



TEA CONSTITUENTS AND HUMAN HEALTH

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Abstract:

Tea is the most common beverage after water. The phenolic compounds contained in certain foods have potential health benefits. The present review focuses on the beneficial effect of tea consumption on human health and analysis of commercial tea samples (Tea extract) was performed for pH, conductance, acidity, alkalinity, turbidity, natural minerals (elements such as Copper, Nickel, Lead, Iron, Aluminium, Calcium, Magnesium, Zinc etc.) and glucose. These contents in tea correlated to different commercial tea and coffee samples.

Keywords: Antioxidants, Tea consumption and health benefits, natural minerals, carbohydrate etc.

Introduction:

Tea is extracted from the leaves of camellia Sinensis (family: Theaceae). The commercial tea is available mainly in three forms black tea, green tea and Oolong tea. The three forms differ only in the method of processing the leaves i.e. depending on post-harvest treatment. Unwilted & unoxidised for Green Tea. Wilted and unoxidised for white tea, Wilted and partially oxidized for Oolong tea, Wilted and fully oxidized for black tea. The Black tea is by far the most popular among the Black tea, Green tea, Oolong tea and white/Ilex tea etc.

The tea consumed 78% black tea in Western countries, 20% green tea in Asian countries, 2% Oolong tea in southern china. Tea is made from the young leaves and unopened leaf buds and has a varied chemical composition.¹⁵

Polyphenols: 30%	Caffeine: 2.4%
Other alkaloids: 1.2%	Carbohydrates: 4%
Theanine: 2%	other amino acids: 2%
Organic aminoacids :0.5%	Volatiles
0.01% (sulphur compound)	

Tea is linked to beneficial effects on human health with polyphenols as the responsible constituents.^{4,9,10} Tea leaves as well as the resulting beverage tea are known to possess high amounts of polyphenols especially flavanols the so called Catechins.⁵ Fresh tea leaf is rich in water soluble polyphenols particularly flavanols, flavanol gallate and flavanol glycosides.⁶ Tea has taste and fragrance. The complex catechins such as theaflavins (2 to 6% and bright red orange) contribute to taste. The caffeine, polyphenols and essential oils (volatile oils consists of alcohols, aldehydes, phenols and some fatty acids) contributing to the flavor.

The pigment thearubigins are the **major polyphenols of black tea**. Major catechins present in tea are (-) epicatechin (EC), (-) epigallocatechin gallate (EGCG), (-) epigallocatechin (EGC) and (-) epicatechin gallate (ECG) and β -Catechin.¹⁷

1. Tea with antioxidant property: The powerful antioxidant properties of the tea are generally attributed to its flavonoid components, theaflavins, bisflavanols and theaflavic acids.¹¹ The Catechins of tea may act as the free radical scavengers which remove endogenously generated superoxide, peroxy and hydroxyl radicals that are formed in the process of metabolism.¹⁷ EGCG scavenging the allyl peroxy radical. The bioavailability of the tea Catechins with milk did not impair. The depletion of antioxidant effect is due to associations between the tea flavanols and milk fat rather than proteins.¹²

2. Tea with anticancer property (potential): The EGCG (polyphenols) have exhibited chemopreventive effect i.e. inhibitory effects against the formation and development of various types cancers. e.g. Tumors,¹⁸ stomach cancer, Prostate cancer, breast cancer (stage I and II), Colon cancer, lung cancer, esophageal cancer etc. Recent studies have shown that the positive association between tea and esophageal cancer was because of the high temperature at which the tea is consumed.

3. Tea for oral health: Tea promotes healthy teeth and gums; Superior periodontal health therefore it is functional food for oral health. The polyphenols that have antibacterial properties against oral pathogens such as streptococcus mutans.¹⁹ Tea is good source of fluoride. The trace fluoride mineral (1 ppm) helps get beautiful white teeth and prevent tooth loss and oral cancer. It is found that fluoride element increase bone mineral density (BMD) in pharmacological doses.¹⁴

4. Tea effective in kidney (renal) failures: EGCG recovered glomerular filtration rate, increased glutathione (antioxidant levels) and reduced malondialdehyde and inflammatory cytokines.

