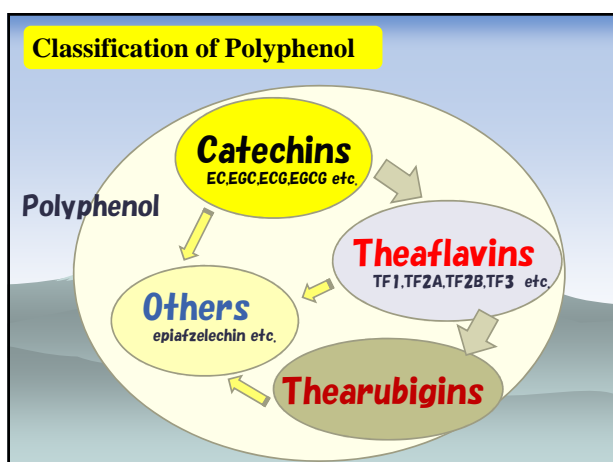


Classification of function of Japanese green tea

Function	Category	Sub-category	Components
Primary Function	Nutritional Function	Vitamins	VitaminC, VitaminE, β Carotene,
		Minerals	Potassium, Phosphorus, Zinc, Manganese etc
Secondary Function	Sensory Function	Taste	Theanine, Amino acid, Catechins, Caffeine etc
		Aroma	Terpene, Alcohol, Ester etc
		Color	Flavonol, Theaflavins, Chlorophyll
Tertiary Function	Body Modulating Function		Catechins, Flavonol, Caffeine, Vitamins, Amino acid, Minerals etc.



Catechins changed to theaflavins

The synthesis of Theaflavins from Catechins

Leading body	%1)
$(-)-EC + (-)-EGC \Rightarrow TF1$ Theaflavin	8.0
$(-)-ECG + (-)-EGC \Rightarrow TF2 A$ Theaflavin 3-o-gallate	30.0
$(-)-EC + (-)-EGCG \Rightarrow TF2 B$ Theaflavin 3'-o-gallate	20.0
$(-)-ECG + (-)-EGCG \Rightarrow TF3$ Theaflavin 3,3'-di-o-gallate	40.0

1) The ratio in Total Theaflavins of Black tea

Catechins

EC, ECG

EGG, ECGG

Theaflavins
(TF1, TF2A, TF2B, TF3)

The strength of the astringency

Theaflavins
TF3>TF2A,2B>TF1

Catechins
EGCG>ECG>EGC>C,EC

Comparison of chemical contents of green tea and black tea

Characteristic constituents of Green tea and Black tea (Dry weight)

	Green tea	Black tea
Amino acid (mg/100g)	4023.16	2355.32
Theanine (mg/100g)	875-3030	1461
Glutamic acid(mg/100g)	184-533	130
Chlorophyll(mg/g)	0.435-2.569	1.039
Carotene(mg/g)	0.0196-0.0510	0.017
Theaflavins(%)	0.00-0.33	2.31
Thearubigins(%)	0.00-11.51	14.45
EGCG(mg/g)	23.37-155.15	5.53
Total Catechins(mg/g)	36.62-279.22	17.36

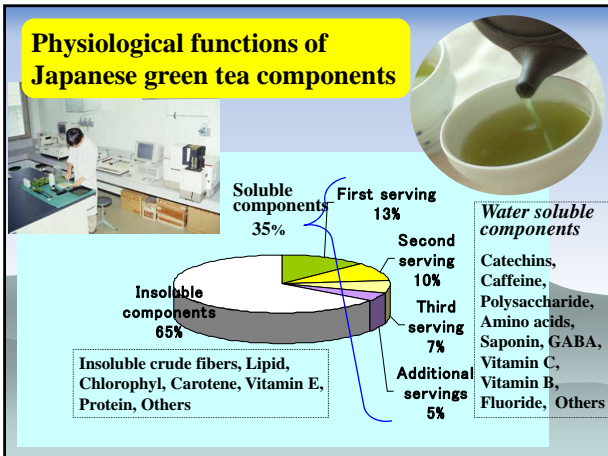
Comparison of chemical contents of green tea and black tea infusion

The chemical contents of green tea and black tea infusion (Dry weight %)

