

Tea is a medicine originally

Shen Nong

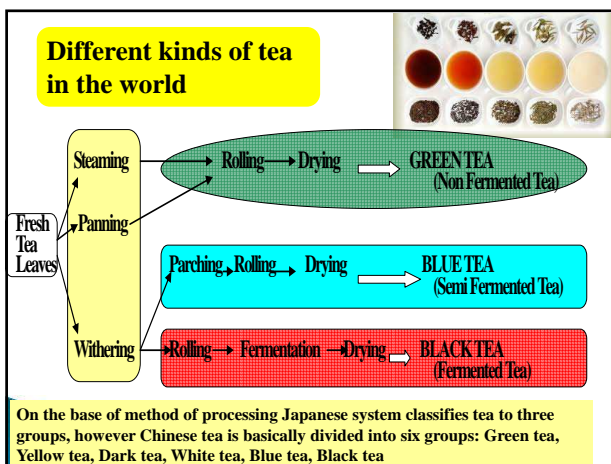
Shen Nong was an early emperor, scholar, herbalist and the Agriculture of God in posterior.

Tea is a top medicine

The oldest medicinal book

Tea have different chemical components from other plants

- ☆ **Caffeine**
- ☆ **Catechins of Gallate type**
- ☆ **Theanine (Free Amino Acid)**
- ☆ **Others (Fluorine, Aluminum etc.)**



Can make the various types of tea from the same leaves

Tea leaves

Catechines
Chlorophyll
Vitamine C

Green tea

Catechines ⇒
Chlorophyll ⇒
Vitamine C ⇒

Black tea

Theaflavins, Thearubigins
Pheophytin
Nothing (Oxide, Hydrolyzate)
like flowerly or fruity

Catechins changed to theaflavins

The synthesis of Theaflavins from Catechins

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

1) The ratio in Total Theaflavins of Black tea

The strength of the astringency

Catechins	Theaflavins
EGCG > ECG > EGC > C, EC	TF3 > TF2A, 2B > TF1

Green Tea
Catechins
Black Tea
Theaflavins



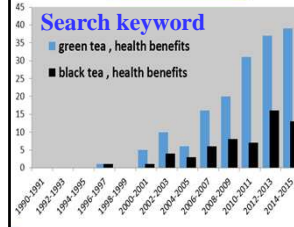
Comparison of chemical contents of green tea and black tea

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

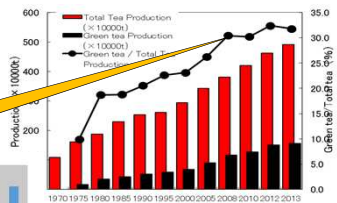
	Green tea	Black tea
Amino acid (mg/100g)	4023.16	2355.32
Theanine (mg/100g)	875-3030	1461
Glutamic acid(mg/100g)	184-533	130
Chlorophyll(mg/g)	0.435-2.569	1.039
Carotene(mg/g)	0.0196-0.0510	0.017
Theaflavins(%)	0.00-0.33	2.31
Thearubigins(%)	0.00-11.51	14.45
EGCG(mg/g)	23.37-155.15	5.53
Total Catechins(mg/g)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

Change of world tea production

Green tea production is on the rise, as it has high functionality

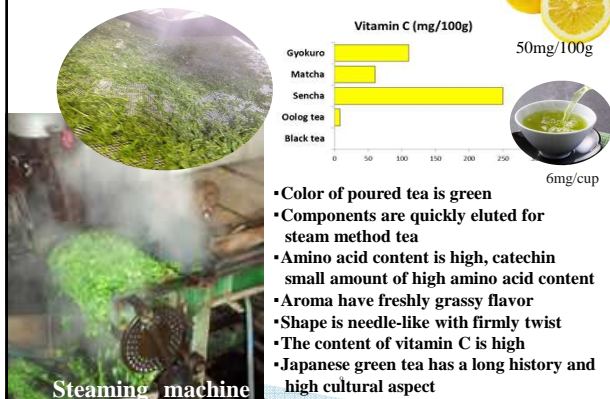


Number of papers containing green tea, black tea, catechins, theaflavins and health benefits from 1985 to 2015