5. Tea as nanoparticles: The phenolic compounds are disinfectants in food systems.

Delivering EGCG (antimicrobial agent) using lipid nanocapsules and liposome encapsulation to better control pathogens for commercial food safety application.²⁰

6. Effectiveness of tea in skin damage: EGCG effective in slowing down in process of aging. Inhibits matrix metalloproteinase enzymes, cytokines etc. Prevents solar UVB light induced skin disorders including photo aging; melanoma and non-melanoma skin cancers.²¹

7. Tea prevents hair loss: The tea affects on the 5 α -reductase type I enzymes which converts testosterone to DHT.²² The sex hormone binding protein globulin, which carries testosterone hormone around the body. Therefore reducing levels of free testosterone, so that it cannot be converted to dihydrotestosterone (DHT) in the hair follicle. This is thought to shorten the hair cycle and cause hair loss in men and proves healthier for hair growth.

8. Antibacterial and antifungal activity of tea: Polyphenols fights/suppress the growth of pathogenic bacteria eg. Escherichia Coli, Salmonella typhi, Staphylococcus aureus and Pseudomonas species²³ and also inhibit reproduction growth of the medically important bacteria eg. Salmonella, Clostridium and Bacillus.²⁴ The catechins against fungal activity eg. Candida albicans and Aspergillus fumigatus has been explored.²³

9. Tea improves Insulin sensitivity: Green tea consumption may help to prevent type-2 diabetes. The flavanoids have antidiabetic effects.²⁷ Tea prevents glycogen accumulation in the renal tubules. Lowers blood levels of glucose (Improves glucose tolerance)

10. Tea protects against Cardiovascular Diseases: Regular consuming G. tea inhibit atherosclerosis, lowers risk of stroke, reduces blood pressure (block thromboxane and Angiotension converting enzymes)²⁸. Suppresses

platelets aggregation and prevents thrombosis, heart attack and brain strokes.

11. Tea helps in combat obesity: G.T catechins and EGCG reduces adipocytes differentiation and proliferation lipogenesis i.e. birth of new fat cells.²⁶ GT sends glucose to muscles where it is used for energy rather than to fat tissue, where it is stored (Burns fat and fight obesity)

12. Tea for good vision: EGCG can protect human retina against UV damage in cultured human retinal pigmented epithelial cells²⁹ protects against the formation of cataracts reduce free radical damage (Protect eyes)

13. Tea has Antiviral potentials: G.T blocks viral attachment and entry into cells. EGCG have anti-HIV activity in each step of the HIV life cycle.³⁰ EGCG binds with CD₄³¹, inhibits adenovirus infection and influenza viruses. (EGCG binds to the hemagglutinin of the influenza virus).GT Catechin and Theanine are effective in preventing influenza.³²

14. Therapeutic Potentials of Tea: Prevents nerve degeneration in P&A disease. GT have neuroprotective properties i.e. Therapeutic potentials against Parkinson's (dopamine related) and Alzheimer's disease (H₂O₂ and β -amyloid related).³³

15. Antiallergic potential of Tea: O-methylated derivative of EGCG isolated from Oolong tea is reported to have more inhibitory effects on type I and IV allergies in mice than does EGCG³⁴.

16. Synergism with antibiotics: useful in fighting drug resistance problem especially among enteropathogens²³. G.T. catechins have antimicrobial activity. The activity of G.T. extract is enhanced in combination with antibiotics e.g. with Penicillin G against Bacillus Subtilis bacterium.³⁵

Result and Discussion: Parameter estimated for employing the standard methods.¹ The values of parameters of commercial tea samples varied are presented in Table 1.

