Jiaogulan tea (*Gpostemma pentaphyllum*) potentiates the antidiabetic effect of white tea via AMPK and PI3K pathway in C57BL/6 mice

Xiaoyan Xia [a], Jing Xu [a], Xude Wang [a], Hua Wang [a], Zhenchuan Lin [b], Keping Shao [b], LinLin Fang [c, *], Chenning Zhang [d, *], and Yuqing Zhao [a, e, *]

[a] School of Functional Food and Wine, Shenyang Pharmaceutical University, Shenyang 110016, China
[b] Pinpin Tea Industry Co., Ltd., Fujian, 355200, China
[c] College of Pharmacy, Dalian Medical University, Dalian, 116044, Liaoning Province, China
[d] Taihe hospital, Hubei University of Medicine, Shiyan, 442000, China
[e] Key Laboratory of Structure-Based Drug Design and Discovery of Ministry of Education, Shenyang Pharmaceutical University, Shenyang 110016, China

*** Corresponding authors:**
Yuqing Zhao: Tel: +86 24 43520309, Fax: +86 24 435230300; E-mail: zyq4885@126.com
Chenning Zhang: Tel: +86 0719 8876611; E-mail: ZhangCN1118@163.com
Linlin Fang: Tel: +86 0411 86110417; E-mail: fanglinlin880616@163.com

Supplementary data

Chemical Analysis by UPLC-Q-Exactive MS

The chemical analysis of white tea and Jiaogulan was performed on an UPLC-Q-Exactive-MS system. The chromatographic analysis was carried out using an UltiMate 3000 UPLC system (Thermo Fisher Scientific, USA). The samples were separated on a Hypersil Gold C_{18} column (Thermo, 100 × 2.1 mm, 1.9 μm) at a flow rate of 0.3 mL/min and the column temperature was maintained at 40 °C. A solution of mobile phase 5 % acetonitrile and 0.1% formic acid in water (A) and 0.1% formic acid in acetonitrile (B) were employed. 10 μL of samples were injected into the system with automatic injector and separated employing a gradient elution (0-2.0 min: 0-20% B; 2.0-9.5 min:20-100% B; 9.5-15.5 min: 100% B; 15.5-15.6 min: 100-0% B; 15.6-18 min: 0% B). The automatic injector was set at 4 °C. The UPLC system was coupled to a Thermo Q-Exactive mass spectrometer (Thermo Fisher Scientific, USA). The mass spectrometry determination was operated in both positive (+) and negative (-) ionization modes. The optimal ESI source conditions were set as follows: source heater temperature (300 °C), sheath gas flow rate (45 arb), auxiliary gas flow rate (15 arb), sweep gas flow rate (1arb), capillary temperature (350 °C). The above parameters were the same in the two modes. The (S)-Lens RF Level was 30% in positive mode and 60% in negative mode. The spray voltage was set at 3.0 kV in ESI^+ mode and 3.2 kV in ESI^- mode. The full scan and fragment spectra were collected over m/z 70-1050 at a resolution of 70, 000 (in full scan MS^1) and 17,500 (data-dependent (dd) mass ranges in MS^2), respectively. MS^2 experiments were performed by high-energy collision-induced dissociation (HCD) at collision energy of 15, 30 and 45 V.