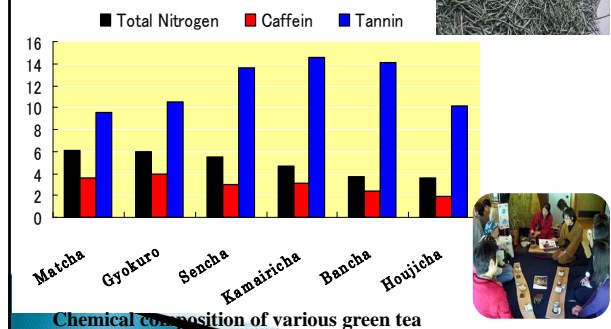


Shift in no. of research papers on catechin (Google Scholar)

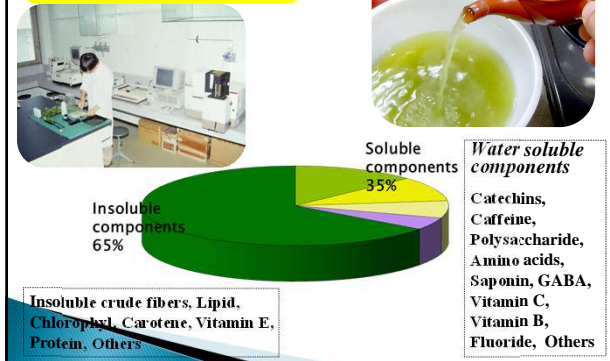
Characteristics of Japanese green tea



Chemical composition of various kinds of Japanese green tea



Main components of Japanese green tea

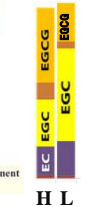


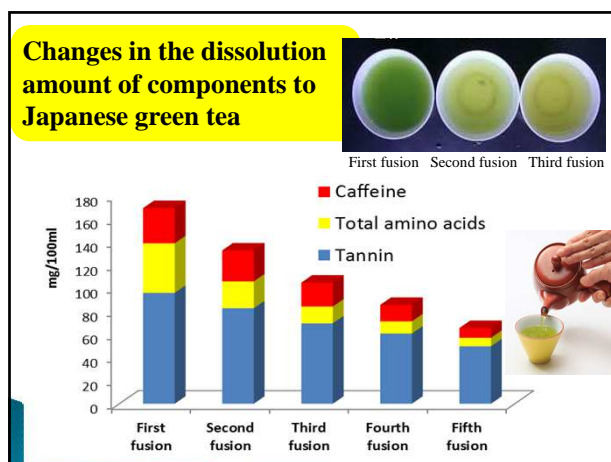
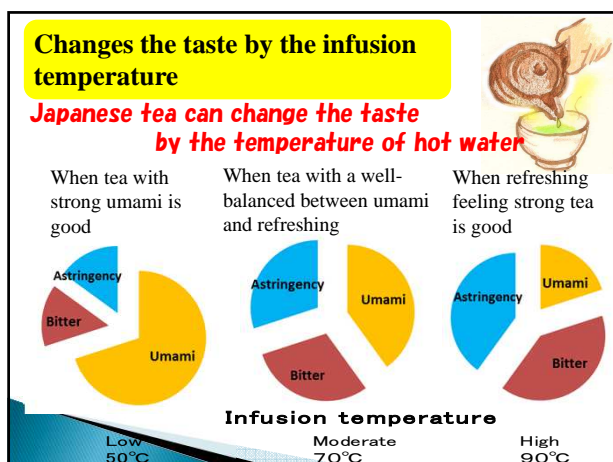
The soluble rate of chemical component is different on different water temp.



The major component and the taste of tea

Amino Acids	Theanine	Sweet, Umami
	Glutamic acid	Umami, acidity
	Epicatechin	Bitter
Catechins	Epigallocatechin	Bitter
	Epicatechin gallate	Astringent, Bitter
	Epigallocatechin gallate	Astringent, Bitter
Caffeine		Bitter





