1.10±0.1303 **	1.15±0.2009 **	1.37±0.1713 **▲▲#	1.1 3
13	4.16	205.09 31	[M+H] ⁺	C ₁₁ H ₁₂ N ₂ O ₂	Tryptophan	1.53±0.3605	0.52±0.1254 **	0.76±0.0396 *▲	0.68±0.0750 **	1.0 4
14	0.82	104.07 47	[M+H] ⁺	C ₄ H ₁₀ NO ₂	Gamma- Aminobutyric acid	1.13±0.1975	1.70±0.1621 **	2.64±0.1319 **▲▲	2.86±0.4772 **▲▲	1.2 8
15	2.07	128.03 44	[M-H] ⁻	C ₅ H ₇ NO ₃	Pyroglutamic acid	12.14±0.5357	3.28±0.2197 **	10.11±0.456 6 **▲▲	5.92±0.3525 **▲▲##	1.2 8
16	0.76	175.03 51	[M-H] ⁻	C ₅ H ₇ N ₂ O ₅	Dencichine	5.73±0.2033	0.91±0.1820 **	2.57±0.2339 **▲▲	0.00±0.0000 **▲▲##	1.2 5
17	4.11	118.08 66	[M+H] ⁺	C ₅ H ₁₃ NO ₂	Valine	10.79±1.6216	11.10±0.433 5	5.76±0.3519 **▲▲	6.82±0.2105 **▲▲##	1.4 3
18	0.88	116.07 11	[M+H] ⁺	C ₅ H ₁₁ NO ₂	Proline	11.27±0.6161	5.63±0.2675 **	4.12±0.1722 **▲▲	5.52±0.2400 ****	1.1 2

19	6.13	147.11 31	[M+H] ⁺	C ₆ H ₁₄ N ₂ O ₂	Lysine	5.98±0.6417	2.56±0.3702 **	4.81±0.2778 **▲▲	6.18±0.2862 ▲▲##	1.6 5
20	0.81	88.039 3	[M-H] ⁻	C ₃ H ₇ NO ₂	Alanine	0.00±0.0000	0.27±0.0711 **	0.29±0.0426 **	0.20±0.0492 **#	1.1 1
21	5.32	134.04 55	[M+H] ⁺	C ₄ H ₇ NO ₄	Aspartic acid	0.00±0.0000	2.07±0.2179 **	0.63±0.0502 **▲▲	0.78±0.0836 **▲▲#	1.4 9
22	9.71	1239.6 373	[M-H] ⁻	C ₅₉ H ₁₀₀ O ₂₇	Ginsenoside Ra ₃	14.49±1.0002	29.60±0.746 7 **	29.68±0.864 8 **	31.70±2.071 3 **	1.2 2
23	9.79	1107.5 965	[M-H] ⁻	C ₅₄ H ₉₂ O ₂₃	Ginsenoside Rb ₁	52.38±2.8641	42.11±0.741 8 **	43.26±2.275 8 **	36.78±1.076 2 **▲▲##	1.1 1
24	10.12	1077.5 852	[M-H] ⁻	C ₅₃ H ₉₀ O ₂₂	Ginsenoside Rc	28.3±1.8004	22.59±0.655 3 **	25.52±1.318 5 **▲▲	19.37±0.962 2 **▲▲##	1.2 2
25	11.26	945.54 28	[M-H] ⁻	C ₄₈ H ₈₂ O ₁₈	Ginsenoside Rd	17.85±1.3465	23.52±0.557 6 **	20.98±0.701 9 **▲▲	20.15±0.645 2 **▲▲	1.1 1
26	6.69	945.54 37	[M-H] ⁻	C ₄₈ H ₈₂ O ₁₈	Ginsenoside Re	8.03±0.7168	5.86±0.3868 **	6.17±0.1710 **	5.35±0.3829 ***#	1.0 8
27	9.18	799.48 48	[M-H] ⁻	C ₄₂ H ₇₂ O ₁₄	Ginsenoside Rf	36.03±1.4112	29.06±1.291 7 **	20.86±1.375 2 **▲▲	30.36±0.673 2 ***#	1.0 2
28	6.74	845.49 07	[M- HCOOH] ⁻	C ₄₂ H ₇₂ O ₁₄	Ginsenoside Rg ₁	193.66±11.93 51	203.02±6.58 01	222.94±6.79 08 **▲▲	271.16±6.73 55 **▲▲##	1.1 2