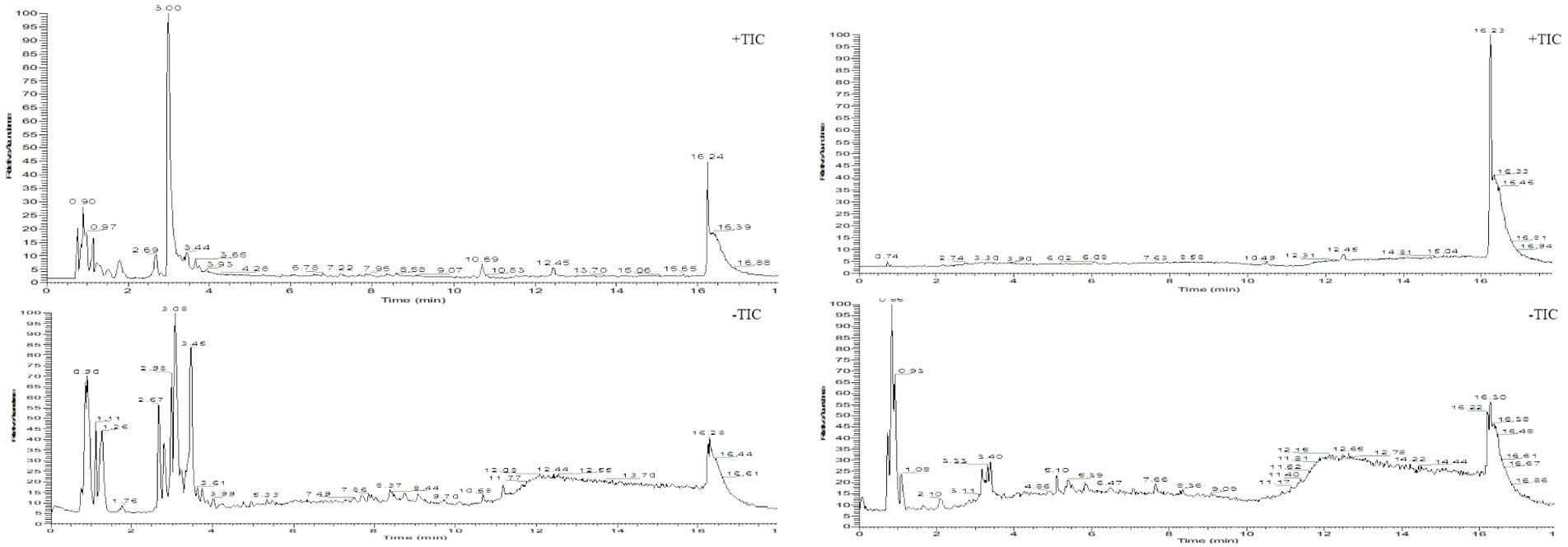

Figure S1. The total ion chromatogram (TIC) of the white tea and Jiaogulan. (A) TIC of white tea; (B) TIC of Jiaogulan

Table S1. Identification and the relative contents of 52 compounds in white tea and Jiaogulan via UPLC Q-Exactive MS/MS

NO.	Rt (min)	Observed mass	Calculated mass	Error (ppm)	Identification	Formula	Ion Mode	MS/MS	Relative Contents [a]	
									WT (%)	JGL (%)
					Phenolics					
1	0.93	153.0423	153.0426	-1.76	3-Hydroxyanthranilic acid	$C_7H_7NO_3$	+	154.05	0.0105	ND
2	1.845	168.0411	168.0423	-7.14	2',4',6'-Trihydroxyacetophenone	$C_8H_8O_4$	-	61.99, 123.04, 167.03	ND	0.0241
3	2.153	154.0253	154.0266	-8.44	Protocatechuic acid	$C_7H_6O_4$	-	153.02	ND	0.0703
4	2.671	138.0314	138.0317	-1.96	3,4-Dihydroxybenzaldehyde	$C_7H_6O_3$	+	56.97, 116.97, 139.04	0.0860	0.0048
5	2.84	138.0303	138.0317	-10.14	Salicylic acid	$C_7H_6O_3$	-	93.03, 136.02, 137.02	ND	0.2234
6	2.881	354.0947	354.0951	-1.21	Chlorogenic Acid	$C_{16}H_{18}O_9$	+	163.04, 355.10	0.0104	ND
7	3.117	170.0203	170.0215	-7.06	Gallic acid	$C_7H_6O_5$	-	97.03, 125.02, 126.03, 169.02	0.0162	0.0035
8	3.122	180.0420	180.0423	-1.44	Caffeic Acid	$C_9H_8O_4$	+	135.04, 163.04, 181.07	0.0204	0.3779
9	3.134	164.0471	164.0473	-1.28	p-Coumaric acid	$C_9H_8O_3$	-/+	119.05, 121.03, 163.04	0.1214	0.2588
10	3.453	122.0367	122.0368	-0.66	4-Hydroxybenzaldehyde	$C_7H_6O_2$	+	79.02, 88.02, 123.04	0.2619	0.0273
11	3.624	448.1007	448.1006	0.22	Astragalin	$C_{21}H_{20}O_{11}$	-	227.03, 285.04, 301.03, 447.09	0.0183	0.3615
12	4.218	138.0303	138.0317	-10.14	4-Hydroxybenzoic acid	$C_7H_6O_3$	-	93.03, 94.04, 136.86, 137.02	ND	0.0498

