Supplementary materials

Biological activity of extracts and kombucha ferments obtained from melliferous plant flowers (*Tilia* L. and *Calluna vulgaris* (L.) Hull): antioxidant, cytotoxic, anti-inflammatory and antibacterial properties

Table S1. LC–MS profile of phenolic compounds identified in *Calluna vulgaris* L. flowers.

Rt (min)	$[M-H]^-$ (m/z)	Δ ppm	Formula	Compound
4.61	331.06686	-0.63	$C_{13}H_{15}O_{10}$	Gallic acid hexoside
4.72	169.01442	1.02	$C_7H_6O_5$	Gallic acid
6.48	371.09801	-0.97	$C_{16}H_{20}O_{10}$	Unknown
6.52	299.07720 (137)	-0.14	$C_{13}H_{16}O_8$	Hydroxybenzoic acid hexoside
6.78	331.06578	-3.89	$C_7H_6O_5$	Gallic acid hexoside
6.95	371.09878	1.10	$C_{16}H_{20}O_{10}$	Unknown
7.18	371.09894	1.53	$C_{16}H_{20}O_{10}$	Unknown
7.42	315.07193 (109, 152)	-0.71	$C_{13}H_{16}O_9$	Dihydroxybenzoic acid hexoside
8.53	153.01907	-1.70	$C_7H_6O_4$	Protocatechuic acid
9.83	431.11923	-0.62	$C_{18}H_{24}O_{12}$	Unknown
9.92	353.08823 (191, 179)	1.20	$C_{16}H_{18}O_9$	Chlorogenic acid isomer
10.68	123.04522?	0.54	$C_7H_8O_2$	Unknown
11.03	353.08801 (191, 179)	0.58	$C_{16}H_{18}O_9$	Neochlorogenic acid
13.40	337.09155 (163, 191, 173)	-3.97	$C_{16}H_{18}O_8$	3-*p*-Coumaroylquinic acid (I)
14.12	337.09167 (163, 191, 173)	-3.61	$C_{16}H_{18}O_8$	3-*p*-Coumaroylquinic acid (I)
14.35	353.08785 (191, 179)	0.13	$C_{16}H_{18}O_9$	Chlorogenic acid isomer
15.45	289.07139 (245, 221)	-1.28	$C_{15}H_{14}O_6$	Catechin
16.00	353.08752 (191, 179)	-0.81	$C_{16}H_{18}O_9$	Chlorogenic acid*
16.85	179.03471	-1.51	$C_9H_8O_4$	Caffeic acid
18.55	353.08765 (191, 179)	-0.44	$C_{16}H_{18}O_9$	Chlorogenic acid isomer
19.37	289.07177 (245, 221)	0.03	$C_{15}H_{14}O_6$	Epicatechin
19.55	337.09199 (191, 173)	-2.67	$C_{16}H_{18}O_8$	5-*p*-Coumaroylquinic acid (I)
20.15	337.09206 (191, 173)	-2.46	$C_{16}H_{18}O_8$	5-*p*-Coumaroylquinic acid (I)
20.15	371.09851	0.38	$C_{16}H_{20}O_{10}$	Unknown
21.22	465.10387	-0.04	$C_{21}H_{22}O_{12}$	Taxifolin glucoside
22.47	337.09268 (191, 173)	-0.62	$C_{16}H_{18}O_8$	5-*p*-Coumaroylquinic acid (I)
22.55	465.10365	-0.43	$C_{21}H_{22}O_{12}$	Taxifolin hexoside
25.54	497.12992	-0.29	$C_{22}H_{26}O_{13}$	Unknown
26.99	595.13022	-0.40	$C_{26}H_{28}O_{16}$	Unknown flavonoid
27.29	609.14732	1.99	$C_{27}H_{30}O_{16}$	Unknown flavonoid
28.62	507.11400	-0.82	$C_{23}H_{24}O_{13}$	Unknown flavonoid
30.61	493.09843	-0.68	$C_{22}H_{22}O_{13}$	Unknown flavonoid
32.19	463.08897 (300)	1.66	$C_{21}H_{20}O_{12}$	Quercetin 3-*O*-galactoside