29	9.28	823.48 11	[M+Na] ⁺	C ₄₂ H ₇₂ O ₁₄ Na	Pseudo-ginsenoside F ₁₁	8.80±0.3715	7.11±0.3669 **	5.71±0.1587 **▲▲	4.88±0.2690 **▲▲##	1.1 2
30	14.54	829.49 58	[M-HCOOH] ⁻	C ₄₃ H ₇₃ O ₁₅	Ginsenoside 20(S)Rg ₃	4.51±0.2811	7.59±0.7914 **	8.26±0.5763 **	8.87±1.0676 **▲▲	1.0 4
31	10.20	683.43 67	[M-HCOOH] ⁻	C ₃₇ H ₆₄ O ₁₁	Ginsenoside Rh ₁	5.08±0.5662	7.91±0.7120 **	15.01±0.506 8 **▲▲	15.04±0.737 2 **▲▲	1.0 3
32	11.21	683.43 71	[M-HCOOH] ⁻	C ₃₇ H ₆₃ O ₁₁	Ginsenoside 20(S)F ₁	1.47±0.2123	4.03±0.4301 **	4.47±0.4717 **	7.28±0.5636 **▲▲##	1.1 9
33	15.50	667.44 21	[M-HCOOH] ⁻	C ₃₈ H ₆₂ O ₁₂	Ginsenoside Rh ₂	1.26±0.2505	1.89±0.2335 *	3.22±0.5823 **▲▲	2.80±0.4684 **▲▲	1.3 2
34	9.61	769.47 42	[M-H] ⁻	C ₄₁ H ₆₉ O ₁₃	Ginsenoside F ₃	15.14±0.6292	9.03±0.9341 **	14.22±0.616 5 *▲▲	2.82±0.4509 **▲▲##	1.3 0
35	6.30	931.51 67	[M-H] ⁻	C ₄₇ H ₈₀ O ₁₈	Notoginsenoside R ₁	0.00±0.0000	0.00±0.0000	8.60±1.0580 **▲▲	9.08±0.6017 **▲▲	1.0 1
36	16.73	299.25 85	[M-H] ⁻	C ₁₈ H ₃₆ O ₃	2-hydroxy stearic acid	6.05±1.0019	6.95±0.3305	9.68±1.1711* ▲▲	20.06±1.9757 ▲▲##	1.2 2
37	13.81	793.43 80	[M-H] ⁻	C ₄₂ H ₆₆ O ₁₄	Zingibroside R ₁	3.74±0.1188	6.34±0.5808 **	15.20±0.8661 **▲▲	5.66±0.4642 **##	1.0 9
38	9.71	423.36 22	[M+Na] ⁺	C ₂₈ H ₄₈ O	Campesterol	28.41±1.7261	25.80±0.4368 **	23.87±1.0348 **▲▲	7.43±0.3712 **▲▲##	1.3 7
39	11.68	425.37 78	[M+H] ⁺	C ₃₀ H ₄₈ O	β-Amyrone	7.09±0.9253	10.25±1.2522 **	3.74±0.8894 **▲▲	3.42±0.5915 **▲▲	1.3 5
40	3.85	97.101 5	[M-H ₂ O] ⁻	C ₇ H ₁₄ O	3-Methyl-3-hexen-2-ol	0.60±0.0677	1.42±0.1523 **	1.32±0.0802 **	4.33±0.4284 **▲▲##	1.3 4

41	3.95	147.04 43	[M+H] ⁺	C ₉ H ₆ O ₂	Coumarin	2.39±0.3046	2.23±0.0852	2.60±0.1680 ▲	3.40±0.2827 **▲▲##	1.4 1
42	10.01	169.08 61	[M-H ₂ O] ⁻	C ₉ H ₁₆ O ₄	Nonanedioic acid	1.79±0.2616	8.21±0.8379 **	9.70±1.1400 **	32.99±5.6423 **▲▲##	1.1 5
43	16.39	279.23 27	[M-H] ⁻	C ₁₈ H ₃₂ O ₂	Linoleic acid	272.83±13.177	215.53±10.587 **	141.28±8.685 **▲▲	309.71±9.273 **▲▲##	1.1 0
44	16.19	271.22 76	[M-H] ⁻	C ₁₆ H ₃₂ O ₃	2-Hydroxy hexadecanoic acid	122.91±6.2863	86.50±2.1905 **	94.16±3.8043 **▲▲	145.65±3.117 **▲▲##	1.0 9
45	5.49	162.07 64	[M+H] ⁺	C ₆ H ₁₁ NO ₄	2-Aminoadipate	0.21±0.0476	0.77±0.0928 **	0.83±0.1086 **	2.76±0.5879 **▲▲##	1.2 9
46	6.90	195.10 20	[M+H] ⁺	C ₁₁ H ₁₄ O ₃	Methoxyeugenol	2.27±0.4868	2.45±0.1419	2.42±0.2681	1.84±0.1113 *▲▲##	1.3 1

p*<0.05, *p*<0.01 compared to GG group.

