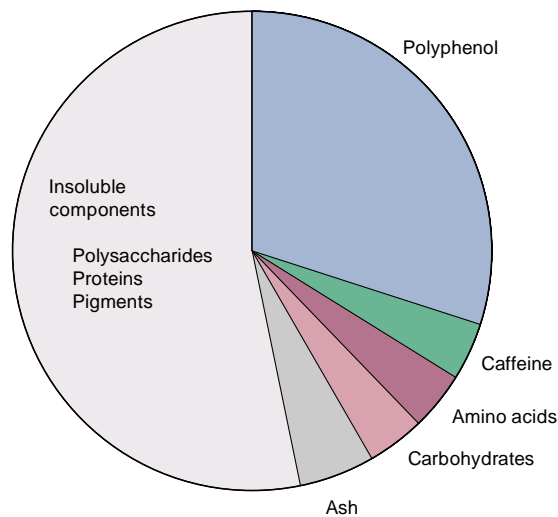


Tea Components

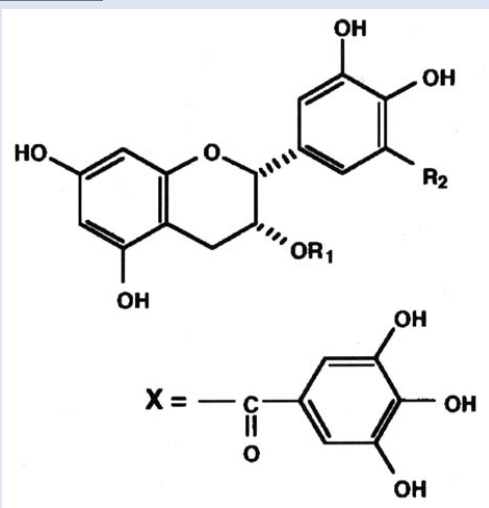
The differences of varieties, the environmental effects, various methods of processing and modes of propagations cause the change of chemical composition of tea leaves. As shown in the figure on the right, the composition of fresh tea flush contains various components, such as polyphenol (include catechins), caffeine, amino acids, vitamins, flavonoids, polysaccharides and fluorine. Structural formulae of catechins, caffeine, theanine, saponins as main green tea components are drawn in the figure below. Polyphenols and caffeine are the most important chemicals of tea, considerable pharmacological significance. Polyphenols are present to the extent of 30-35 % in the dry tea leaf matter and their content determines the quality of the beverage.

Composition of fresh tea leaves



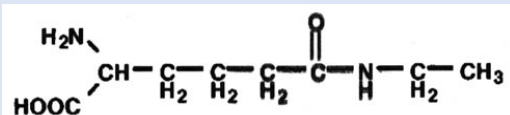
Structural formulae of green tea components

Catechins

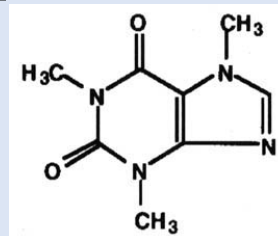


- (-)-Epicatechin :R₁=R₂=H
- (-)-Epigallocatechin :R₁=H, R₂=OH
- (-)-Epicatechin gallate :R₁=X, R₂=H
- (-)-Epigallocatechin gallate :R₁=X, R₂=OH

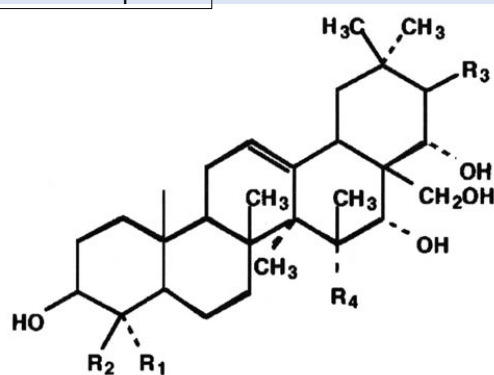
Theanine



Caffeine



Tea leaf saponins



- Barringtonol C :R₁=R₂=CH₃, R₃=OH, R₄=H
- Camelliagenin A :R₁=R₂=CH₃, R₃=R₄=H
- A1-barrigenol :R₁=R₂=CH₃, R₃=H, R₄=OH
- R1-barrigenol :R₁=R₂=CH₃, R₃=R₄=OH

