Table 1. Characterization of chemical constituents of GHB by UPLC-ESI-Q-TOF-MS.

No.	Rt	Molecular formula	Detected $[M+H]^+$/ $[M-H]^-$	Expected $[M+H]^+$/ $[M-H]^-$	Error /ppm	MS/MS (m/z)	Identification
1*	0.83	$C_{19}H_{18}O_6$	341.11012	341.1025	-3.8	387[M+HCOOH]- 341[M-H]- 179[C9H8O4-H]- 161[C10H10O2-H]- 119[C9H8O4-2OCH2-H]-	Tetramethyl-O-scutellarin
2	1.37	$C_{11}H_{18}NO$	180.1385	180.1388	-1.7	180[M+H]+ 121[M-C3H10N]+	N-candicine
3*	1.64	$C_{13}H_{16}O_{10}$	331.0676	331.0665	3.3	331[M-H]- 313[M-H-H2O]- 168[M-H-GLc]- 149[M-H-H2O-H]- 125[M-C7H4O5-2H2O]-	b-Glucogallin
4*	1.84	$C_{23}H_{30}O_{14}$	529.1561	529.1557	0.8	529[M-H]- 355[M-H-C7H10O5]- 193[M-H-C7H10O5-Glc]- 178[M-H-C7H10O5-Glc-CH3]- 149[M-H-GLU- C8H10O7]- 134[M-H-GLU-C8H10O7-CH3]-	3-({3-[4-(β-Glucopyranosyloxy)-3-methoxyphenyl]-2-propenoyl}oxy)-1,4,5-trihydroxycyclohexanecarboxylic acid
5	2.10	$C_{15}H_{20}O_{10}$	359			197,182,123	Unknown
6	2.23	$C_{26}H_{30}O_{12}$	533.1617	533.1600	3.2		Amurensin
7*	2.28	$C_{23}H_{30}O_{14}$	529.1550	529.1557	1.3	529[M-H]- 367[M-H-Glc]- 191[M-H-Glc-C10H8O3]- 173[M-H- Glc-C10H8O4]- 134[M-H-Glc -CH3-C8H10O7]- 111[M-H-Glc -C10H9O4-CO2-OH]-	3-O-feruloylquinic acid
8*	2.50	$C_{16}H_{18}O_9$	353.0884	353.0873	3.1	191[M-C9H6O3]-	Neochlorogenic acid
9*	2.86	$C_{19}H_{28}O_{11}$	431.1537	431.1553	-3.7	299[M-H-C5H8O4]- 191[M-H-C5H8O4-C7H8O]- 149[M-H-Glc-C8H8O]- 101[M-H-C8H8O-OCH3-C6H12O6]-	2-(p-hydroxyphenyl) ethanol 1-O-β-D-glucoside

10	3.52	$C_{19}H_{24}NO_3$	314.1760	314,1756	1.3	298[M-CH3]+ 269.1[M-3CH3] 237.0[M-OCH3-OH-2CH3]+ 192[M-CH3-C7H6O]+ 175[M-CH3-C7H6O-OH]+	(--Oblongine
11*	3.53	$C_{16}H_{18}O_9$	353.0873	353.0873	0	191[M-C9H6O3]-	Chlorogenic acid
12*	3.80	$C_{17}H_{20}O_9$	367.1043	367.1029	3.8	191[M-H-C10H8O3]- 173[M-H-C10H11O4]- 149[M-44]+ 134[M-H-CH3-C8H10O7]- 117[M-H-CH3-C8H10O7-CH3]- 111[M-H-C10H9O4-CO2-OH]-	3-O-feruloylquinic acid
13	4.16	$C_{20}H_{24}NO_4$	342.1695	342.1705	-2.9	311[M- CH3NH2-]+ 297[M-OCH2-CH3]+ 282[M-OCH2-CH3-CH3]+ 265[M-OCH2-CH3-CH3-OH]+ 237[M-OCH2-CH3-CH3-OH -CO]+ 192[M-C9H1102]+ 177[M-C9H11O2-CH3]+ 149[M-C11H13NO2]+	Phellodendrine
14	4.25	$C_{23}H_{29}NO_8$	448.1954	448.1971	-3.8	448[M+H]+ 434[M+H-CH2]+ 286[M+H-Glc]+ 262[M-]	(p-hydroxybenzyl)-6, 7-dihydroxy-N-m ethyltetrahydro iso-quinoline-7-O-p--D-glucopyranoside
15	4.53	$C_{20}H_{26}NO_4$	344.1864	344.1862	0.6	299[M-N(CH3)2]+ 235[M-N(CH3)2CH2-CH3-OCH3]+ 207[M-C8H9O2]+ 175[M-C8H9O2-CH3-CH3]+ 137[M-C12H17NO2]+	Tembetarine
16	4.63	$C_{16}H_{20}NO_3$	274.1415	274.1443	2.9	256[M-H2O]+ 226[M-H2O-2CH3]+ 202[M-OCH3-C2H4]+ 172[M-OCH3-C2H4-OCH3]+ 144[M-OCH3-C2H4-OCH3-CO]+	unknown
16	4.69	$C_{19}H_{22}NO_4$	328.1902	328.1913	2.1	312[M-OCH3+H]+ 297[M-OCH3+H-CH3]+	Unknown