▲*p*<0.05, ▲▲*p*<0.01 compared to 13-year-LXSS group.

#*p*<0.05, ##*p*<0.01 compared to 15-year-LXSS group.

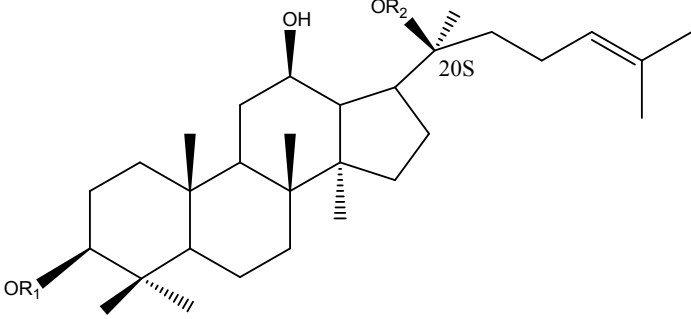
Table 3 Information of 34 standards compounds

NO.	R.T.(min)	Ion mode	m/z	Mean measured mass(Da)	Theoretical exact mass(Da)	Mass accuracy(ppm)	Fragments	Elemental composition	Identification results
1	3.47	[M+Na] ⁺	203.0537	203.0537	203.0532	2.5	C ₆ H ₁₁ O ₆ Na	C ₆ H ₁₁ O ₆	Fructose
2	0.77	[M-H] ⁻	179.0552	179.0552	179.0556	2.2	C ₆ H ₉ O ₅	C ₆ H ₁₂ O ₆	Myo-Inositol
3	5.35	[M+Na] ⁺	365.1059	365.1059	365.1060	0.3	C ₁₂ H ₂₁ O ₁₁	C ₁₂ H ₂₂ O ₁₁ N a	Maltose
4	5.78	[M+H] ⁺	343.1247	343.1247	343.1240	2.0	-	C ₁₂ H ₂₂ O ₁₁	Melibiose
5	5.15	[M+H] ⁺	343.1239	343.1239	343.1240	0.3	-	C ₁₂ H ₂₂ O ₁₁	Sucrose
6	0.90	[M-H] ⁻	665.2125	665.2125	665.2140	2.3	-	C ₂₄ H ₄₂ O ₂₁	Stachyose
7	0.82	[M-H] ⁻	193.0343	193.0343	193.0348	2.6	C ₆ H ₇ O ₆	C ₆ H ₉ O ₇	Glucuronic acid
8	0.89	[M-H] ⁻	503.1605	503.1605	503.1612	1.4	-	C ₁₈ H ₃₂ O ₁₆	Raffinose
9	0.89	[M-H] ⁻	133.0135	133.0135	133.0137	1.5	C ₄ H ₄ O ₄	C ₄ H ₆ O ₅	Malic acid
10	2.07	[M-H] ⁻	115.0020	115.0020	115.0031	9.6	-	C ₄ H ₄ O ₄	Fumaric acid
11	1.80	[M-H] ⁻	191.0191	191.0191	191.0192	0.5	C ₅ H ₃ O ₃	C ₆ H ₈ O ₇	Citric acid
12	2.39	[M-H] ⁻	117.0184	117.0184	117.0188	3.4	C ₃ H ₅ O ₂	C ₄ H ₆ O ₄	Succinic acid
13	4.16	[M+H] ⁺	205.0931	205.0931	205.0977	22.3	C ₁₁ H ₁₀ NO ₂	C ₁₁ H ₁₂ N ₂ O ₂	Tryptophan

