Supplementary

Figure captions

Figure S1 Buckwheat (*F. esculentum*) bee pollen sample (A) and buckwheat (*F. esculentum*) bee pollen extract (FBPE) (B).

Figure S2 High performance liquid chromatography (HPLC) chromatograms of phenolic standards (A) and FBPE (B) at 210nm. Chlorogenic acid (1), Caffeic acid (2), Resveratrol (3), Catechin (4), Luteolin (5), Kaempferol (6).

Figure S3 Structural identification of 6 main phenolic compounds in FBPE.

Figure S4 Representative images showing flow cytometry of T cell subsets in different groups of splenocytes.

A B

Figure S1. Buckwheat (*F. esculentum*) bee pollen sample (**A**) and buckwheat (*F. esculentum*) bee pollen extract (FBPE) (**B**).

A B

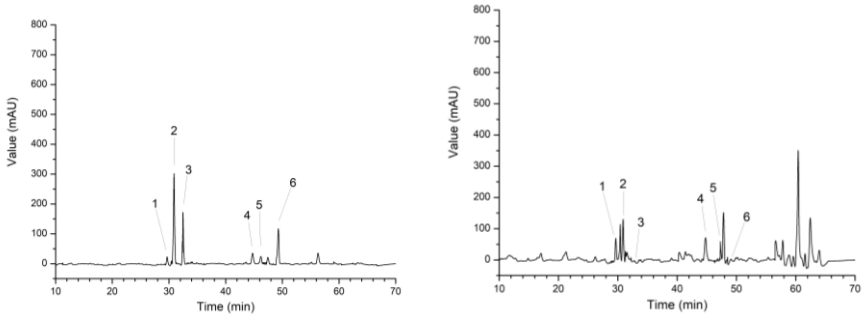
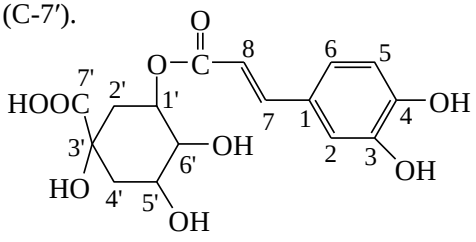
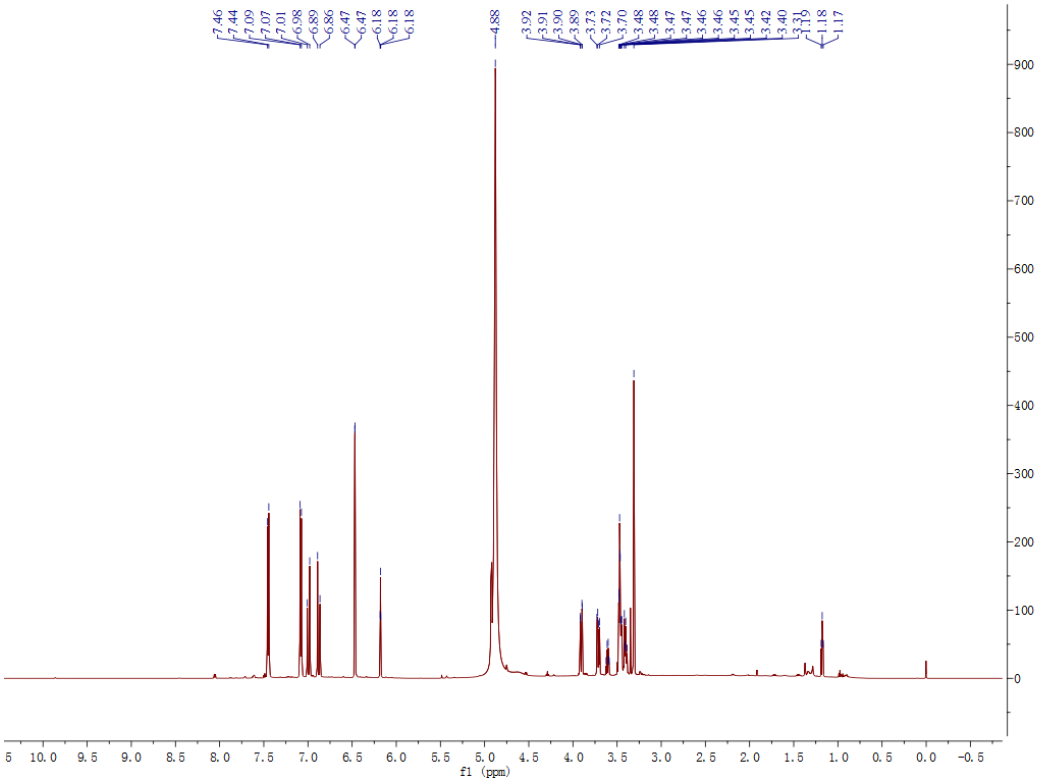


