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Synergistic Activity of Tea with some common Medicinal Plants: A Review

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Abstract

A review work has been done on the Synergistic activity of tea with some common medicinal plants**.** Tea is an aromatic beverage prepared by using the leaves of *Camellia sinensis*. Many people use tea with some medicinal spice and herbs for health purpose and as well as stimulant.In the present review Green Tea and Black Tea both are with the plants namely- tea (*Camellia sinensis*), ginger (*Zingiber officinale*), black pepper (*Piper nigrum*) and tulsi (*Ocimum sanctum*) clove (*Syzygium aromaticum*) lemon (*Citrus limon*) have beenselected as all these plants show flavonoid, antioxidant antimicrobialpotential individually. It was observed that various herbs have different bioactive components with different antioxidant activities. When they are mixed together, the mixtures shows higher or lower antioxidant capacity than their individual extracts. It may be due to synergistic interaction among different biochemical compounds.

After water, tea is one of the most ancient, cheapest and most widely consumed health beverages throughout the world for its health, sensory, stimulant, relaxing and cultural properties[3]. Primary studies showed the presence of secondary metabolites and presence of antioxidants and antimicrobial properties in green tea[6]. Tea having polyphenols, flavonoids, especially catechins, are the leading functional components, which accounts for 30% of the dry weight of green tea leaves. To enhance the tea flavour and medicinal properties, various tea combinations are available commercially. The combination of plant products may exhibit different types of interactions (synergistic) among their different phytochemicals, and may change or enhance their biological properties. These varieties are absolute paramount, but limited scientific data is available that whether these combinations

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Table-1. List of Medicinal plants used with tea to enhance its properties

Sl No.	Scintific Name	Common Name	Family	Plant part used in tea
1	*Zingiber officinale*	Ginger	Zingiberaceae	Rhizome
2	*Ocimum gratissimum*	Tulsi	Lamiaceae	Leaves
3	*Citrus limon*	Lemon	Rutaceae	Fruit juice
4	*Syzygium aromaticum*	Clove	Myrtaceae	Flower bud
5	*Piper nigrum*	Pepper	Piperaceae	Fruit parts

(theplantlist.org)

will act in a synergistic manner. The synergistic effect is the effect of two or more processes interacting together to produce an effect that is greater than the cumulative effect that those processes produce when used individually. In medicine, the interaction of two or more drugs when their combined effect is greater than the effects seen when each drug is given alone (Table-1).

The ginger (Zingiber officinale) ginger root or ginger rhizome is widely used as a spice and a folk medicine, the active principles Gingerols and their corresponding dehydration products are responsible for strong antioxidant activity.

Black pepper(Piper nigrum) a popular spice shows potential antioxidant activity. The main bioactive constituent is piperine,it increases the bioavailability of many phytochemicals present in food items.

Tulsi *(Ocimum* sp***)*** is commonly known as "Queen of plants". It is a very good source of linalool, eugenol, and cineole etc.For the presence of eugenol it shows antioxidant property and also thought that it is responsible for inhibition of lipid peroxidation.

Citrus limon: Lemon juice contain phenolic acid, ascorbic acid, citric acid, limonoids, carotenoids, minerals and flavanone (naringin)prevents many diseases associated with oxidative stress.

Syzygium aromaticum : The main active constitutes are eugenol and shows antimicrobial and antioxidant activity.[4]

Table-2. Phytochemical composition of green tea and black tea

S.No.	Phytochemical
1	Tannins
2	Caffeine
3	Terpenoids
4	Cardiac glycosides
5	Saponins
6	Steroids
7	Phenol
8	Flavonoids
9	Quinones
10	Catechin
11	Epigallocatechin
12	Epicatechin
13	Epicatechingallate
14	Epigallocatechingallate
15	Gallocatechin
16	Theaflavin
17	Theaflavin-3,3' digallate

(Rani R *et al.*,[9])