33.31	463.08878 (300)	1.25	$C_{21}H_{20}O_{12}$	Quercetin 3-*O*-glucoside (isoquercitrin)
36.96	433.07865 (300)	2.34	$C_{20}H_{18}O_{11}$	Unknown flavonoid
37.88	433.07802 (300)	0.89	$C_{20}H_{18}O_{11}$	Unknown flavonoid
38.77	515.11925 (353)	-0.48	$C_{25}H_{24}O_{12}$	Dicaffeoylquinic acid
39.07	447.09311	-0.39	$C_{21}H_{20}O_{11}$	Kaempferol glucoside (astragalin)
39.51	449.10815 (287)	-1.74	$C_{21}H_{22}O_{11}$	Unknown flavonoid
40.47	445.07720 (269)	-0.98	$C_{21}H_{18}O_{11}$	Apigenin 7-glucuronide
45.39	431.09759	-1.81	$C_{21}H_{20}O_{10}$	Kaempferol-7-rhamnoside
51.11	301.03505	-1.08	$C_{15}H_{10}O_{7}$	Quercetin
51.80	285.04029	-0.60	$C_{15}H_{10}O_{6}$	Luteolin
52.74	705.16645 (301)	-1.12	$C_{32}H_{34}O_{18}$	Unknown flavonoid
55.76	487.08722 (269)	-2.01	$C_{23}H_{20}O_{12}$	Unknown flavonoid
58.55	269.04488	-2.47	$C_{15}H_{10}O_{5}$	Apigenin
59.27	285.04007	-1.37	$C_{15}H_{10}O_{6}$	Unknown flavonoid

Table S2. LC–MS identification of phenolic compounds in *Tilia* L. extracts and fermented samples.

Rt (min)	**m/z [M–H]⁻**	**Δ ppm**	**Formula**	**Compound**
4.54	331.06701	-0.18	$C_{13}H_{15}O_{10}$	Gallic acid hexoside
4.68	169.01446	1.90	$C_{7}H_{6}O_{5}$	Gallic acid
6.19	299.07801 (137)	2.56	$C_{13}H_{16}O_{8}$	Hydroxy acid hexoside
6.48	331.06728	0.63	$C_{13}H_{15}O_{10}$	Gallic acid hexoside
7.11	315.07224 (109, 152)	0.27	$C_{13}H_{16}O_{9}$	Dihydroxybenzoic acid hexoside
7.71	169.01471	2.72	$C_{7}H_{6}O_{5}$	Trihydroxybenzoic acid
8.29	153.01937	0.25	$C_{7}H_{6}O_{4}$	Protocatechuic acid
9.08	329.08806 (167)	0.77	$C_{14}H_{18}O_{9}$	Vanillic acid hexoside
10.50	181.05026 (135)	-2.05	$C_{9}H_{10}O_{4}$	Unknown
10.64	353.08856 (191, 179)	2.13	$C_{16}H_{18}O_{9}$	Neochlorogenic acid
11.98	325.09324	1.07	$C_{15}H_{18}O_{8}$	*p*-Coumaric acid hexoside
12.34	299.07751 (137)	0.90	$C_{13}H_{16}O_{8}$	Hydroxybenzoic acid hexoside
13.16	297.06151 (179)	-0.27	$C_{13}H_{14}O_{8}$	Caffeic acid derivative
13.04	337.09167 (163, 191, 173)	-3.61	$C_{16}H_{18}O_{8}$	3-*p*-Coumaroylquinic acid (I)
13.59	443.19204	-0.52	$C_{21}H_{32}O_{10}$	Unknown
13.74	337.09182 (163, 191, 173)	-3.17	$C_{16}H_{18}O_{8}$	3-*p*-Coumaroylquinic acid (II)
14.59	325.09355	2.02	$C_{15}H_{18}O_{8}$	*p*-Coumaric acid hexoside
15.07	551.19816 (505)	0.03	$C_{23}H_{36}O_{15}$	Unknown
15.41	289.07135 (245, 221)	-1.42	$C_{15}H_{14}O_{6}$	Catechin