Figure S2. High performance liquid chromatography (HPLC) chromatograms of phenolic standards (**A**) and FBPE (**B**) at 210nm.

Chlorogenic acid (1): ^{1}H-NMR (400 MHz, methanol-d_4): δ 7.48 (1H, d, *J*= 15.9 Hz, H-7), 6.97 (1H, d, *J*= 2.0 Hz, H-6), 6.88 (1H, dd, *J*= 2.0, 8.1 Hz, H-2), 6.70 (1H, d, *J*= 8.2 Hz, H-5), 6.19 (1H, d, *J*= 15.9 Hz, H-8), 5.25 (1H, d, *J*= 4.2 Hz, H-5′), 4.08 (1H, s, H-1′), 3.65 (dd, *J*= 8.4, 3.1 Hz, H-6′), 3.30~3.20 (2H, m, H-2′), 2.03 (2H, d, *J*= 5.2 Hz, H-4′). ^{13}C-NMR (400 MHz, DMSO-d_6): δ 127.74 (C-1), 115.12 (C-2), 149.58 (C-3), 147.08 (C-4), 116.43 (C-5), 123.00 (C-6), 146.79 (C-7), 115.19 (C-8), 168.62 (C-9), 71.95 (C-1′), 38.17 (C-2′), 73.38 (C-3′), 38.69 (C-4′), 71.22 (C-5′), 76.09 (C-6′), 177.03 (C-7′).