	Green tea	Black tea
Total Catechin	30-42	3-10
Theaflavin	0	2- 6
Polyphenol	2	3
Flavonol	8	24
Theanine	3	3
Organic Acids	2	2
Caffeine	3-6	3-6
Vitamine C	4	0



Physiological functions of Japanese green tea components



Physiological functions of green tea components

Green Tea Components	Contents	Functions
Catechins	10~18%	Anti-oxidative, radioprotective, Anti-mutagenic, Anti-tumor, Enzyme inhibitory, Anti-hypercholesterolemic, Anti-hyperglycemic, Fat reducing, Anti-hypertensive, Anti-ulcer, Anti-bacterial etc.
Caffeine	3~4%	Removal of fatigue, Sleepy feeling, Diuretic etc.
Vitamin C	150~250mg%	Removal of stress, Cold prevention
Vitamin B	1.4mg%	Excitometabolic action of carbohydrates and amino acids
Vitamin E	25~70mg%	Anti oxidative, Aging prevention
γ amino butyric acid	0.1~0.2%	Anti hypertensive
Flavonoids	0.6~0.7%	Halitosis prevention
Theanine	0.6~2%	Anti hypertensive

Physiological functions of black tea components

Black Tea Components	Contents	Functions
Theaflavins (+Thearubigins)	1~2%	Blood flow improvement effect. Anti-oxidative, Anti-mutagenic, Anti-hypercholesterolemic, Anti-virus , Anti-hyperglycemic, Fat reducing, Anti-hypertensive, Anti-ulcer, Anti-bacterial etc.
Caffeine	3~4%	Removal of fatigue, Sleepy feeling, Diuretic etc.
Vitamin C	0%	
Vitamin B	0.1mg%	Excitometabolic action of carbohydrates and amino acids
Vitamin E	11.4mg%	Anti oxidative, Aging prevention
γ amino butyric acid		Anti hypertensive
Flavonoids	1~3%	Halitosis prevention
Theanine	1.40%	Anti hypertensive

Book of health benefits of green tea



Characteristic of health benefits of black tea

- ☆ Blood flow improvement effect
(**Nothing in Catechins**)
- ☆ Anti-viral, bacterial action
(**Stronger than that of Catechins**)
- ☆ Anti-hypercholesterolemic action
- ☆ Anti-hyperglycemic action
- ☆ Anti-hypertensive action
- ☆ Fat reduce action



Anti-bacterial action in polyphenol

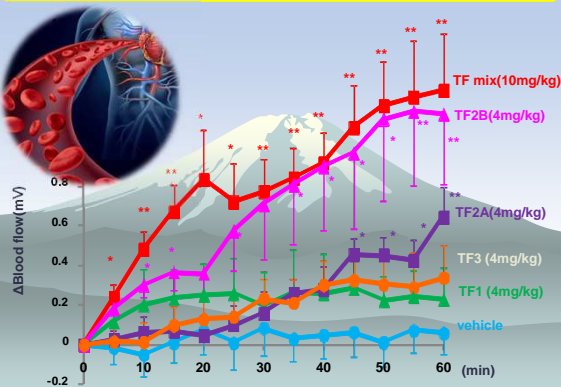
Theaflavins > Catechins

Comparison of minimum growth inhibiting concentration of tea polyphenol against bacteria (Hara, Y & Watanabe, M. 1999)

	<i>B.subtilis</i>	<i>B.sleurothermophilus</i>	<i>D.nigrificans</i>
	minimum growth inhibiting concentration(ppm)		
EGC	>800	300	>1000
EC	>800	800	>1000
EGCG	>800	200	>1000
ECG	>800	<100	>1000
TF1	>1000	200	>1000
TF2A	500	300	>1000
TF2B	450	300	>1000
TF3	400	200	>1000



Blood flow improvement effect of theaflavins

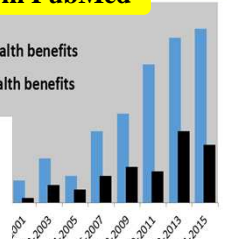
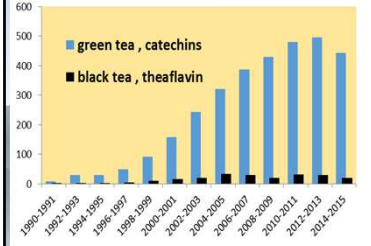