		$C_{20}H_{26}NO_3$				265[M-OCH3+H-CH4-OCH3]+ 150[C9H11O2+H]+ 121[C9H11O-CH2]+	
17	4.76	$C_{20}H_{24}NO_4$	342.1710	342.1705	1.5	297.1[M-(CH3)2NH]+ 265.0[M-(CH3)2NH-CH3OH]+ 192[M-(CH3)2NH-CH3OH-CO-C2H4]+	Magnoflorine
18*	4.87	$C_{16}H_{20}O_{10}$	371.0961	371.0978	-4.6	295[] 195[] 177[] 134[]	unknown
19*	5.36	$C_{17}H_{20}O_9$	367.1017	367. 9	-3.3	367[M-H]- 191[M-H-(GLU-H2O)]- 173[M-H-C10H8O3-H2O]- 134[M-H-CH3-C8H10O7]- 111[M-H-C10H9O4-CO2-OH]- 109[M-H-CO2-OH-C10H13O4]-	3-O-feruloylquinic acid
20	5.41	$C_{20}H_{24}NO_4$	342.1714	342.1710	1.2	314[M-C2H4]+ 297[M-C2H4-CH4-H]+ 269 M-C2H4-CH4-H-CHO]+ 150[M-C11H13NO2]+ 135[M-C11H13NO2-CH3]+	Tetrahydrojatrorrhizine
21*	5.60	$C_{28}H_{38}O_{13}$	581.2225	581.2234	-1.5	419[M-H-Glc]- 404[M-H-Glc-CH3]- 389[M-H-Glc-2CH3]- 373[M-H-Glc-CH3-CH2OH]-	(±)-5，5’-dimethoxylaricire-sinol-4-O-glucoside
22	5.75	$C_{19}H_{23}NO_3$	314.1747	314.1756	-2.9	299[M-CH3]+ 269.12[M-N(CH3)2]+ 237.09[M-N(CH3)2CH2-OH]+ 192[M-CH3-C7H8O]+ 143.0[M-C9H18NO2]+ 107[M-C12H18NO2]+	Lotusine
23*	6.10	$C_{17}H_{22}O_{10}$	385.1137	385.1135	0.5	209[M-H-(GLU-H2O)]- 193[M-H-Glu-OH]- 134[M-H-CH3-C8H10O7-H2O]	3-hydroxyl feruloylquinic acid
24	6.40	$C_{21}H_{25}NO_4$	356.1863	356.1862	0.3	311[M-C2H7N]+ 296[M-4CH3]+	Menisperine