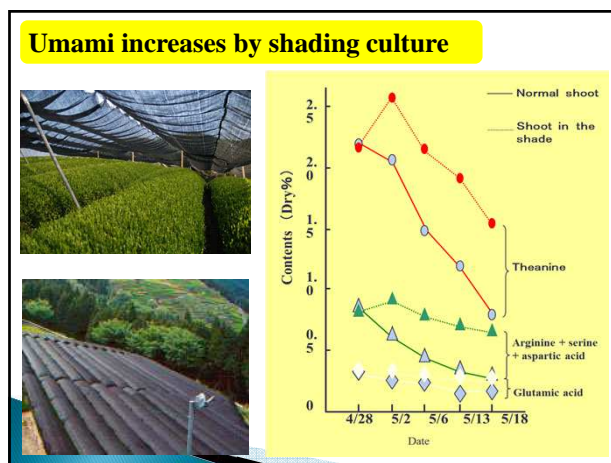
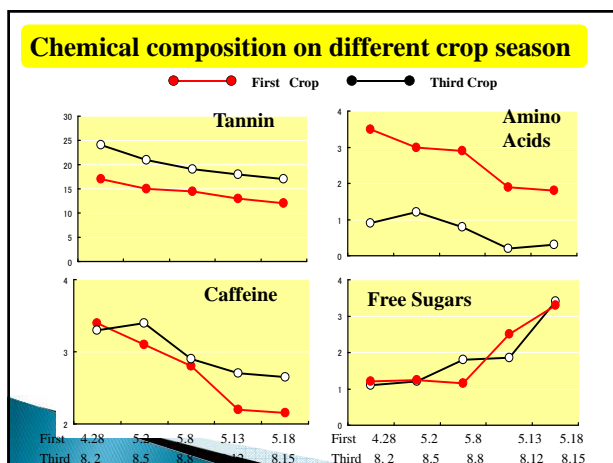
Standard brewing method for Japanese green tea

		Number of persons served	Volume of teacup	Volume of tea	Temperature of hot water	Volume of hot water	Infusion time
		persons	ml	g	°C	ml	seconds
Gyokuro	High grade	3	40	10	50	60	150
	Middle grad	3	40	10	60	60	120
Sencha	High grade	3	100	6	70	170	120
	Middle grad	5	150	10	90	430	60
Houjicha		5	240	15	100	650	30
Bancha		5	240	15	100	650	30

Chemical composition of various leaf order

Chemical Composition of Various Leaf Order(%)

Leaf Order	Tannin	Caffeine	Amino acids	Free Sugars
One and a Bud	14.45	3.50	3.11	0.77
Second Leaf	13.02	3.00	2.92	0.81
Third Leaf	12.79	2.65	2.34	1.02
Fourth Leaf	12.69	2.37	1.95	1.59
Stem	6.23	1.31	5.73	2.61



Matcha is super food



Matcha.

It is possible to consume vitamin A (beta carotene), vitamin E (tocopherol), dietary fiber etc which can not be ingested with tea brewed in teapot.



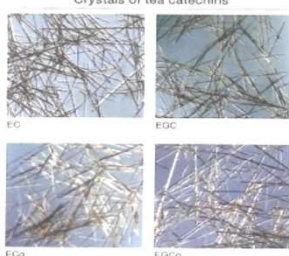
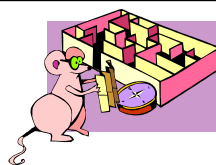
- ☆ Matcha is delicious
- ☆ When brewed with teapot, about 40% of catechin remains in the tea shell, in Matcha all can be ingested.
- ☆ Green color of matcha is beautiful, It is also used for sweets such as cakes and foods.

Physiological functions of green tea components

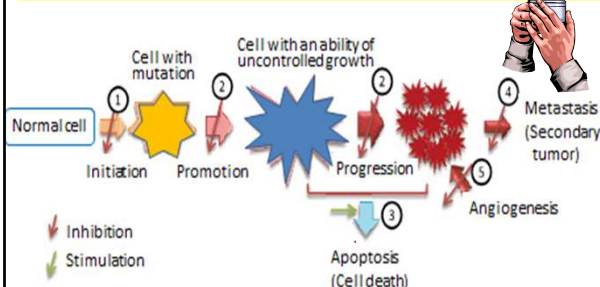
Green Tea Components	Contents	Functions
Catechins	10~18%	Anti-oxidative, radioprotective, Anti-mutagenic, Anti-tumor, Enzyme inhibitory, Anti-hypercholesterolemic, Anti-hyperglycemic, Fat reducing, Anti-hypertensive, Anti-ulcer, Anti-bacterial etc.
Caffeine	3~4%	Removal of fatigue, Sleepy feeling, Diuretic 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

Functionalities of Catechin

- ◆ Antioxidant
- ◆ Antimutagen
- ◆ Cancer-fighting
- ◆ Oxidation resistant
- ◆ Anti-atherogenic
- ◆ Lowers blood cholesterol
- ◆ Lowers fat absorption
- ◆ Antibacterial, antiviral
- ◆ Prevents cavities
- ◆ Improves intestinal flora
- ◆ Eliminates odors
- ◆ Controls blood pressure
- ◆ Etc. Etc. Etc.