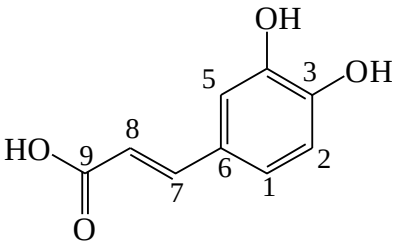


chlorogenic acid

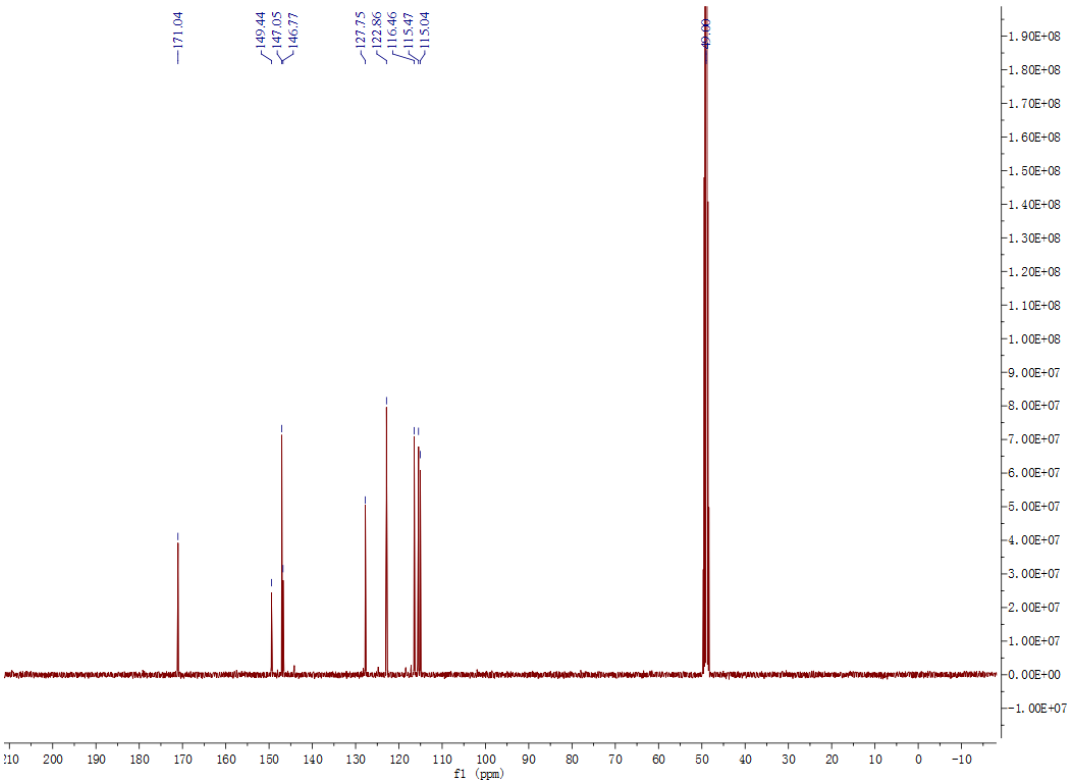


The ^{1}H-NMR spectrum of compound 1

Caffeic acid (2): ^{1}H-NMR (400 MHz, DMSO-d_6): δ 6.97 (1H, d, *J*= 2.0 Hz, H-3), 7.02 (1H, d, *J*= 2.0 Hz, H-5), 6.95 (1H, d, *J*= 2.0 Hz, H-6), 7.41 (1H, d, *J*= 15.9 Hz, H-7), 6.75 (1H, d, *J*= 8.1 Hz, H-8), 12.16 (1H, s, -COOH), 6.17 (1H, d, *J*= 15.9 Hz, -OH×2). ^{13}C-NMR (400 MHz, DMSO-d_6): δ 127.75 (C-1), 116.46 (C-2), 146.77 (C-3), 149.44 (C-4), 115.04 (C-5), 122.86 (C-6), 147.05 (C-7), 115.47 (C-8), 171.04 (C-9).