16.09	353.08831 (191, 179)	1.42	$C_{16}H_{18}O_9$	Chlorogenic acid*
16.77	281.06629 (163)	-1.37	$C_{13}H_{14}O_7$	*p*-Coumaric acid derivative
16.93	401.14510	-0.55	$C_{18}H_{26}O_{10}$	Unknown
17.21	431.19217	-0.23	$C_{20}H_{32}O_{10}$	Unknown
17.66	337.09221 (191, 173)	-2.01	$C_{16}H_{18}O_8$	4-*p*-Coumaroylquinic acid
18.52	387.16598	-0.20	$C_{18}H_{28}O_9$	Unknown
18.91	577.13546	0.54	$C_{30}H_{26}O_{12}$	Procyanidin B
19.34	289.07169 (245, 221)	-0.25	$C_{15}H_{14}O_6$	Epicatechin
19.52	337.09194 (191, 173)	-2.81	$C_{16}H_{18}O_8$	5-*p*-Coumaroylquinic acid
19.93	337.09229 (191, 173)	-1.78	$C_{16}H_{18}O_8$	5-*p*-Coumaroylquinic acid
20.39	353.05189 (163, 189)	1.33	$C_{15}H_{14}O_{10}$	Coumaroylhydroxycitric acid
20.99	593.15170 (317)	0.85	$C_{27}H_{30}O_{15}$	Unknown flavonoid
21.59	465.10402	0.37	$C_{21}H_{22}O_{12}$	Taxifolin glucoside
22.46	337.09239 (191, 173)	-1.48	$C_{16}H_{18}O_8$	5-*p*-Coumaroylquinic acid (I)
23.51	563.14148	1.51	$C_{26}H_{28}O_{14}$	Unknown flavonoid
26.46	755.20528	1.67	$C_{33}H_{40}O_{20}$	Flavonoid
27.61	639.15758	1.42	$C_{28}H_{32}O_{17}$	Flavonoid
29.36	609.14714	1.69	$C_{27}H_{30}O_{16}$	Quercetin derivative
29.99	449.10951	1.28	$C_{21}H_{22}O_{11}$	Flavonoid
30.59	497.33332	0.40	$C_{24}H_{50}O_{10}$	Unknown
31.48	623.16240	1.03	$C_{28}H_{32}O_{16}$	Unknown flavonoid
31.64	169.01454	1.72	$C_7H_6O_5$	Unknown
32.31	463.08889 (300)	1.49	$C_{21}H_{20}O_{12}$	Quercetin galactoside
33.11	463.09008 (300)	4.05	$C_{21}H_{20}O_{12}$	Quercetin 3-O-glucoside (isoquercitrin)
34.24	593.15223	1.74	$C_{27}H_{30}O_{15}$	Kaempferol derivative
37.43	549.08869 (505, 300)	0.18	$C_{24}H_{22}O_{15}$	Quercetin malonyl-hexoside
37.73	433.07844	1.85	$C_{20}H_{18}O_{11}$	Quercetin derivative
37.93	461.10964	1.53	$C_{22}H_{22}O_{11}$	Unknown flavonoid
38.78	577.15747 (269)	2.06	$C_{27}H_{30}O_{14}$	Apigenin derivative
38.90	447.09357 (284)	0.64	$C_{21}H_{20}O_{11}$	Kaempferol glucoside (astragalin)
39.28	447.09398 (284)	1.55	$C_{21}H_{20}O_{11}$	Kaempferol hexoside
40.26	477.06830 (301)	1.75	$C_{21}H_{18}O_{13}$	Quercetin derivative
41.49	607.16808 (284)	2.03	$C_{28}H_{32}O_{15}$	Kaempferol derivative
42.76	461.10940 (299)	1.01	$C_{22}H_{22}O_{11}$	Unknown flavonoid
43.36	463.08897 (301)	1.66	$C_{21}H_{20}O_{12}$	Unknown flavonoid
45.59	447.09344	0.35	$C_{21}H_{20}O_{11}$	Quercetin derivative
46.14	461.07316 (475?)	1.32	$C_{21}H_{18}O_{12}$	Unknown flavonoid

51.20	637.17835 (301)	1.48	$C_{29}H_{34}O_{16}$	Unknown flavonoid
53.75	491.12053 (283)	2.09	$C_{23}H_{24}O_{12}$	Unknown flavonoid
58.53	269.04492	-2.32	$C_{15}H_{10}O_5$	Apigenin
59.86	299.05629	0.59	$C_{16}H_{12}O_6$	Unknown flavonoid