14	0.82	[M+H] ⁺	104.0747	104.0747	104.0712	33.3	C ₄ H ₇ O ₂	C ₄ H ₁₀ NO ₂	Gamma-Aminobutyric acid
15	2.07	[M-H] ⁻	128.0344	128.0344	128.0348	3.1	C ₄ H ₄ NO	C ₅ H ₇ NO ₃	Pyroglutamic acid
16	0.76	[M-H] ⁻	175.0351	175.0351	175.0355	2.3	C ₅ H ₅ N ₂ O ₄	C ₅ H ₇ N ₂ O ₅	Dencichine
17	4.11	[M+H] ⁺	118.0866	118.0866	118.0868	1.7	C ₄ H ₁₀ N	C ₅ H ₁₃ NO ₂	Valine
18	0.88	[M+H] ⁺	116.0711	116.0711	116.0712	0.9	C ₄ H ₈ N	C ₅ H ₁₁ NO ₂	Proline
19	6.13	[M+H] ⁺	147.1131	147.1131	147.1134	2.0	C ₆ H ₁₂ NO ₂	C ₆ H ₁₄ N ₂ O ₂	Lysine
20	0.81	[M-H] ⁻	88.0393	88.0393	88.0399	6.9	-	C ₃ H ₇ NO ₂	Alanine
21	5.32	[M+H] ⁺	134.0455	133.0609	133.0613	3.0	C ₄ H ₆ NO ₃	C ₄ H ₈ N ₂ O ₃	Aspartic acid
22	9.71	[M-H] ⁻	1239.6373	1239.6373	1239.6374	0.1	-	C ₅₉ H ₁₀₀ O ₂₇	Ginsenoside Ra ₃
23	9.79	[M-H] ⁻	1107.5965	1107.5965	1107.5951	1.3	C ₄₈ H ₈₀ O ₁₈	C ₅₄ H ₉₂ O ₂₃	Ginsenoside Rb ₁
24	10.12	[M-H] ⁻	1077.5852	1077.5852	1077.5845	0.7	C ₄₈ H ₈₁ O ₁₈	C ₅₃ H ₉₀ O ₂₂	Ginsenoside Rc
25	11.26	[M-H] ⁻	945.5428	945.5428	945.5423	0.5	C ₄₂ H ₇₁ O ₁₃	C ₄₈ H ₈₂ O ₁₈	Ginsenoside Rd
26	6.69	[M-H] ⁻	945.5437	945.5437	945.5423	1.5	C ₄₂ H ₇₁ O ₁₃	C ₄₈ H ₈₂ O ₁₈	Ginsenoside Re
27	9.18	[M-H] ⁻	799.4848	799.4848	799.4844	0.5	-	C ₄₂ H ₇₂ O ₁₄	Ginsenoside Rf
28	6.74	[M-HCOOH] ⁻	845.4907	845.4907	845.4899	0.9	-	C ₄₂ H ₇₂ O ₁₄	Ginsenoside Rg ₁
29	9.28	[M+Na] ⁺	823.4811	823.4811	823.4820	1.1	C ₄₂ H ₇₂ O ₁₄ Na	C ₄₂ H ₇₂ O ₁₄	Pseudo-ginsenoside F ₁₁
30	14.54	[M-HCOOH] ⁻	829.4958	829.4956	829.4949	0.8	C ₄₂ H ₇₁ O ₁₃	C ₄₃ H ₇₃ O ₁₅	Ginsenoside 20(S)Rg3

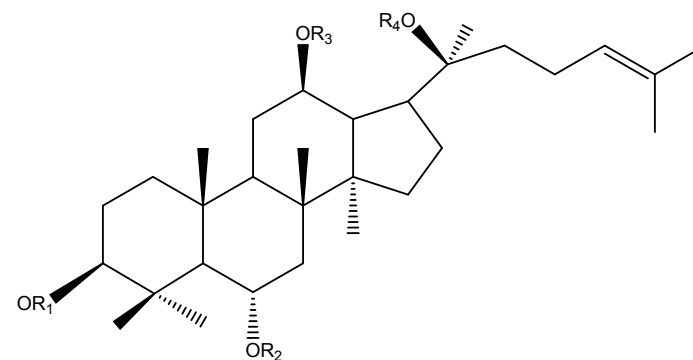
31	10.20	[M-HCOOH] ⁻	683.4367	683.4367	683.4370	0.4	C ₃₆ H ₆₂ O ₉	C ₃₇ H ₆₄ O ₁₁	Ginsenoside Rh ₁
32	11.21	[M-HCOOH] ⁻	683.4371	683.4371	683.4370	0.1	-	C ₃₇ H ₆₃ O ₁₁	Ginsenoside 20(S)F ₁
33	15.50	[M-HCOOH] ⁻	667.4421	667.4421	667.4421	0.0	-	C ₃₈ H ₆₂ O ₁₂	Ginsenoside Rh ₂
34	9.61	[M-H] ⁻	769.4742	769.4742	769.4738	0.5	C ₃₆ H ₆₁ O ₉	C ₄₁ H ₆₉ O ₁₃	Ginsenoside F ₃