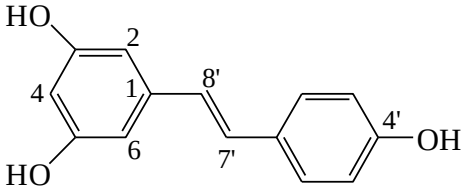


caffeic acid

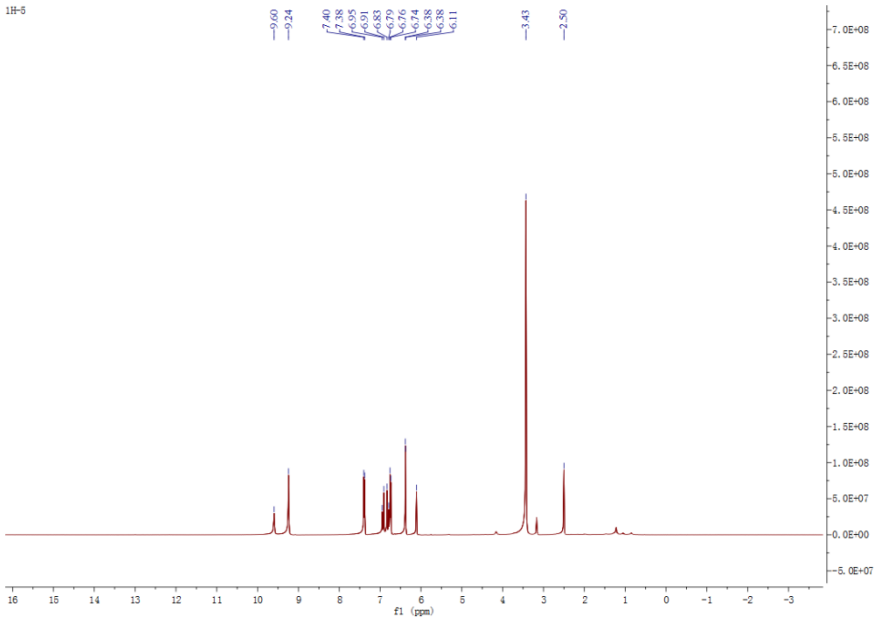


The ^{13}C-NMR spectrum of compound 2

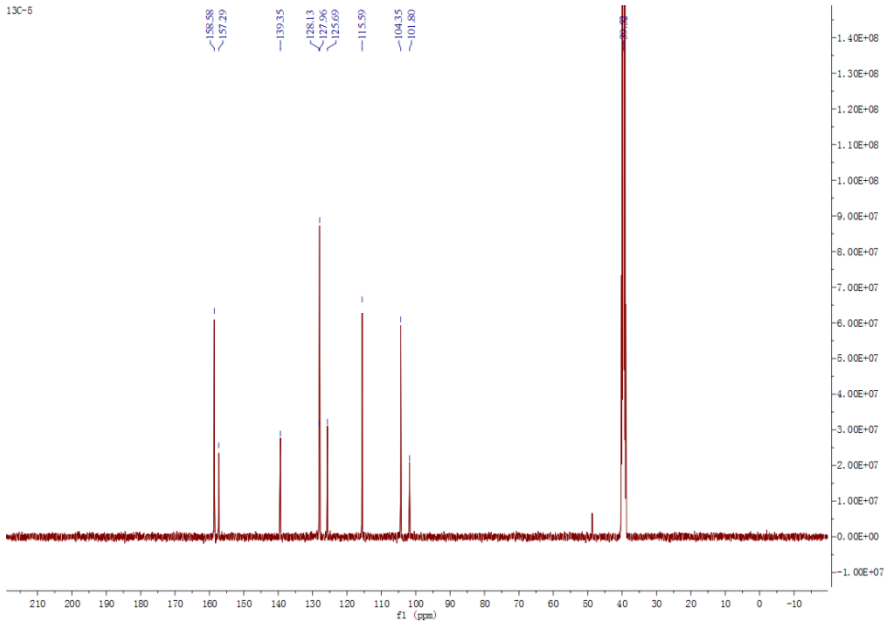
Resveratrol (3): ^{1}H-NMR (400 MHz, DMSO-d_6), δ 6.38 (1H, d, 1.6 Hz, H-2&6), 6.11 (1H, t, 2.0 Hz, H-4), 7.34 (2H, d, 8.4 Hz, H-2′&6′), 6.75 (2H, d, 8.4 Hz, H-3′&5′), 6.93 (1H, d, 16.4 Hz, H-7′), 6.87 (1H, d, 16.4 Hz, H-8′), 9.24 (s, H-3&5-OH), 9.60 (1H, s, H-4′-OH). ^{13}C-NMR (400 MHz, DMSO-d_6): δ 139.4 (C-1), 104.4 (C-2&6), 158.6 (C-3&5), 101.8 (C-4), 128.1 (C-1′), 127.9 (C-2′&6′), 115.6 (C-3′&5′), 157.3 (C-4′), 127.9 (C-7′), 125.7 (C-8′).