Table-3. Phytochemical composition of Medicinal drugs

Phytochemical	*Syzygium aromaticum*	*Piper nigrum*	*Zingiber officinale*	*Ocimum gratissimum*	*Citrus limon*
Bioactive compounds	+				
Antioxidant compounds	+	++	+	+	
Tannins		+		+	
Phenol					+
Phenolic Acids	+				
Flavonoids	+	+	+	+	
Oleoresin			+		
Volatile oil	+	+		+	+ (peel)
alkaloids					+
Steroids			+	+	+
Saponin				+	+
Glycosides			+	+	
Cardiac glycosides		+			+
Ascorbic acid					++
Carbohydrates			++		(Reducing sugar) ++

(researchgate.net).

In the present study, green tea (GT) and black tea (BT) used as base, The individual medicinal plants (tea, ginger, black pepper and tulsi) and different mixtures of extract of tea with other medicinal plants parts have been evaluated for synergistic antioxidant potential. Since antioxidant potential of herbal extract mainly depends on the concentration of total polyphenols and flavonoids therefore we determined their concentration based on the standard methods and correlated with their free radical scavenging activity (Table-2).

Antioxidant potential in medicinal drugs-Antioxidant potential depends on the presence of phenolic compounds and flavonoid compounds, thus the higher antioxidant potential of tulsi and tea can be attributed to the high amounts of polyphenols like, cubenol, eugenol, and flavon-3-ols, epicatechin, epicatechin, catechingallate, and their fermentative products– theoflavins, thearubigin dissolvable in water (Table-4).

Table-4. Antioxidant potential of aqueous extracts and their polyherbal combinations of some medicinal drugs

Extracts and their polyherbal combination In ratio	% Inhibition by DPPH* Assay Aqueous Extract
Tea	81.83
Ginger	30.36
Black Pepper	35.20
Tulsi	96.17
Tea: ginger (1:1)	94.64
Tea: black pepper (1:1)	87.50
Tea: tulsi (1:1)	96.68
Tea : ginger: black pepper (1:1:1)	84.44
Tea : black pepper: tulsi (1:1:1)	96.68
Tea: ginger : tulsi (1:1:1)	98.46
Tea: ginger: black pepper : tulsi (1:1:1:1)	98.72
Gallic acid (Standard) (h)	95.66

(Gupta *et al.*,[5])

The study shows that the best synergistic combination is tea, ginger, black pepper, tulsi (aqueous extracts).[5]

Antioxidant and antimicrobial activity–In the present study,we come to know that,antioxidant and antimicrobial activity of the different clove based herbal teas The total polyphenol content (TPC) and Total Flavonoids Content (TFC) of green and black tea were determined and compared with the mixture of clove and tea respectively It is observed that the increasing concentration of clove, TPC and were also increases linearly as evident from the above study. In case of green tea, the TPC and TFC concentration is decreasing towards the high to low concentration of mixture. Statistically significant differences were observed among these different concentrations of clove based tea with the normal one. For black tea, similar data was observed. In case of black tea, the decreasing order of TPC and TFC concentration is (lowBT conc.+High clove conc.) > (high BT+Low clove conc.) sequentialy. That result was also statistically significant.[4]

Antimicrobial activity against Gram-positive bacteria *S. aureus*and gram-negative bacteria *E.coli*, increased. The significant antimicrobial activity showed by the clove herbal infusions provides us with an easily available antimicrobial agent, that are effective against bacterial infections[7].

Antioxidant activity and chelating effect of lemon and tea -

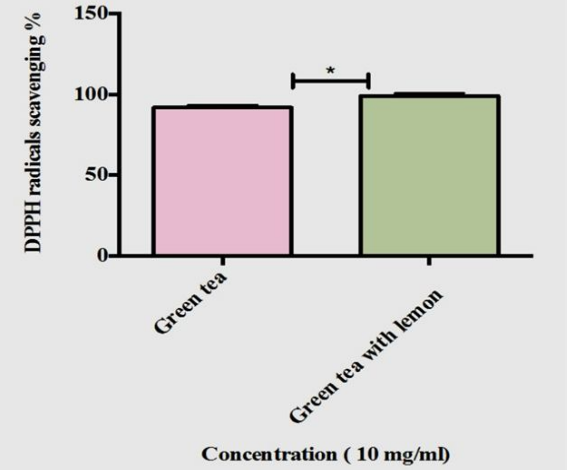

Figure 1. Radical scavenging activity of green tea without and with lemon. The value expressed as mean ± SD (n = 3) of triplicate measurements. Comparisons of means were made using unpaired t-test (*$p < 0.05$).