Table 1

Tea/Coffee Brand	Acidity ppm of CaCO ₃	Vitamin-C per gm C.A.S method	Fe(II) per gm KMnO ₄ method	Fe(II) per gm K ₂ Cr ₂ O ₇	Al(III) per gm ZnSO ₄	pH pH-Metry	Conductance --- x10 ⁻³	Fe(III) Per gm dust, H ₂ SO ₄	Zn
Josh	273	0.037	0.578	0.067	0.008	7.34	0.94	0.0309	
Super dust	247	0.074	0.604	0.112	0.011	6.92	0.98	0.0319	
Coffee Normal	169	0.034	0.788	0.101	0.016	6.68	0.62	Absent	
Pe shawai	279	0.070	0.638	0.122	0.012	6.63	0.81	0.0227	
KeJgur Golden leaf	227	0.037	0.667	0.122	0.015	6.90	0.76	0.0206	
Wagh Bakari	279	0.087	0.684	0.101	0.013	6.85	0.90	0.0184	
Amber	286	0.067	0.627	0.056	0.001	7.11	0.92	0.0381	
Mast-Anant Natraj	253	0.084	0.569	0.056	0.014	7.05	0.86	0.0206	
Green Tea	390	0.070	0.604	0.101	0.010	7.01	0.61	0.0247	
Coffee (Nescafe Sunrise)	149	0.341	1.708	0.112	0.020	7.08	1.18	Absent	

Table 2.

Sr. No.	Parameter studied	mg/1gm	Method used	Sr. No.	Parameter studied	mg/1gm	Method used
01	Copper (samples)	----	EDTA-Fast Sulphone black Fand Iodometry	08	Zinc (Tata Agni)	294	Ionexchange chromatography
02	Nickel (samples)	----	EDTA - Murexide indicator	09	Iron (II) (Tata Agni) Iron (II) (Coffee)	123 73	K ₂ Cr ₂ O ₇ titration
03	Lead (samples)	----	EDTA	10	Iron (II)	896	KMnO ₄ -redox titration
04	Calcium(Peshvai Tea)	140	EDTA - Patton Reader indicator	11	Glucose (Tata Agni)	270	Iodometry
05	Magnesium(Peshvai Tea)	126	EDTA - Erichrome black T indicator	12	Freeacid (Tata Agni)	----	Alc.KOH (0.01N)
06	Magnesium (Tata Agni)	02	EDTA	13	Alkalinity(Tata Agni) (ppm)	1200 560	Methylorange alkalinity Phenolphthalein alkalinity
07	Magnesium (Tata Agni)	34	Ion exchange chromatography	14	Turbidity (Tata Agni) (ppm) Coffee (ppm)	30 9.5	Turbidity

Amino acids degradation is involved in the biogenesis of the tea aroma. The Chlorophyll, Carotenoids, lipids, volatile compounds play an important role in the development of the aroma. Analysis of fresh leaves of Indian tea gave the following composition, values in percentage. Polyphenols: 22.2%, Ash: 5.6%, Starch: 0.5%, Protein: 4.3%, Crude fibre: 27.0%. The maximum amount of caffeine is present in the bud. Coffee contains more caffeine than Tea. The caffeine of tea and coffee consumption stimulates the brain temporarily.

Conductivity: It is an indirect measurement of the minerals. Conductivity of Tea and Coffee extract is due to the presence of natural minerals (essential and non-essential elements). The ash content in tea and Coffee is 5.6% and 10% respectively.² More conductance values were observed by Coffee extract compared with tea extracts.

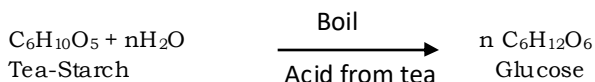
pH: It is the polyphenols compounds and flavonoids of Tea and coffee. The relative pH of these beverages around pH 7 was observed. Catechins are polyphenols with two hydroxyl

groups in β-ring of the catechin molecule. The black tea contains 15 mg catechin per 100ml.³

Vitamin C: Coffee contains 20% vitamins.² The vitamin C content in Coffee is more than Tea was observed. Vitamin C along with other vitamins E, K, A & B (low levels) present also in these beverages. The antioxidant activity of EGCG is about 25-100 times more potent than vitamin C, Vitamin E and Zeaxanthin (flavonoid).^{37,38} Vitamin C along with other antioxidants has potential of the molecular level and helps to prevent cell damage from certain oxidation reactions in the human body.