Resveratrol

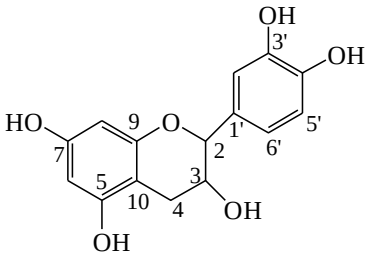


The ^{1}H-NMR spectrum of compound 3

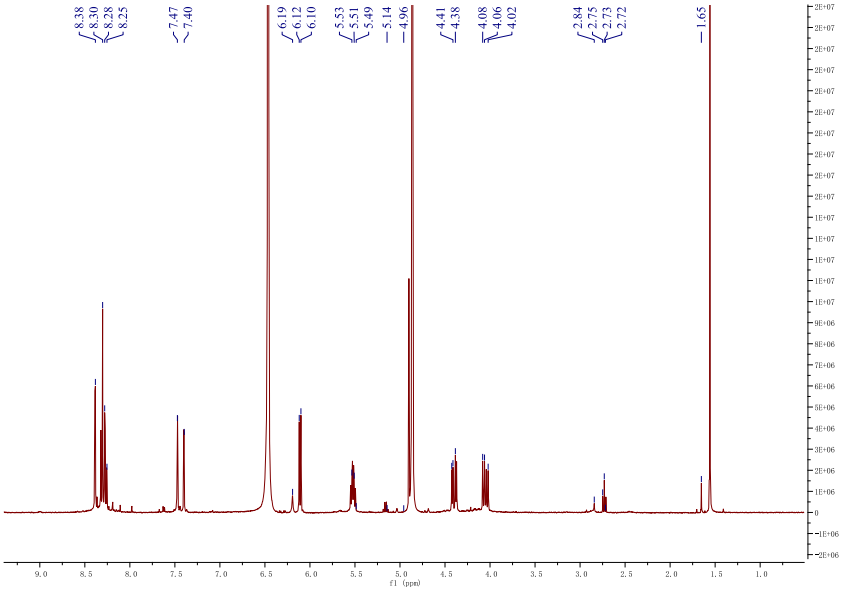


The ^{13}C -NMR spectrum of compound 3

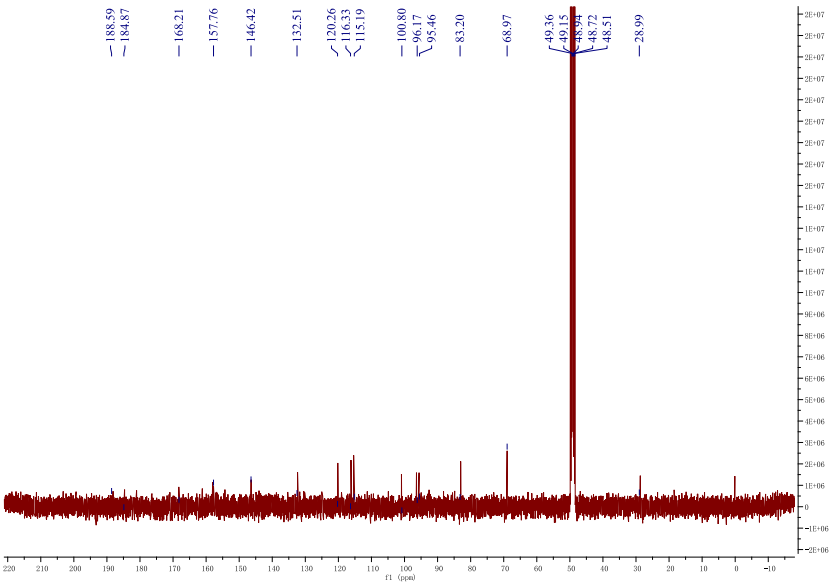
catechin (4): ^{13}C-NMR (400 MHz, DMSO-d_6): δ 83.20 (C-2), 68.97 (C-3), 28.99 (C-4), 188.99 (C-5), 96.17 (C-6), 184.87 (C-7), 95.46 (C-8), 108.21 (C-9), 100.80 (C-10), 132.51 (C-1′), 116.38 (C-2′), 157.76 (C-3′), 146.42 (C-4′), 115.19 (C-5′), 120.26 (C-6′).