Number of papers from 1990 in PubMed

Search keyword

Green tea, catechins

Black tea, theaflavins



Search keyword

Green tea, health benefits

Black tea, health benefits

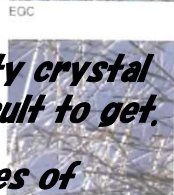
The possible reasons for the larger study of Catechins than Theaflavins

Crystals of catechins

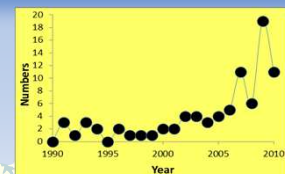
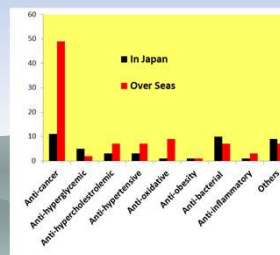
☆ **Absorbency in the body is low more than a catechins.**

☆ **A high degree of purity crystal of a theaflavins is difficult to get.**

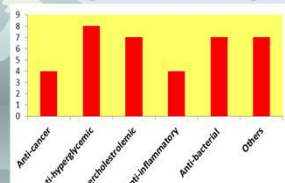
☆ **The chemical structures of thearubigins isn't decided**

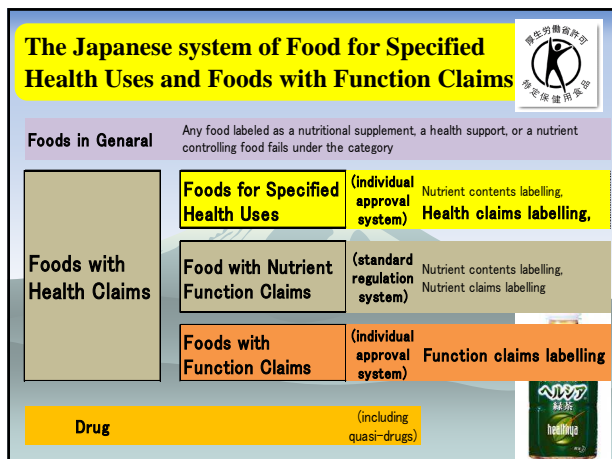


Change in number of papers and patents of theaflavins in Japan



Number of patents of theaflavins in Japan





The example of goods which focused on functionality

Classification	Fields	Goods
New Type of Tea	Utilization as tea	GABA tea, Mixed tea, Low caffeine tea, etc
	New form of tea	Packed tea, Tea bag, Matcha, Instant tea, Card type tea, Tea powder, Tea capsule, Tea tablet
Dietary Field	Use for food	Tea noodle, Tea candy, Tea gum, Tea cake, Tea chocolate, Tea jelly, Tea icecream, etc
	Food material	Tea flavor, Tea paste, Tea essence, powdered tea
	Supplement	Catechin tablet, Water soluble catechin, Theanine tablet
Daily Life Implement Field	For Clothing use	Shirt, Towel, Socks, Handkerchief, Mask, Pillow etc
	For Medical use	Catechin shirt, Catechin cover, Catechin mask
	For Make-up use	Foundation, Cream, Catechin soap, Skincream, Shampoo, Bath soft, Deodorant agent etc
	Daily necessity	Note, paper, Tissue paper, Toilet paper, Slipper
	Others	Wax, Filter, Pet food, Pure tea polyphenol compounds



Daily Life Implement Field
~For clothing and medical use~

Shirt, Towel, Socks, Mask, Pillow etc

Towel Handkerchief Pillow

Shirt, Socks Bedding

New Type of Tea
~New form of tea~

Packed tea, Tea bag, Instant tea, Card type tea, Tea powder, Tea capsule, Tea tablet etc

Tea capsule Tea powder (Stick type) Tea powder

Daily Life Implement Field
~For make-up use~

Foundation, Cream, Soap, Shampoo, Bath salt, Deodorant agent etc

Tea soap Skin cream Cream Skin care cream

Daily Life Implement Field
~Daily necessity~

Note, Letter paper, Tissue paper Toilet paper, Slipper etc

Tissue paper Deodorant tea Sterilizer Fan Toilet paper Insole of shoe

Daily Life Implement Field
~Others~

Wax, Filter, Pet food, Pure tea polyphenol compounds etc

Cat food Sterilizer Pet food Insecticide