



Review Article

Salubrious Green Tea

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Nature provides a lot of medicine for the prevention and treatment of oral infections. One such product of nature is green tea. This review paper discusses on green tea and its role in prevention and treatment of oral infection, various component of a green tea and their role in oral hygiene. Green tea consists of components such as catechins, caffeine, various vitamins saponins, fluorine, chlorophyll etc which has various effects such as anti cariogenic, prevention of bad breath, stops progression of tooth decay, treating oral thrush, reparative dentin formation etc. Green tea is a boon for oral infections. They are also been introduced in mouth washes in substitute for chlorhexidine. A new proverb "A CUP OF GREEN TEA A DAY KEEPS A DENTIST AWAY".

Key Words – Catechins, Antioxidant, Miracle Tea, Nature's Tea, Oral health

1. INTRODUCTION

Nature provides lot of remedies for prevention and treatment of oral infections. One such boon from nature is green tea. A simple leaf obtained from the plant *Camelliasinensis*¹ commonly called a tea plant, when had in the form of a tea can do much in preventing as well as treating various oral infections. It not only helps in treating oral infections but also helps in maintaining general body health and fitness by its

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various effects on systems like cardiovascular system, gastrointestinal system etc². Green tea's success in the treatment and prevention of various diseases are supported by various research studies.^{3,4,5,9}

The major global manufacturers of tea are from sub-tropical countries like INDIA, CHINA AND SRILANKA. More than 35 other countries produce tea. Black tea is mostly produced. There are different types of tea available and they differ only in the way of manufacture. Green tea leaves are picked and immediately sent to be dried or steamed to prevent fermentation, whereas black tea and other types are left to ferment after they are picked¹.

2. HISTORY OF GREEN TEA

The first evidence of green tea in medicinal purposes was recorded 4000 years ago in China. By third century AD it became a daily drink. Green tea was first introduced in Japan during the Nara period (710-794). This was done by few Buddhist monks who brought seeds from China to Japan¹. Japanese tea industry was started by monk EISAI in the gardens of temple. The art of making tea was done in tang's dynasty. They put some tea leaves in warm water and served them in ceramic bowl and offered in Buddhist ceremonies.

Toyotami organized the first tea ceremony in Japan. He gave this tea party to his warriors in order to calm them on a day before a battle. Toyotami's own sado (the way of tea making) teacher, SennoRikyo, is also credited with elevating tea from a simple beverage to a highly respected method of self-realization. Today, there are tea schools in Japan to learn the proper methods of the tea ceremony or chanoyu.^{1, 18, 19, 20}

The Manufacturing Method of Green Tea

Though traditionally green tea was produced manually, now it is being mechanized. The various types of green tea now produced differ according to cultivation practices and processing methods. After the tea leaves are plucked, they must be dried to prevent

fermentation, which stops any activity that causes oxidation. In China, green teas are often pan-fired in very large woks, over a flame or using an electric wok. The tea leaves must be stirred constantly for even drying. Withering is also used, which spreads the tea leaves on racks of bamboo or woven straw to dry in the sun or using warm air. High-end leaves are hand-rolled into various shapes, including curly, twisted, pointed, round, and more. Rolling the tea creates a distinctive look, as well as regulates the release of natural substances and flavor when it is steeped in the cup.

In Japan, steaming is normally used. Before the steaming process begins, the tea leaves are sorted and cleaned. The steaming time determines the type of tea that is produced. In most countries, rolling or shaping green tea leaves is done by machinery. A number of rolling and drying steps take place. A special machine is used to accomplish the first rolling and drying steps simultaneously. The tea leaves are dried to improve their strength so they can be pressed during the next drying process. Moisture from both the surface and from the inside of the tea leaves is removed using this machine. After the tea is shipped to the wholesalers in Japan, it undergoes several other steps to produce the final product. A special machine grades and cuts the tea by particle size, shape, and cleanliness, depending on the final qualities desired. Another drying step follows to produce the aromatic flavor, followed by blending per customer's specifications, packing and finally shipping to retail shops. In other countries, similar sorting, weighing, and packaging steps occur after the shaping process.^{1, 20}

3. COMPONENTS OF GREEN TEA

The following simple minor components of green tea work magic to maintain health:

Catechins:

These are simple Polyphenols. It is the most important component of green tea. It's the astringency component

of the tea. It was first isolated from Indian plant extract catechu- from which it derives its name. There are again four main subtypes of catechins in green tea.

Epicatechin, Epigallocatechin, Epicatechingallate, Epigallocatechingallate.