catechin

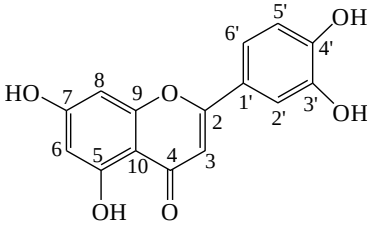


The ^{1}H-NMR spectrum of compound 4

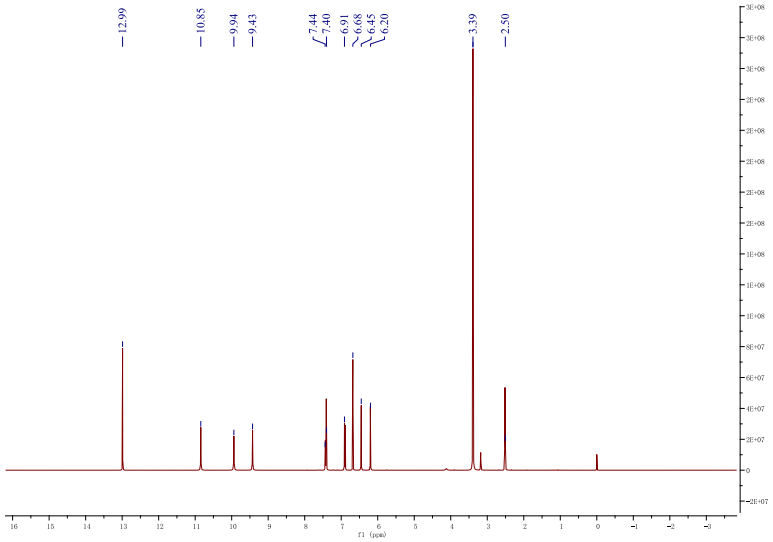


The ^{13}C-NMR spectrum of compound 4

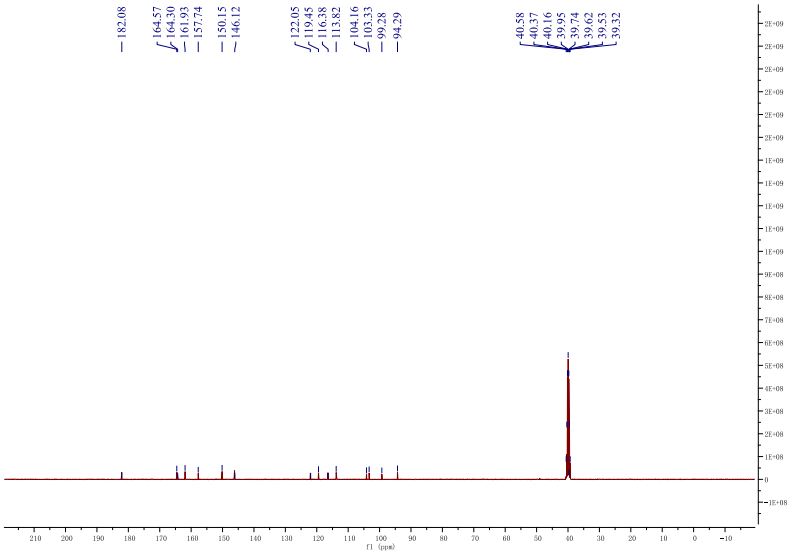
Luteolin (5): ^{1}H-NMR (400 MHz, DMSO-d$_6$), δ 12.98 (1H, s, 5-OH), 7.43 (1H, br d, 6′-H), 7.41 (1H, br s, 2′-H), 6.90 (1H, d, *J*= 9.0 Hz, 5′-H), 6.46 (1H, d, *J*= 1.8 Hz, 8-H), 6.20 (1H, d, *J*= 1.8 Hz, 6-H), 6.67 (1H, s, 3-H). ^{13}C-NMR (400 MHz, DMSO-d$_6$): δ 150.15 (C-2), 103.33 (C-3), 182.12 (C-4), 164.35 (C-5), 99.28 (C-6), 164.57 (C-7), 94.29 (C-8), 161.93 (C-9), 104.16 (C-10), 121.96 (C-1′), 116.47 (C-2′), 157.74 (C-3′), 146.19 (C-4′), 113.82 (C-5′), 119.45 (C-6′).