						279[M-C2H7N-OCH3]+ 191.1[M-C10H13O2]+ 178.0[M- C10H13O2-CH3]+ 165.0[M- C10H13O2-2CH3+]	
25*	6.68	$C_{27}H_{36}O_{13}$	567.2062	567.2078	-2.8	567[M-H+HCOOH]- 521[M-H]- 341[M-H-Glc-H2O]- 329[M -Glc-OCH3]- 162[Glu]-	(+/-)8-(4-Hydroxy-3-methoxyphenyl)-6,7-bis(hydroxymethyl)-3-methoxy-5,6,7,8-tetrahydro-2-naphthalenyl β-D-glucopyranoside
26	6.81	$C_{20}H_{26}NO_3$	328.1917	328.1913	1.2	283[M-N(CH3)2]+ 269[M-N(CH3)2CH2]+ 254[M-N(CH3)2CH2-CH3]+ 206[M-CH3-C7H6O]+	Armepavine
27	6.96	$C_{17}H_{21}NO_4$	304.1542	304.1549	-2.3	286[M-H2O]+ 256[M-OCH3-CH3]+ 232[M-OCH3-C3H5]"+ 201[M-H2O-OCH3-CH3-C3H5]+	Dasycarpamin
28*	7.33	$C_{21}H_{20}O_{12}$	463.0898	463.0877	4.5	463[M-H]- 435[M-H-H2O]- 300[M-H-(Gal-H2O)]- 162[Gal-H2O]-	Hyperin
29	7.60	$C_{21}H_{26}NO_4$	356.1866	356.1862	1.1	192[M-C9H1102]+ 177[M-C9H11O2-CH3]+ 149[M-C11H13NO2]+	N-Methyltetrahydrocolumbamine
30	8.06	$C_{20}H_{17}NO_5$	352.1186	352.1185	0.3	352[M+H]+ 336[M+H-CH3]+ 322[M+H-2CH3]+ 320[M+H-CH4O]+ 308[M+H-CH4O-CH3]+ 294[M+H-CH4O-2CH3]+ 290[M+H-CH2O2-CH3]+ 276[M+H-CH2O2-2CH3]+	Oxyberberine
31	8.15	$C_{21}H_{21}NO_5$	368.1506	368.1498	2.2	368[M+H]+ 352[M+H-O]+ 336[M+H-O-CH4]+ 324[M+H-CO-CH4]+	Oxypalmatine

						308[M+H-O-CH4-CO]+ 294[M+H-O-CH4-CO-CH2]+	
33*	8.91		428			311[M-OH]- 209[] 187[] 125[]	Unknown
34	9.35	$C_{22}H_{28}NO_4$	370.2000	370.2018	-4.9	338[M-2CH3]+ 237[M-2CH3-C5H9O2]+ 206[M-CH3-C9H7O2]+ 190[M-CH3-C9H7O2-CH3]+	1,2,9,10-Tetramethoxy-6,6-dimethyl-5,6,6a,7-tetrahydro-4H-dibenzo[de,g]quinolinium
35	9.49	$C_{20}H_{20}NO_4$	338.1381	338.1392	-3.3	323[M-CH3]+ 322[M –CH4]+ 308[M-2CH3]+ 307[M -2CH3-H]+ 294[MCH4-CO]+ 280[M-2CH3-CO]+ 279[MCH4-CO-CH3]+ 265[M-2CH3-CO-CH3]+ 237[M-2CH3-CO-CH3-CO]+	Jatrorrhizine
36*	10.11	$C_{26}H_{30}O_{11}$	517.1687	517.1710	-4.4		Phellamurin
37	10.16	$C_{21}H_{24}NO_4$	354.1704	354.1705	-0.3	340[M-CH3]+ 322[M-2CH3]+ 190[M-C10H13O2]+	N-Methyl canadine
38	10.82	$C_{21}H_{22}NO_4$	352.1547	352.1549	-0.6	337[M-CH3]+ 336.1[M-CH4]+ 320[M-CH4-CH4]+ 308[M-CH4-CO]+ 292[M-4CH3]+ 278[M-CH4-CO-2CH3]+ 254[M-4CH3-CO]+	Palmatine
39	11.06	$C_{20}H_{18}NO_4$	336.1228	336.1236	-2.4	321[M-CH3]+ 320[M-CH4]+ 306[M- CH4-CH3]+ 292[M-CH4-CO]+ 278[M-2CH3-CO]+ 276[M-CH4-CO-CH4]+	Berberine