In tea samples methyl orange alkalinity greater than phenolphthalein alkalinity it is due to OH⁻. Due to alkalinity and polyphenols content of tea acts as surfactants (detergent action).

Glucose: The starch is a polymer and polysaccharides when tea containing starch was boiled in distilled water, starch undergoes hydrolysis and gives glucose. Tea containing polyphenols (acids) may act as a catalyst.



Acidity: The polyphenols and flavanols of tea are water soluble. Free acids are absent in Tea extract. The acidity of tea extract was due to ferulic acid (phenolic compound), theaflavinic acid (flavonoid-bright red orange colour) and Chlorogenic acid, Coumarylquinic acid (glycosides of flavanols) Acidity order: Green Tea > Black Tea > Coffee

Acidity of coffee extract was due to Chlorogenic acid and least predominant acetic acid. During roasting chlorogenic acid and other acids such as citric acid and malic acids are partially destroyed.

Aluminium content: Aluminium is a non-essential element. Order of Al content: Coffee > Black tea > Green Tea.

Iron: Metal ions promote the antioxidant property of tea. Fe affects the taste of tea and coffee. The Fe(II) content in tea and coffee beverages was varied with different commercial samples. The more volume of KMnO₄ (oxidizing agent) consumed by coffee extract compared with tea extract. Therefore coffee is rich in antioxidants. Order of Fe (II) content: Coffee > green Tea > Black Tea. The Fe(III) content in coffee samples was absent. This is because Fe(III) is chelated. The antioxidant (flavonoids) of coffee prevents oxidative reactions by chelating free Iron (III) and Copper (II).

Copper, Nickel & Lead: Investigation found that Cu (II), Ni (II) and Pb(II) were absent in these beverages.

Fe Integral part of hemoglobin. The iron is essential to all organism as oxygen carrier. It's deficiency cause anemia. High Fe in body cause hemochromatosis, hemochromatosis (bronze diabetes) Nickel is non-essential element. High Ni contaminations in body cause cancer of lung and sinus. Lead is one of the hazardous and potentially harmful polluting agents.

Calcium : It is used in cell walls, bones and some shells. It helps in blood coagulation, muscular contraction and nervous excitability in human body. High Ca in body cause calcification of tissues formation of stone (Ca-Oxalate) and cataract.

Magnesium : It helps in proper functioning of nerves and muscles (impulse transmissions) of human body. Recently, Investigation found that Magnesium inhibit Type-2 diabetes it may due to impulse transmission in muscle. Its deficiency caused neuromuscular irritation.³

Zinc : It is used in enzymes and control cell growth division, function (RNA and DNA synthesis) High Zn in body cause irritation and damage mucus membrane, gastric ulcer, pancreatitis.

The White tea controls D.N.A damage, Green Tea increases digestive process and improve youth. Black Tea strengthens the arteries.³⁹

Experimental: The extracts were obtained from one gm of tea commercial tea & coffee samples each in distilled water where heated to boil off. Then extract was filter with ordinary filter paper, the volume of filtrate made 100 cm³ for each. These filtrates (10 cm³ diluted solution) were used for estimations. Repeat the procedure for each sample. The water extract of samples were kept in room temperature in dark place during experimental work.

Conclusion: Daily limit tea consumption give sufficient support to human body to fight various disease. The tea and coffee has pharmacologically potent (medicinal value) and have low or no side effect so it is natural remedy to almost all the health related issues.

Acknowledgement:

The author is thankful to the Principal Br. Balasaheb khardekar college, Vengurla for providing necessary laboratory facilities to carry out this work.

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