luteolin

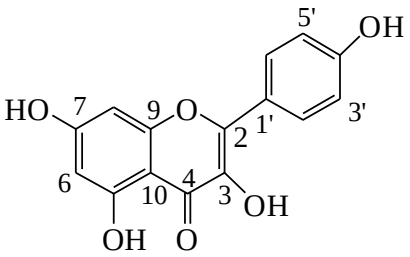


The ^{1}H-NMR spectrum of compound 5

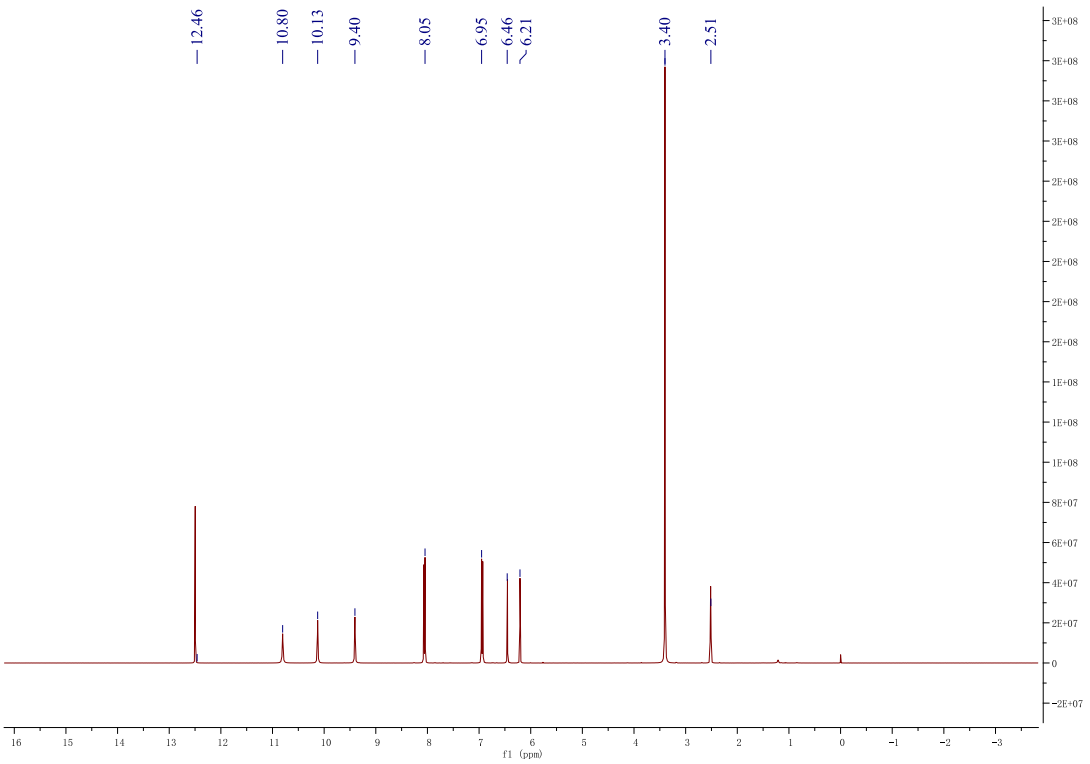


The ^{13}C-NMR spectrum of compound 5

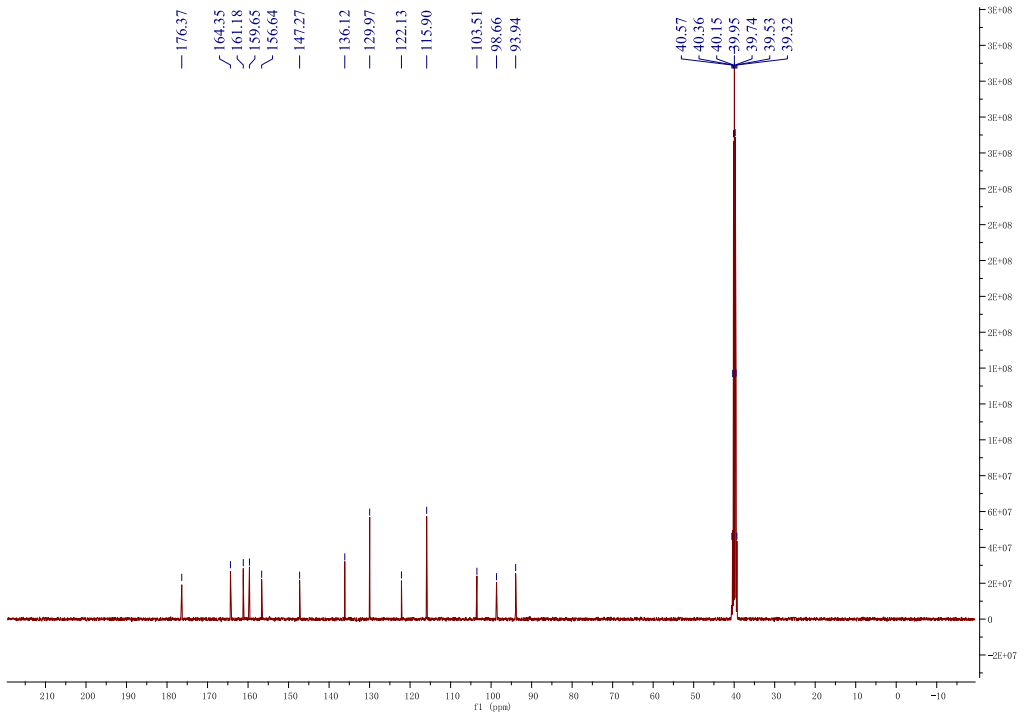
Kaempferol (6): ^{1}H-NMR (400 MHz, DMSO-d_6): δ 12.49 (1H, s, 5-OH), 10.80 (1H, s, 7-OH), 10.13 (1H, s, 4-OH), 9.43 (1H, s, 3-OH), 8.05 (2H, d, *J*= 8.8Hz, H-2, 6), 6.93 (2H, d, *J*= 8.8 Hz, H-3′, 5′), 6.44 (1H, d, *J*= 1.5 Hz, H-8), 6.19 (1H, d, *J*= 1.5 Hz, H-6). ^{13}C-NMR (400 MHz, DMSO-d_6): δ 147.27 (C-2), 136.12 (C-3), 176.37 (C-4), 161.18 (C-5), 98.66 (C-6), 164.35 (C-7), 93.94 (C-8), 156.64 (C-9), 103.51 (C-10), 122.13 (C-1′), 129.97 (C-2′&6′), 115.90 (C-3′&5′), 159.65 (C-4′).



kaempferol



The ^{1}H-NMR spectrum of compound 6



The ^{13}C -NMR spectrum of compound 6

Figure S3. Structural identification of 6 main phenolic compounds in FBPE.