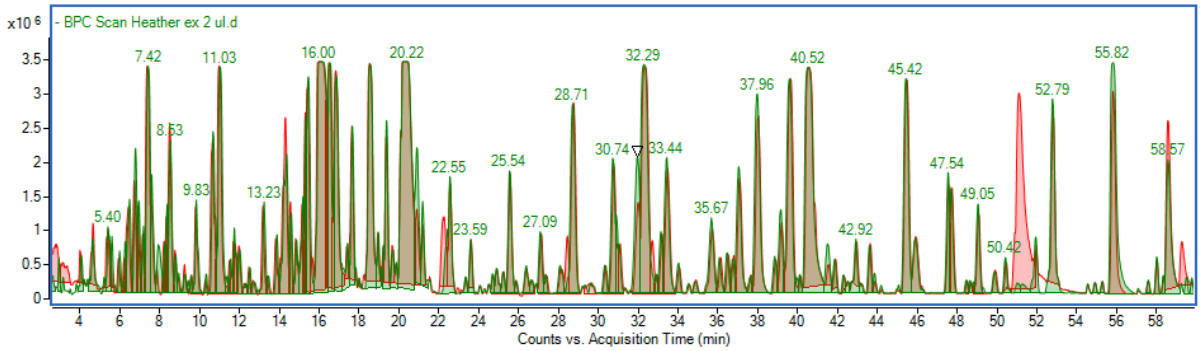


Figure S1. Overlaid representative LC–DAD–MS chromatograms of *Calluna vulgaris* L.flower extract (green line) and fermented extract (red line).

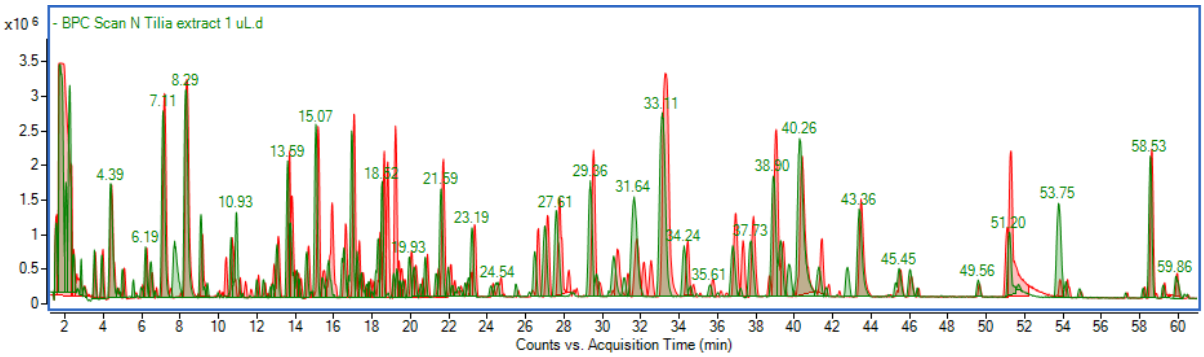
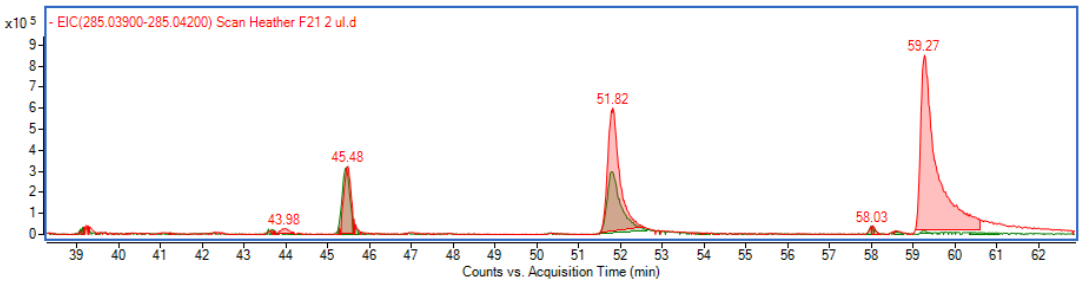


Figure S2. Overlaid representative LC–DAD–MS chromatograms of *Tilia* L. flower extract (green line) and fermented extract (red line).