Table 4 Molecular structure of ginsenosides

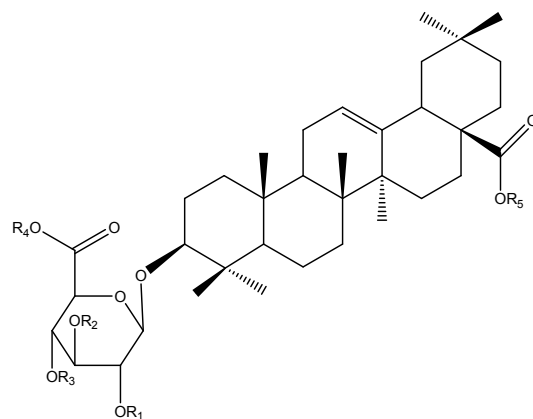
NO	Protopanaxadiol-type ginsenosides			
	Ginsenosides		R ₁	R ₂
1	Ginsenoside Ra ₃		-Glc2-1Glc	Glc6-1Glc3-1Xyl
2	Ginsenoside Rb ₁		-Glc2-1Glc	-Glc6-1Glc
3	Ginsenoside Rc		-Glc2-1Glc	-Glc6-1Ara(f)
4	Ginsenoside Rd		-Glc2-1Glc	-Glc

5	Ginsenoside 20(S)-Rg ₃	-Glc2-1Glc	-H
6	Ginsenoside Rh ₂	-Glc	-H

Protopanaxatriol-type ginsenosides



	ginsenoside	R ₁	R ₂	R ₃	R ₄
7	Ginsenoside Re	-H	-Glc2-1Rha	-H	-Glc
8	Ginsenoside F ₁	-H	-H	-H	-Glc
9	Ginsenoside F ₃	-H	-H	-H	-Glc6-1Ara(p)
10	Ginsenoside Rf	-H	-Glc2-1Glc	-H	-H
11	Ginsenoside Rg ₁	-H	-Glc	-H	-Glc
12	Ginsenoside 20(S)-Rh ₁	-H	-Glc	-H	-H
13	Notoginsenoside R ₁	-H	-Glc2-1Xyl	-H	-Glc