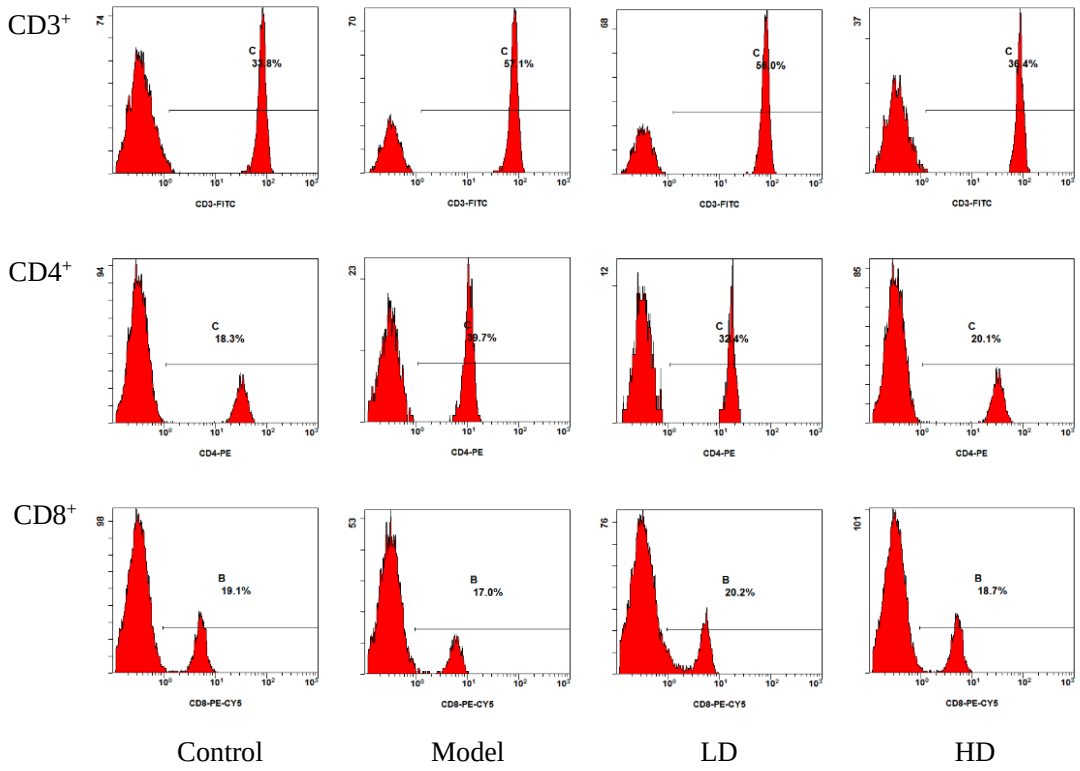


Figure S4. Representative images showing flow cytometry of T cell subsets in different groups of splenocytes.

Table S1 Phenolic compounds of FBPE

TPC mg gallic acid/g	TFC mg rutin/g	No.	Compounds	M_r	Ion mode	Exptl (m/z)	Formula	t_R (min)	Content (mg/g)
18.59±1.03	16.35±1.95	1	Chlorogenic acid	354	-	353	$C_{16}H_{18}O_9$	29.53	1.45±0.10
		2	Caffeic acid	180	-	179	$C_9H_8O_4$	30.47	3.47±0.13
		3	Resveratrol	228	-	227	$C_{14}H_{12}O_3$	32.26	5.25±0.51
		4	catechin	290	+	291	$C_{15}H_{14}O_6$	44.85	2.40±0.18
		5	Luteolin	286	-	285	$C_{15}H_{10}O_6$	47.89	9.46±0.12
		7	Kaempferol	286	-	285	$C_{15}H_{10}O_6$	49.10	3.67±0.04

Results presented in the table are expressed as mean±standard deviation (SD) for 3 replications.