Cancer development and actions of tea catechins



Cancer progresses through several stages as it develops including initiation, promotion, progression, and metastasis. Green tea catechins have been shown to exert anti-cancer effects at each of these stages.

Epidemiological studies on correlation between green tea intake and the risk of human cancer

Study type	Cohort		Case-control	
	Risk reduction	No risk reduction	Risk reduction	No risk reduction
Colon	3	6	4	3
Lung	0	4	2	3
Stomach	2	6	8	8
Esophagus	0	2	4	5
Breast	3	5	3	0
Prostate	2	0	2	0
Ovaries	1	0	2	0
Pancreas	0	2	2	1
Kidney and bladder	0	1	1	4
Liver	1	0	0	0
Endometrium	0	0	2	1
Thyroid	1	1	0	0
Blood	1	0	0	0

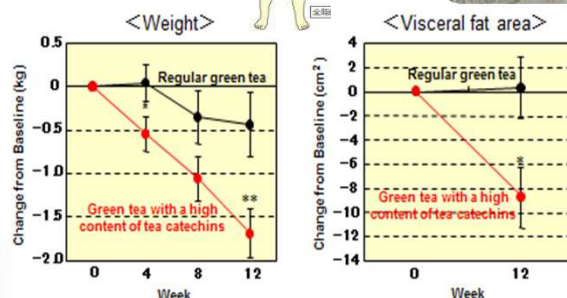
Cohort study:

a group of similar individuals who differ with respect to certain factors under study to determine how these factors affect the rates of a certain outcome.

Case-control study:

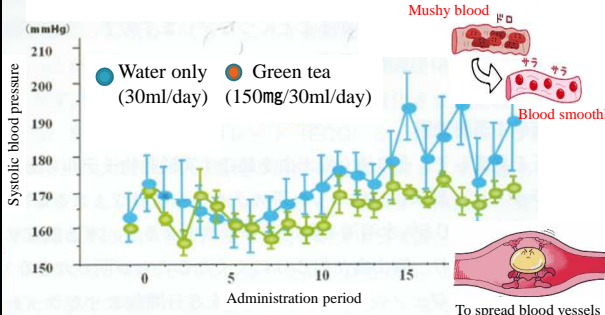
two existing groups differing in outcome are identified and compared on the basis of some supposed causal attribute.

Effects of catechins on weight and visceral fat area

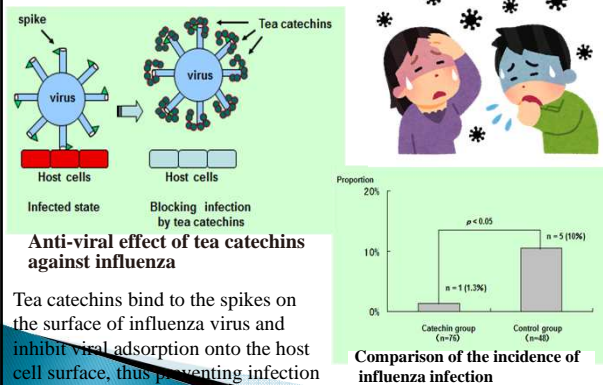


Effects of catechins on suppression of blood pressure increase

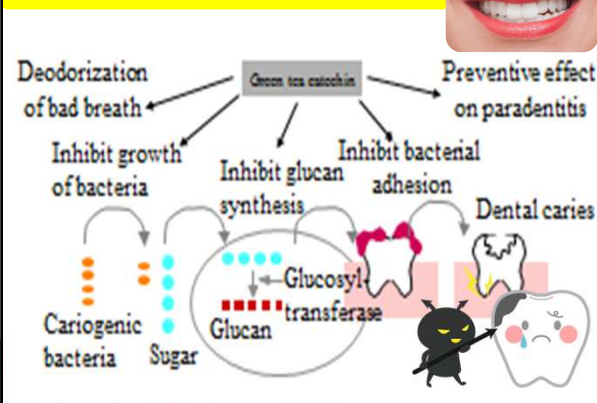
Change in the blood pressure of subjects taking green tea.