					Flavonoids				
1	2.676	306.0733	306.0740	-2.29	(-)-Epigallocatechin	$C_{15}H_{14}O_7$	+	139.04, 163.04, 181.05	0.6725	0.0047
2	2.839	286.0471	286.0477	-2.10	Cyanidin	$C_{15}H_{11}ClO_6$	+	84.08, 149.02, 231.06, 259.06, 287.05	ND	0.0044
3	2.934	596.1746	596.1741	0.84	Eriocitrin	$C_{27}H_{32}O_{15}$	-	125.02, 137.02, 385.09, 595.17	ND	0.0144
4	3.068	290.0783	290.0790	-2.41	Epicatechin	$C_{15}H_{14}O_6$	+	123.04, 139.04, 165.05, 291.09	0.3482	0.0016
5	3.074	290.0791	290.0790	0.38	(±)-Catechin	$C_{15}H_{14}O_6$	-	109.03, 125.02, 289.07	0.0570	0.0620
6	3.092	458.0838	458.0849	-2.40	Epigallocatechin Gallate	$C_{22}H_{18}O_{11}$	+	83.01, 169.01, 457.08	4.6972	0.0073
7	3.201	318.0369	318.0376	-2.20	Myricetin	$C_{15}H_{10}O_8$	-	137.02, 151.00, 179.00,317.03	0.0926	0.0009
8	3.321	610.1522	610.1534	-1.92	Rutin	$C_{27}H_{30}O_{16}$	-	151.00, 255.03, 271.02, 609.16	0.1347	11.9193
9	3.426	464.0948	464.0955	-1.51	Isoquercitrin	$C_{21}H_{20}O_{12}$	-	125.02, 169.01, 271.03, 463.09	0.4158	0.9239
10	3.517	286.0471	286.0477	-2.10	Kaempferol	$C_{15}H_{10}O_6$	+	139.04, 153.02, 287.05	0.0592	0.0111
11	3.546	316.0578	316.0583	-1.58	Isorhamnetin	$C_{16}H_{12}O_7$	+	317.07	ND	0.0023
12	3.754	432.1047	432.1056	-2.04	Genistin	$C_{21}H_{20}O_{10}$	+	271.06125, 433.11450	0.0144	ND
13	3.904	274.0835	274.0841	-2.19	Phloretin	$C_{15}H_{14}O_5$	+	108.05, 169.05, 275.09	0.0013	0.0009
14	3.939	302.0420	302.0427	-2.32	Quercetin	$C_{15}H_{10}O_7$	-	153.02, 301.07	0.0231	0.0019
15	3.941	300.0628	300.0634	-2.00	Diosmetin	$C_{16}H_{12}O_6$	+	301.07	ND	0.0009
16	4.387	288.0626	288.0634	-2.85	Eriodictyol	$C_{15}H_{12}O_6$	-	135.04, 151.00, 287.06	0.0050	ND
17	4.406	286.0471	286.0477	-2.24	Luteolin	$C_{15}H_{10}O_6$	-/+	153.02, 285.04, 287.05	0.0251	0.1490
18	4.533	316.0578	316.0583	-1.58	Rhamnetin	$C_{16}H_{12}O_7$	+	317.07	ND	0.0010
19	4.877	270.0522	270.0528	-2.41	Apigenin	$C_{15}H_{10}O_5$	+	153.02, 271.06	0.0158	ND
20	4.895	272.0678	272.0685	-2.57	Naringenin	$C_{15}H_{12}O_5$	-	93.03, 151.00, 271.06	0.0122	ND
					Saponins				
1	5.127	620.4283	620.4288	-0.81	Ginsenoside Rh4	$C_{36}H_{60}O_8$	+	/	ND	0.0211
2	5.559	604.3967	604.3975	-1.32	Hederagenin 3-O-arabinoside	$C_{35}H_{56}O_8$	+	/	ND	0.0019
3	5.686	974.5082	974.5086	-0.41	Madecassoside	$C_{48}H_{78}O_{20}$	-	/	ND	1.2933
4	5.792	942.5195	942.5188	0.74	Soyasaponin I	$C_{48}H_{78}O_{18}$	-	/	ND	0.0054
5	5.804	884.4767	884.4770	-0.34	Gracillin	$C_{45}H_{72}O_{17}$	-	/	ND	1.2882
6	5.828	958.5131	958.5137	-0.63	Soyasaponin A3	$C_{48}H_{78}O_{19}$	-	/	ND	0.3122
7	5.898	944.4979	944.4981	-0.21	Araliasaponin II	$C_{47}H_{76}O_{19}$	-	/	ND	0.1126
8	6.021	978.5394	978.5399	-0.51	Ginsenoside I	$C_{48}H_{82}O_{20}$	-	/	ND	0.4637
9	6.112	940.5016	940.5032	-1.70	Dehydrosoyasaponin I	$C_{48}H_{76}O_{18}$	-	/	ND	0.2767
10	6.234	960.5290	960.5294	-0.42	Notoginsenoside G	$C_{48}H_{80}O_{19}$	-	/	ND	0.8716
11	6.428	796.4609	796.4609	0.00	Soyasaponin III	$C_{42}H_{68}O_{14}$	-	/	ND	0.1009
12	6.459	930.5189	930.5188	0.11	Hoduloside VII	$C_{47}H_{78}O_{18}$	-	/	ND	0.0498
13	6.774	868.4811	868.4820	-1.04	Dioscin	$C_{45}H_{72}O_{16}$	+/-	/	ND	0.0153
14	6.844	828.4875	828.4871	0.48	Vinaginsenoside R2	$C_{43}H_{72}O_{15}$	-	/	ND	0.1159
15	7.071	816.4874	816.4871	0.37	Majonoside R1	$C_{42}H_{72}O_{15}$	-	/	ND	0.0153
16	7.292	842.5024	842.5028	-0.47	Vinaginsenoside R1	$C_{44}H_{74}O_{15}$	-	/	ND	0.0162
17	7.619	800.4922	800.4922	0.00	Ginsenoside Rf	$C_{42}H_{72}O_{14}$	-	/	ND	0.3067
18	7.716	782.4815	782.4816	-0.13	Ginsenoside La	$C_{41}H_{68}O_{13}$	-	/	ND	0.0555
19	9.864	714.4196	714.4190	0.84	Cyclopassifloside VII	$C_{37}H_{62}O_{13}$	-	/	ND	0.0543

20	10.649	738.4229	738.4190	5.28	Polypodosaponin	$C_{39}H_{62}O_{13}$	-	/	ND	0.0239

[a] The relative content of the target compounds was calculated by their area (%) in the total ion chromatography.
ND: not detected.