Some catechin change forms due to heat produced during manufacturing process like:

Epicatechin	Catechin
Epigallocatechin	Gallocatechin
Epicatechingallate	Catechingallate
Epigallocatechingallate	Gallocatechingallate

Catechins undergo oxidation very quickly. In green tea, since the process for making tea involves preventing the action of oxidizing enzymes, most of the catechins remain unoxidized. In oolong and black teas, the action of oxidizing enzymes produces oxidized polymers (complex catechins, such as theaflavins). Unlike catechins, which are colorless in aqueous solution, these oxidized catechins become orange or red. This is what gives oolong and black teas their distinctive reddish color. Theanine is produced in tea roots, which then it spread to leaves also. This theanine when exposed to sunlight gets converted to catechin. Thus here cover culture is done with less oxidation; hence theanine is available in green tea in huge amount. This simple polyphenol catechin has following benefits to our body.¹³

Annexure 1, Table 1: Benefits Of Catechin To Our Body

Caffeine:

Tea in overall has a very good amount of caffeine. Caffeine which we find all around us in many products such as in the cola we drink, coffee, candies etc. Manufactures of some companies also add caffeine in paracetamol and ibuprofen tablets. Caffeine has the property to keep one alert and refreshed. They are said to have a mild diuretic. It can stimulate central nervous

system and also prevents drowsiness. This caffeine is of a huge in number in tea and especially green tea. The caffeine content in younger shoots is higher in comparison to adult leaves. The caffeine content of infused tea beverage is approximately 0.01-0.02%. This equals to approximately 15-30mg of caffeine per cup of tea consumed.¹³

Annexure 1, Table 2: Benefits Of Caffeine

Amino acids:

Tea has a rich flavor and sweetness. It also has a relaxing effect. This is due to the theanine content of the green tea. These theanine is 60% of the total aminoacid content of the tea. Theanine are present only in the tea plant and are more in amount in younger shoots than in adult. Since green tea is manufactured by a process called cover culture, the oxidation of these theanine is prevented. Hence theanine is available in surplus amount in green tea in comparison to other teas. Theanine also limits the effect of caffeine, thus giving us a moderate effect of caffeine¹³

Annexure 1, Table 3: Benefits Of Theanine

Other aminoacids seen in green tea are:

- Glutamine
- Asparagines
- Arginine and
- Serine

Vitamins:

Regularly drinking green tea, which is full of vitamins, is good for health. Vitamins, along with saccharides, lipids, proteins and minerals, are one of the five primary nutrients used by the body. Although vitamins are essential nutrients, they cannot be produced within the human body, and must be acquired through food.

Green tea is known for having more vitamins in higher concentrations than other foods, and this fact alone makes tea a superior beverage. Many types of oolong and black tea contain few vitamins, with Vitamin C

and other vitamins are mostly lost during the production process.¹³

Annexure 1, Table 4: Vitamins And Their Benefits To Our Body

Saponins:

All types of tea contain saponins. These are the bitter component of the tea and also have an astringent effect. Green tea contains about 0.1% saponins¹³. They help in lowering the blood pressure and also have an Anti – Influenza effect

Fluorine:

The dream of every conservative dentist is to provide a fluoride rich restoration to provide resistant to caries. Green tea consists of fluorine which helps in preventing as well as in treating caries. Other components that are present in green tea are GABA, MINERALS LIKE CALCIUM, POTASSIUM, MANGANESE, PHOSPHORUS etc.¹³

4. GREEN TEA IN PREVENTION OF DENTAL CARIES

Dental caries is an irreversible microbial disease and a multifactorial disorder (21). Green tea has a good impact in preventing dental caries and also in the progression of tooth decay. This is possible because of two components in green tea, they are catechins and fluorine. Since bacterial flora is one of the factors, catechins by their anti-bacterial activity prevent dental caries. Fluorine with their ability to form fluoroapatite crystals prevents progression of tooth decay.²³ Dental caries is a dental disease found all over the world. Hence natural product like green tea is a boon to prevent dental caries. Japanese literature states that “those who continuously drink a large amount of green tea have less tooth decay”. One shall not lose their natural looking tooth due to decay when they have green tea on a regular basis^{3, 4,14,15,16} Bacteria are one of the main cause of dental caries. Bacteria stick to the tooth structure to form a pellicle. This pellicle is sticky

and is formed in the presence of enzyme glucosyltransferase produced by streptococcus bacteria which are the most important cause for the caries to occur followed by other bacteria like lactobacillus and actinomycetes.²¹ Thus when these bacteria colonize they form a biofilm. In these biofilm fermentation of sugars from dietary sources occur producing sugar acid (lactic acid) which leads to erosion of enamel and then it progresses to other structures of tooth.

In this process green tea with their biocomponent catechin acts at different levels^{3,4,14,15,16,22}.

- 1) Prevents proliferation of bacterial colonies.
- 2) Prevents adhesion of substances on tooth structure.
- 3) Inhibits glucosyltransferase enzyme.

There is clinical evidence from various researches like SAKANAKA ET AL and others conveying that when these colonies are exposed there is reduction in colony count. The exact mechanisms of EGCG’s antibacterial activity are unknown, but it is believed that EGCG disrupts the cell membrane and prevents DNA supercoiling, ultimately leading to the destruction of the bacterial cell²². Researchers also found that catechin causes denaturation of protein in bacteria and prevents their attachment to the hydroxyl apatite. It was also found that catechin inhibit enzyme glucosyltransferase.