Chemical Composition of Various Kinds of Japanese Green Tea

Chemical composition of Gyokuro, Sencha, Kamairicha, Bancha, Hojicha and Matcha is shown in the table below. Matcha, Gyokuro and Sencha are rich in total nitrogen, whereas Bancha and Hojicha are poor. Tannin content of Kamairicha is high, while

that of Matcha, Gyokuro and Hojicha is poor. Ascorbic acid content of Sencha, Bancha and Kamairicha is high, but of Gyokuro and Hojicha is low.

Chemical composition of various green teas

Green tea	Total nitrogen (%)	Caffeine (%)	Tannin (%)	Free sugars (%)	Soluble matter (%)	Ascorbic acid (mg%)
Matcha	6.11	3.62	9.55	0.85	42.11	174
Gyokuro	5.98	3.95	10.56	0.90	38.64	100
Sencha	5.49	2.93	13.60	1.47	40.10	393
Bancha	3.74	2.44	14.14	2.08	36.83	273
Kamairicha	4.65	3.06	14.57	1.89	39.89	270
Hojicha	3.53	1.88	10.13	0.95	31.41	90

S. Maeda et al., *Tea Res. J.*, No.45, 85(1977)
K. Ikegaya et al. *Tea Res. J.*, No.60, 79(1984)

Chemical Constituents of Japanese Green Tea at Different Stages of Growth

Chemical constituents of Japanese green tea in different stages of growth and crop seasons are shown in the table below. During the development of tea shoots, total contents of nitrogen, tannin, caffeine, and amino acids decreases. The phosphorus and potassium contents are high in the early harvest (young leaves)while calcium and free

sugar contents are high in the middle and the late harvest(matured leaves) Among the crops, the 1st crop of tea shows the highest nitrogen, ascorbic acid and amino acid contents, but the lowest amounts of tannin, caffeine and calcium. The levels of potassium of different crop seasons are approximately identical.

Chemical constituents of green tea on the different stages of growth

Tea season	Plucking Time	Banji shoot to the total (%)	Total nitrogen (%)	Tannin (%)	Caffeine (%)	Amino acids (%)	Free sugars (%)
First crop of tea	Early harvest	0.5	5.81	17.25	2.95	3.34	2.45
	Middle harvest	39.7	5.26	15.45	2.51	2.61	2.40
	Late harvest	96.0	4.21	13.20	2.41	1.50	3.40
Third crop of tea	Early harvest	18.3	4.40	21.32	3.76	0.99	2.10
	Middle harvest	61.1	4.10	19.56	3.02	0.80	2.40
	Late harvest	97.5	3.55	17.20	2.87	0.39	3.80

Tea season	Plucking Time	Soluble matter (%)	Ascorbic acid (mg%)	Pectin (%)	Potassium (%)	Phosphorus (%)	Calcium (%)	Magnesium (%)
First crop of tea	Early harvest	41.72	360	3.40	2.49	1.19	0.55	0.54
	Middle harvest	40.48	414	3.57	2.37	0.91	0.58	0.43
	Late harvest	37.92	416	4.32	2.10	0.68	0.64	0.43
Third crop of tea	Early harvest	46.44	294	3.20	2.40	0.82	0.69	0.65
	Middle harvest	45.00	360	3.25	2.34	0.66	0.71	0.65
	Late harvest	41.12	270	4.66	2.16	0.53	0.71	0.58

H. Takayanagi et al., *Tea Res. J.*, No.61, 20(1985)