Effects of catechins on influenza virus *



Effects of catechins on dental disease



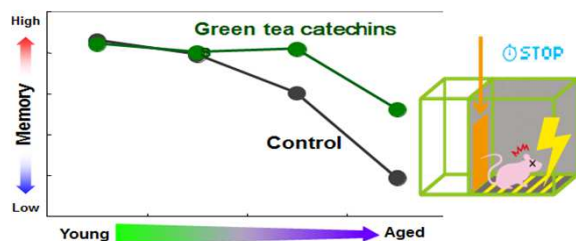
Anti-bacterial action in polyphenol

Theaflavins > Catechins

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

	<i>B. subtilis</i>	<i>B. sphaerothermophilus</i>	<i>D. nigricans</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

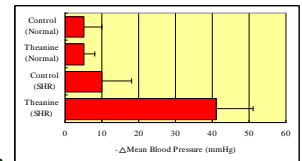
Memory retention in mice ingested catechin



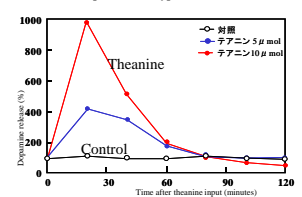
Senescence-accelerated mouse (SAMP10) shows memory decline with aging. As mice prefer a dark place, mice move into the dark box when placed in the light box. However, when mouse was given a weak electric shock through the floor of the dark box, mouse learned not to enter the dark room. Memory retention was tested one month later using same test. Memory decline was much suppressed in mice ingested green tea catechins than in control mice that ingested water.

Functionalities of theanine

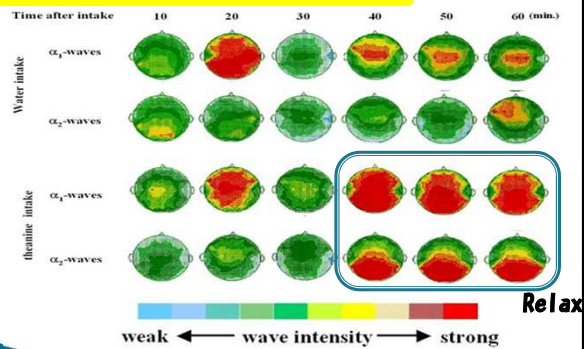
- Regulates cranial nerves performance
- Prevents vascular dementia
- Strengthens anti-tumor agents
- Anti-hypertensive



Effect of theanine on mean blood pressure in normal and spontaneous hypertensive rats (SHR)

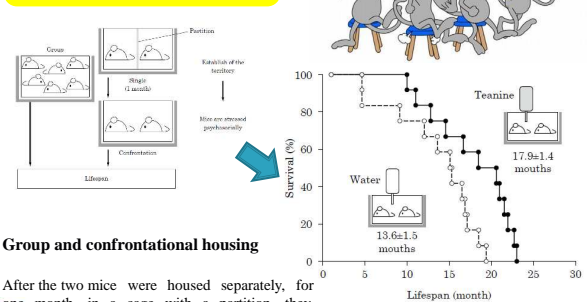


Effect of theanine on relaxation



Electroencephalographic measurement of alpha waves shows higher frequencies among human subjects taking theanine as compared to those taking water.

Effect of theanine on psychosocial stress



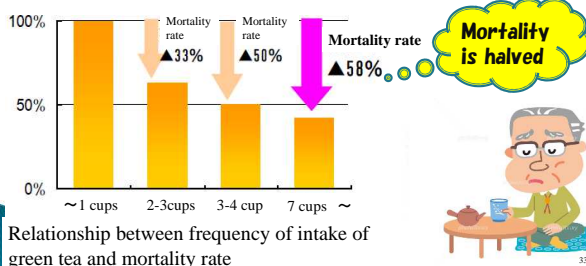
After the two mice were housed separately, for one month, in a cage with a partition, they were housed confrontationally by removing the partition. Generally, group housing mice have long lifespan more than the stress mice.

Prolonged lifespan of mice by theanine intake

Tea is a longevity medicine

The elderly who drinks many green tea lives longer

People who drink 7 or more green tea a day live long



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
	Beverage	Can drink, Bottle, Tetra pack, Tea wine, Sport drink
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

Thank you for your kind attention