ginsenoside

R₁

R₂

R₃

R₄

R₅

14

Zingibroside R₁

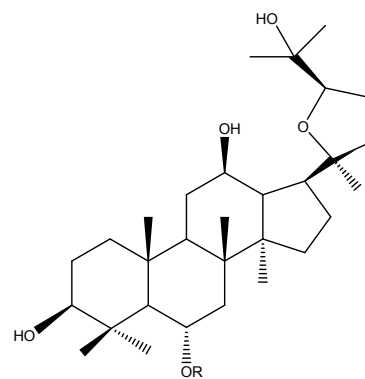
-Glc

-H

-H

-H

-H



Ginsenoside

R

15

Pseudo-ginsenoside F₁₁

-Glc2-1Rha

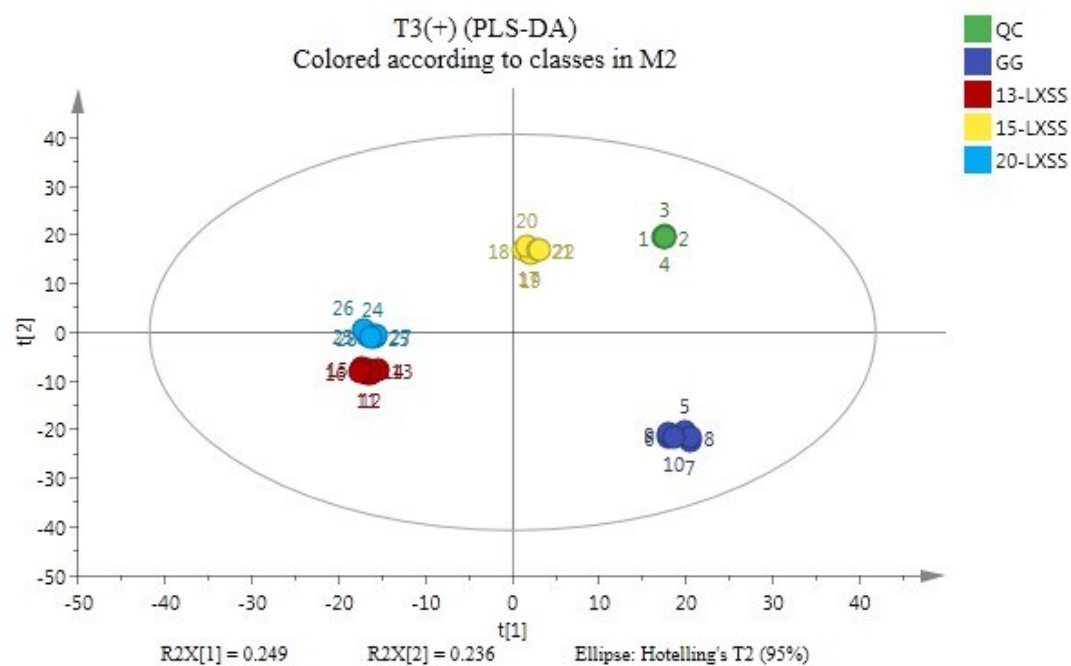


Figure 1

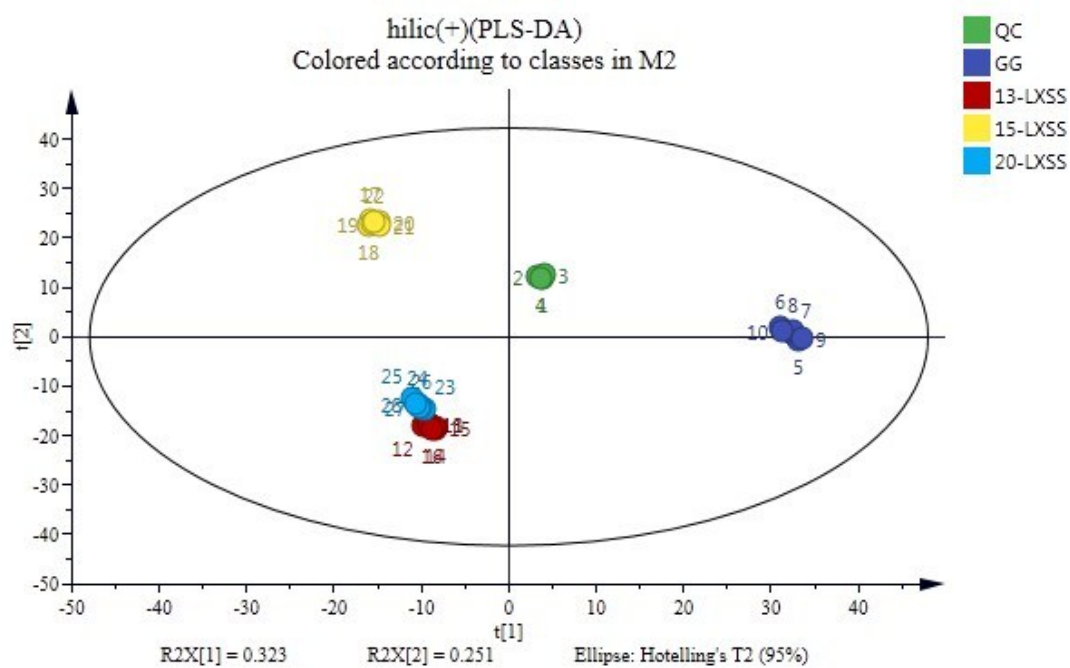


Figure 2

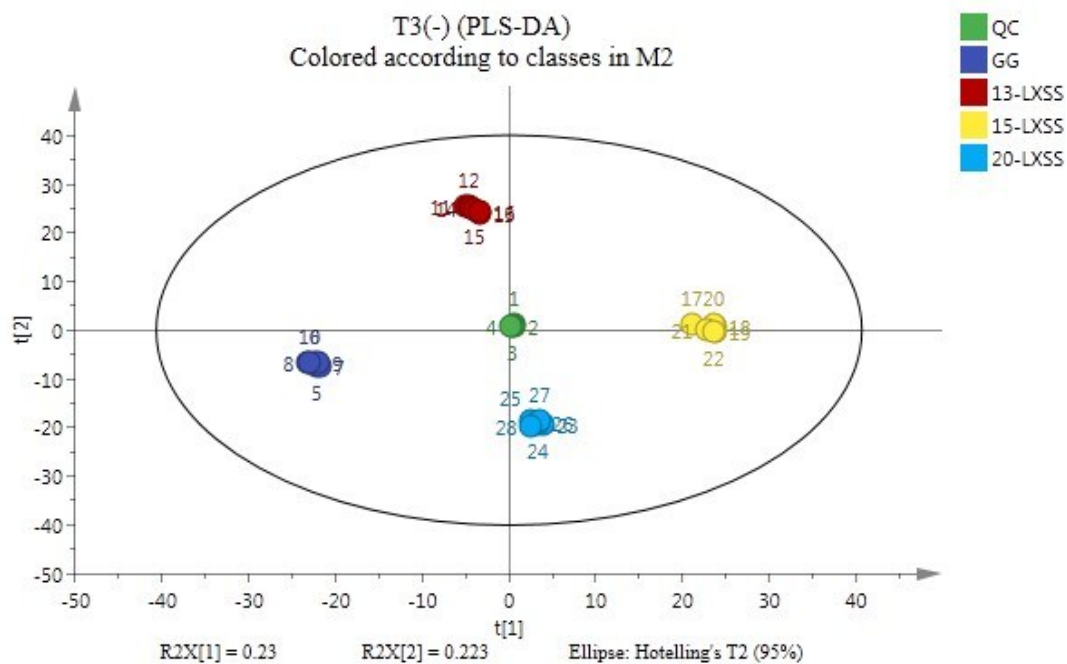