40*	11.73	$C_{19}H_{34}O_{15}$	501.1766	501.1761	1.0	457[M-CO2]- 413[M-2CO2]- 395[M-2CO2-H20]- 371[M-2CO2-H20-CH3]	γ-hydroxybutenolide deniatives □
41*	12.32	$C_{26}H_{32}O_8$	471.2009	471.2019	-2.1	368[M-H-H2O-CO-CH2O2]- 356[M-H-H2O-CO-C2H2O2]- 338[M-H-H2O-CO-C2H2O2-H2O]- 331[]- 312[M-H-CO-H2O-C11H16O4]-	Obacunoic acid
42*	12.71	$C_{18}H_{34}O_5$	329.2319	329.2318	-2.7	311[M-H-HO]- 293[M-H-2HO]- 229[M-H-HO-C6H10O]- 211[M-H-CO2-(CH2)4CH3]- 171[M-H-OH-(CH2)8CH3OH]-	Sanleng acid
43*	13.06	$C_{26}H_{30}O_9$	485.1793	485.1812	-3.9	485[M-H]- 467[M-H-H2O]- 423[M-H-H2O-CO2]- 411[M-H-H2O-C2O2]-	Rutaevin
44	13.33	$C_{26}H_{30}O_8$	471.2012	471.2019	-1.5	453[M+H-H20]+ 425[M+H-CO-H2O]+ 367[M+H-H2O-CO-CH2O2]+ 312[M+H-CO-H2O-C11H16O4]+	Obaculactone
45	13.65	$C_{21}H_{22}NO_4$	352.1194	352.1185	2.6	337[M-CH3]+ 258[M-CH3-OCH3-CH4O2]+	Thalphenine
46	13.83	$C_{26}H_{30}O_7$	455.2073	455.2070	0.7	437[M-H2O]+ 411.0[M-CO-O]+ 409[M-CO-H2O] 359.1[M+H-C4H3O-CO]+	Obacunone

Table2. MS and MS/MS data of the identified components in rat plasma after oral administration of GHB in both positive and negative mode.

Peak	Name	Primary ID	VIP[2]	$[M+H]^+/[M-H]^-$	Theoretical value	ppm	Fragment	Molecular formula
1	M1	0.96_474.1682	4.0897	474.1743	474.1764	4.4	298[M-(GluA-H2O)]+ 283[M-(GluA-H2O)-CH3]+ 268[M-(GluA-H2O)-CH3-CH3]+ 254[M-(GluA-H2O)-(CH3)2NH]+	$C_{24}H_{28}NO_9$
2	M2	2.34_474.1743	1.5418	474.1772	474.1764	1.7	298[M-(GluA-H2O)]+ 283[M-(GluA-H2O)-CH3]+ 268[M-(GluA-H2O)-CH3-CH3]+ 254[M-(GluA-H2O)-(CH3)2NH]+	$C_{24}H_{28}NO_9$
3	M3	2.51_518.2046	2.7167	518.2022	518.2026	-0.8	190[]+ 518[M]+ 342[M-(GluA-H2O)]+ 192[M-(GluA-H2O)-C9H1102]+ 177[M-(GluA-H2O)-C9H1102-CH3]+	$C_{23}H_{32}NO_{10}$
4	Phellodendrine	3.52_342.1647	0.6646	342.1689	342.1705	-4.7	297[M-OCH3-CH3]+ 265[M-OCH3-CH4-OCH3]+ 192[M-C9H1102]+ 177[M-C9H11O2-CH3]+ 149[M-C11H13NO2]+	$C_{20}H_{24}NO_4$
5	M4	3.62_384.1284	1.5689	384.1471	384.1447	6.2	384[M]+	$C_{17}H_{22}NO_9$

6	Magnoflorine	3.97_342.1659	3.4882	342.1702	342.1705	-0.9	208[M-(GluA-H2O)]+ 297.1[M-(CH3)2NH]+ 265.0[M-(CH3)2NH-CH3OH]+ 192[M-(CH3)2NH-CH3OH-CO-C2H4]+	$C_{20}H_{24}NO_4$
7	M5	4.02_532.2194	1.3065	532.2181	532.2183	-0.4	532[M+H]+ 356[M+H-(GluA-H2O)]+ 191[M-H-C10H8O3]- 173[M-H-C10H11O4]-	$C_{27}H_{33}NO_{10}$
8*	3-O-feruloylquinic acid	4.52_367.1019	1.0293	367.1024	367.1029	-1.4	134[M-H-CH3-C8H10O7]- 111[M-H-C10H9O4-CO2-OH]- 109[M-H-CO2-OH-C10H13O4]-	$C_{17}H_{20}O_9$
9	M6	4.75_500.1487	4.4879	500.1534	500.1557	-4.6	500[M]+ 324[M-(GluA-H2O)]+ 309[M-(GluA-H2O)-CH3]+ 294[M-(GluA-H2O)-CH3]+,	$C_{25}H_{26}NO_{11}$
10	M7	4.91_514.1715	1.7527	514.1694	514.1713	-3.7	280[M-(GluA-H2O)-CH4-CO2]+ 514[M]+ 338[M-(GluA-H2O)]+ 323[M-(GluA-H2O)-CH3]+ 322[M-(GluA-H2O)-CH4]+ 294[M-(GluA-H2O)-CO3-OCH3]	$C_{26}H_{28}NO_{10}$
11	Menisperine	5.49_356.1824	0.6688	356.1863	356.1862	0.3	311[M-C2H7N]+ 296[M-4CH3]+	$C_{21}H_{25}NO_4$