(a)



(b)

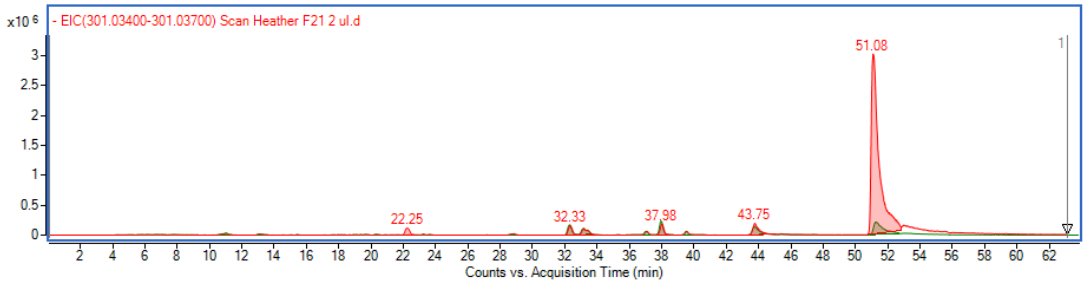
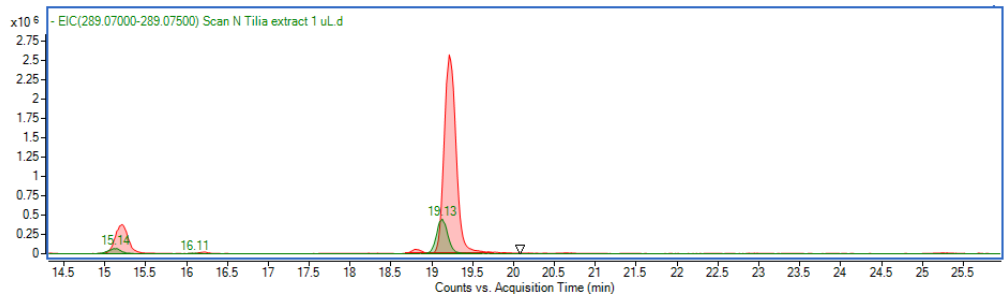
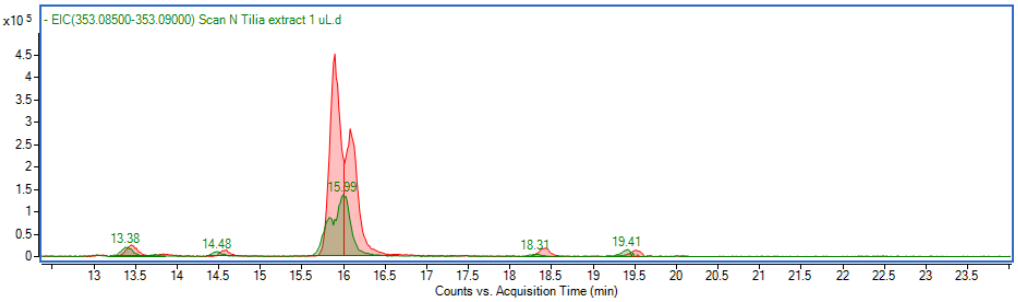


Figure S3. Extracted ion chromatograms in the mass ranges characteristic of kaempferol (a), and quercetin (b), proanthocyanidins (c). *Calluna vulgaris* L. flower extract (green line) and fermented extract (red line).

(a)



(b)



(c)

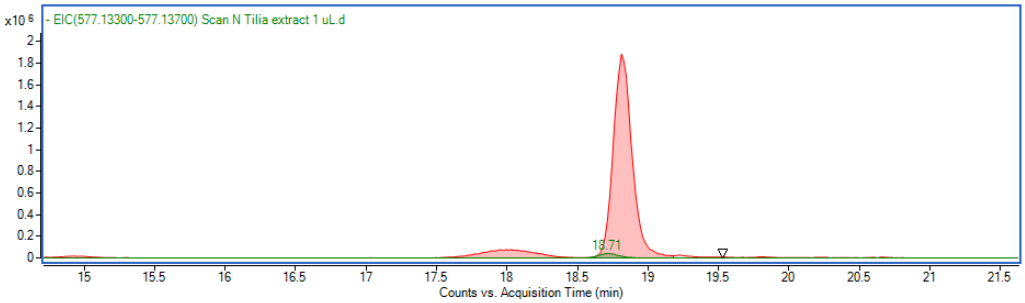


Figure S4. Extracted ion chromatograms in the mass ranges characteristic of (epi)catechin (a), chlorogenic acid (b), and proanthocyanidins (c). *Tilia* L. flower extract (green line) and fermented extract (red line).