Figure 3

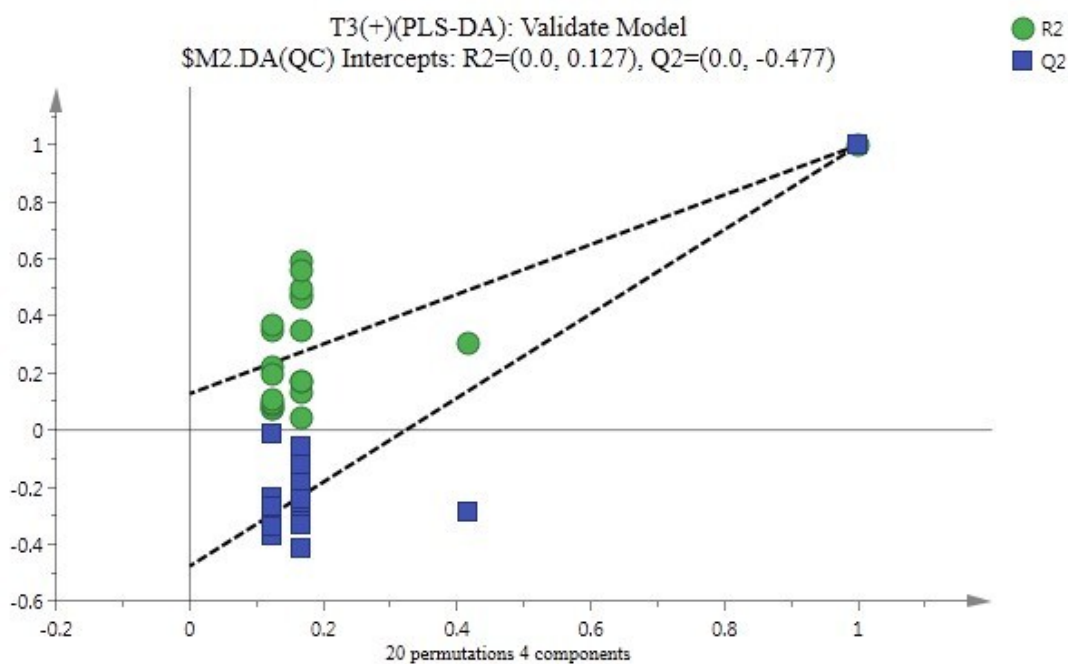


Figure 4

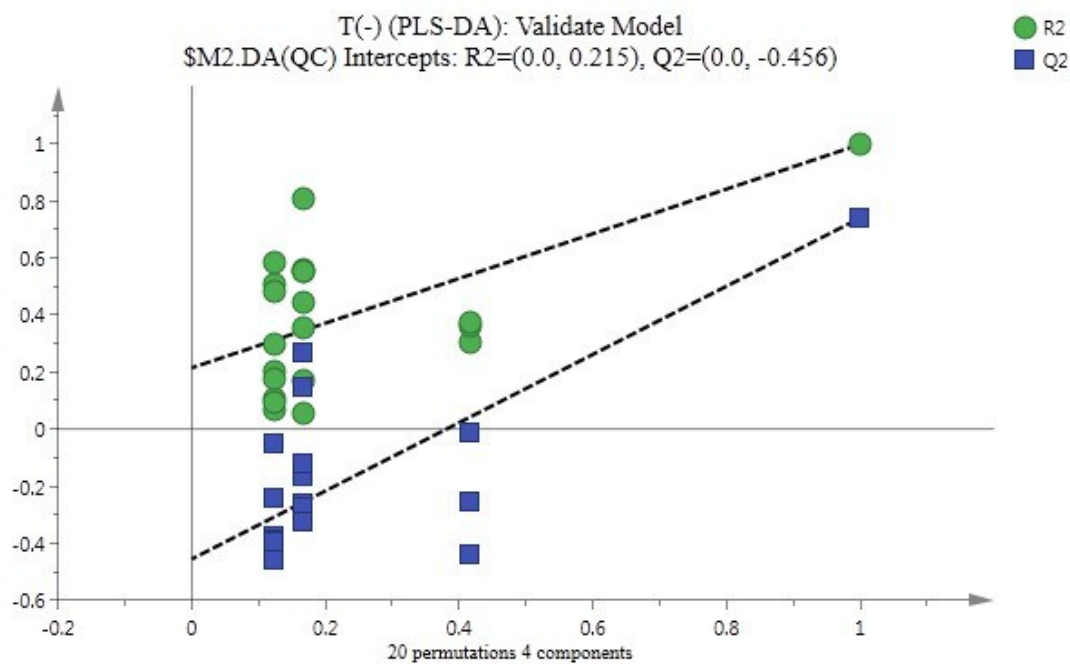


Figure 5

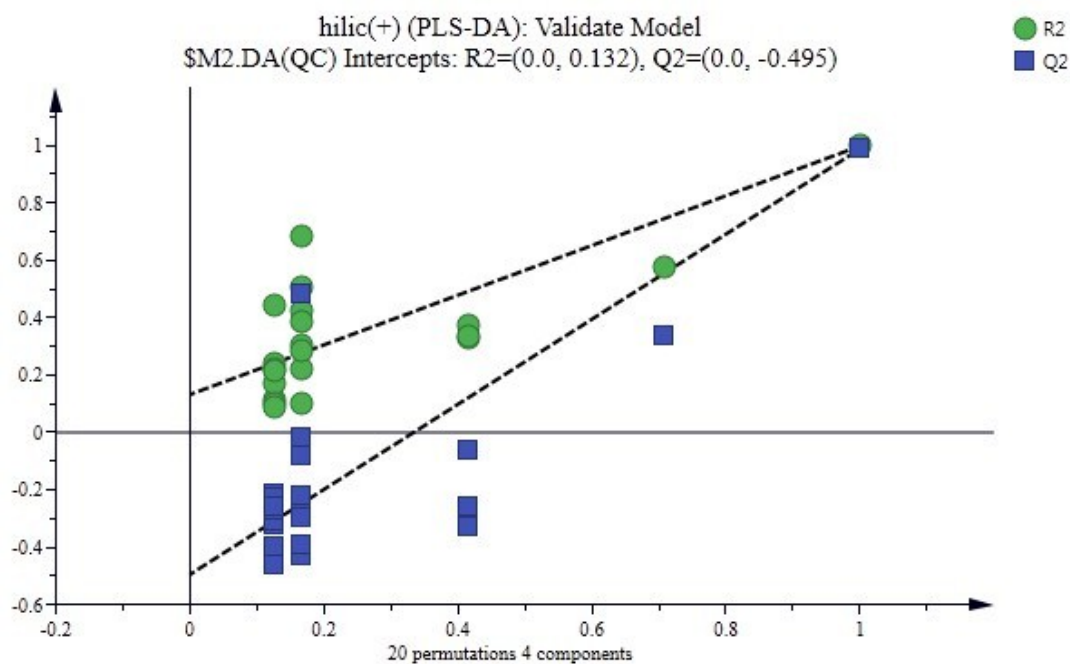


Figure 6