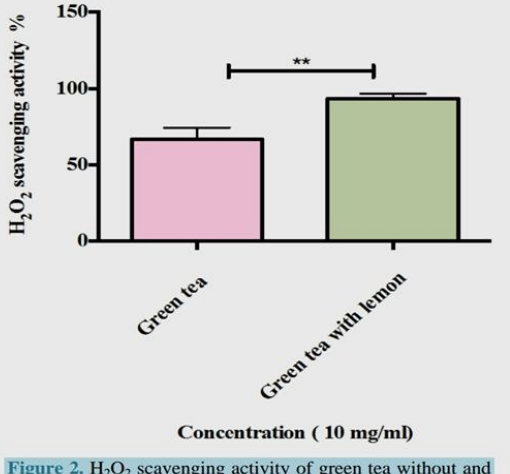

Figure 2. H_2O_2 scavenging activity of green tea without and with lemon. The value expressed as mean ± SD (n = 3) of triplicate measurements. Comparisons of means were made using unpaired t-test (**$p < 0.005$).

(A. B. Al-Ghafari*et al.*,[2])

It was also reported that, green tea has high radical scavenging ability by using DPPH free radical scavenging method. The green tea with lemon showed more polyphenol contents than green tea . Due to the presence of additional phenolic compounds in lemon,which increase the amount of antioxidant in our body. Flavonoids have a direct role in scavenging free radicals produced mostly as reactive oxygen species (ROS) found that naringin, which is a part of lemon flavanone, can stimulate the immune system to avoid oxidative damage caused due to oxidation, by increasing the activity of the body's antioxidant enzymes including catalase, glutathione peroxidase and superoxide dismutase. These enzymes catalyze the dismutation of superoxide radical, which is the most common free radical in the body, into hydrogen peroxide (H_2O_2). As a result, the addition of lemon might increase the ability of samples to reduce amount of H_2O_2. (Ayabe *et al.*)[1].

The ability of lemon to chelate iron was weak, that naringin did not chelate iron completely because it was incapable to overrun all active sites of iron. It indicatedthat, the main component of lemon, citric acid was not a good chelating agent for ferrous ion and its chelating ability was low. The high chelating iron activity in this study derived from green tea and it might be due to the specific functional group in its catechinflavanols structure.[2]

On the basis of above discussion the antioxidant potential of plant extract depends on the phenolic compounds and flavonoids present in that particular extract.

Green tea and ***Ocimum gratissimum*** combinations in 1:1 ratio, displayed significant antioxidant Potential, and 1:1 is the best proportion, showing the highest radical quenching abilityand effective synergism in both in vitro and ex vivomodels. Thus, this study providesthe scientific basis combining aqueous infusions at a particular ratio to attainmaximum antioxidant potential. Due the presence of additional phenolic compound in lemon, green tea with lemon also shows a better antioxidant activity.

In green tea ,flavanol group of polyphenols,catechins, are found in higher concentrations than black tea. So, antioxidant activity order isgreen tea > black tea. Further studies are needed using different tea brands with differentsupplementsto estimate the best type of tea supplementation that provides the optimal antioxidantsfor potential health benefits.

Thus it can be concluded that the selected extract combination produce their effect in the synergistic manner with green tea.There is a scope for confirming the results of this study on relevant animalmodels followed by studies for clinical support in future for development poly-herbalformulation of green tea with respective plant extracts.

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