12	Tetrahydropalmatine	7.09_356.1851	1.0901	356.1859	356.1862	-0.8	279[M-C2H7N-OCH3]+ 191.1[M-C10H13O2]+ 178.0[M- C10H13O2-CH3]+ 165.0[M- C10H13O2-2CH3+] 192[M-C9H1102]+ 177[M-C9H11O2-CH3]+	$C_{21}H_{26}NO_4$
13	M8	8.13_592.1117	1.5059	592.1121	592.1125	-0.7	592[M]+ 416[M-(GluA-H2O)]+ 336[M-(GluA-H2O)-SO3]+	$C_{26}H_{26}NO_{13}S$
14	M9	8.25_370.1295	1.6244	370.1286	370.1291	-1.4	370[M]+ 352[M-H20]+ 336[M-H2O-CH3]+ 320[M-H2O-CH3-CH4]+ 308[M-H2O -CH3-CO]+ 292[M-H2O-CH3-CH4-CO]+	$C_{20}H_{20}NO_6$
15	M10	8.61_354.0962	1.3754	354.0962	354.0978	-4.5	354[M]+ 336[M-H2O]+ 320[M-H2O -CH4]+ 308[M-H2O -CH3-CO]+ 292[M-H2O -CH3-CO-CH4]+	$C_{19}H_{16}NO_6$
16	M11	8.88-530.1706	0.8325	530.1686	530.1662	4.5	530[M]+ 354[M-(GluA-H2O)]+	$C_{26}H_{28}NO_{11}$
17	Palmatine	9.64_352.1524	2.2561	352.1549	352.1549	0	336.1[M-CH3]+	$C_{21}H_{22}NO_4$

18	Berberine	9.86_336.1189	3.658	336.1239	336.1229	3.0	320[M-CH3-CH4]+ 308[M-CH3-CO]+ 292[M-CH3-CO-CH4]+ 321[M-CH3]+ 320[M-CH4]+ 306[M- CH4-CH3]+ 292[M-CH4-CO]+	$C_{20}H_{18}NO_4$
19*	prototype	10.53_501.1769	0.9563	501.1766	501.1761	1.0	457[M-CO2]- 413[M-2CO2]- 395[M-2CO2-H20]- 371[M-2CO2-H20-CH3]- 311[M-H-HO]- 293[M-H-2HO]-	$C_{19}H_{34}O_{15}$
20*	sanleng acid	12.16_329.2313	1.4103	329.2313	329.2328	-4.6	229[M-H-HO-C6H10O]- 211[M-H-CO2-(CH2)4CH3]- 171[M-H-OH-(CH2)8CH3OH]-	$C_{18}H_{34}O_5$
21*	Rutaevin	12.92_485.1821	0.9810	485.1822	485.1812	2.1	485[M-H]- 467[M-H-H2O]- 423[M-H-H2O-CO2]- 411[M-H-H2O-C2O2]-	$C_{26}H_{30}O_9$
22	Obaculactone	13.56_471.1963	3.9406	471.2021	471.2019	0.4	453[M-H20]+ 425[M-CO-H2O]+ 367[M-H2O-CO-CH2O2]+	$C_{26}H_{30}O_8$

23	M12	13.75_473.2182	1.9243	473.2174	473.2175	-0.2	312[M-CO-H2O-C11H16O4]+ 473[M+H]+ 455[M+H-H2O]+ 427[M+H-CO-H2O]+ 368[M+H-CO-H2O-CHO2]+ 437[M-H2O]+	$C_{26}H_{32}O_8$
24	Obacunone	14.97_455.2041	2.1673	455.2050	455.2070	-4.4	411.0[M-CO-O]+ 409[M-CO-H2O] 359.1[M+H-C4H3O-CO]+	$C_{26}H_{30}O_7$