A study with animals³ on dental caries says that bacteria that doesn’t produce glucosyltransferase doesn’t produce dental caries. Short clinical studies done by some volunteers conveyed that person consuming green tea has no plaque formation⁶. This was seen with black tea but not as efficient as green tea since catechin content of black tea is too much reduced due to oxidation. This anti cariogenic effect is seen in most tea without milk with high benefits from green tea. Hence green tea can be considered a boon to dental caries prevention and progression.

5. GREEN TEA IN PERIODONTAL DISEASES

The gingival space between the gum and tooth surface contains a number of microbial flora. They then progress to form gingivitis, an inflammatory condition of gums and might progress to periodontitis in their advanced stage. The substance found in gingival space is usually microbes, neutrophils, inflammatory cells, serum exudates etc. Severe bleeding is seen in gingivitis. The most commonly associated bacteria with these inflammatory conditions are *Prevotella* species and *Porphyromonasgingivalis*.

As mentioned earlier green tea prevents plaque formation, thus they reduce gingival inflammation^{3,5,16}. Green tea is a remedy for halitosis since catechins deodorize methyl mercaptan, the main cause of halitosis.¹³ Researchers found a bactericidal activity against *Prevotella* and *Porphyromonasgingivalis*³. Various clinical studies convey that green tea on regular consumption prevents and reduces periodontal pocket formation. Most recent studies also say that epigallocatechins also neutralize various toxins that are aetiology for these periodontal diseases. Some studies state that green tea consumption can be one of the remedies for acute pericoronitis¹⁶.

From the properties of green tea in dental caries and periodontal diseases it is evident that they possess a significant bactericidal effect. Thus green tea is good antibacterial substance from the nature. Anything that is natural has fewer side effects compared to that in artificial.

6. GREEN TEA AS AN ANTIVIRAL AGENT

Virus is a microorganism causing various diseases in human such as AIDS, hepatitis, swine flu etc. Some of these viral diseases are curable by our own body immune mechanism. But some aren't, certain viruses undergo mutation every year or season changing their

genome and cause various infections in humans. Though scientists could find vaccination for various viral infections they failed to find vaccination for some infections or couldn't able to have a permanent vaccination for that infection as some of these virus are mutating. One such virus is the influenza virus. Every year or season this influenza virus peaks as a pathogen and affects the human population. They mutate every season when they peak out. One time will be H1N1 and the next time H1N2 etc. Green tea is a product from nature that prevents this swine flu from affecting individuals^{7,8}. Their antiviral property kills the virus once it is contacted³. Since most of the disease spreads via breathing having green tea helps to kill these organisms before they enter human body causing a disease.

Some researchers found when green tea by products were administered to chickens orally, they found dose dependent reduction of these influenza virus thus proving the antiviral property of green tea^{7,8}. Researchers found that this green tea which contains epigallocatechin inhibits endonuclease enzyme action of influenza virus⁸. This endonuclease is required for virus to act on host m-RNA. In addition to this researchers are also working on green tea, proving it to help against HIV and Hepatitis virus³. Not only influenza also other viruses like HSV, Herpes zoster, HPV are also seen to be affected by polyphenols of green tea. Since most of viral infections spread via nasal and oral route green tea consumption prevents various viral infections. Most viral infections manifest in oral cavity, as oral cavity is the index of bodies health. Thus viral infection and its treatment as well as prevention are important for dentists. Green tea is a medication for dentists to prescribe for their patients as green tea is useful to treat following viral diseases like swine flu, AIDS, hepatitis and other diseases caused by various viruses.

7. GREEN TEA AND MYCOTIC INFECTIONS

Mycotic infections, the first disease to come to mind is Oral Candidiasis caused by *Candida albicans*. They are opportunistic infections of oral cavity. Some researchers found that polyphenol of tea have good effect on Yeast and yeast like fungus^{3, 10}. Since the polyphenol catechin is excess in green tea compared to other teas, it becomes a choice of treating fungal infections. The same concept of preventing biofilm formation is the cause for the tea components against the candida. When culture study was done they were found to reduce 90% of candidal colonies¹⁰. Also they break apart yeast formations. In the yeast cultures, when the green tea is introduced they showed suppression in yeast growth.¹⁰

There are also physicians who use green tea externally to treat patients. External use reduces the rashes due to fungal infections. Also in some places green tea bathing is also available and it prevents skin rashes. Persons with diabetic foot were asked to immerse their feet for 15 min daily in green tea and were found with improved skin conditions in 14 weeks. *Candida albicans* are also found to be causing overgrowth in genitals of immune compromised patients. Green tea consumption helps in preventing these fungal multiplication²⁴. When treated with antibiotics like amphotericin B they showed various side effects, but that is not the case with green tea. It has been found that used green tea bags can be chilled and applied directly on the infected area, this prevents itching²⁵. Researchers also found green tea helped in preventing candida associated lesions such as angular cheilitis, denture stomatitis etc¹¹. Thus green tea is a product of nature that helps in treating as well as preventing various fungal infections like angular cheilitis, denture stomatitis, fungal infections due to immune suppression, fungal rashes on skin etc.

8. GREEN TEA AND ORAL CANCERS

Cancers are malignant growth of tissues in our body. They are fatal and cause several discomforts when it affects a person. Tobacco smoking, chewing and alcoholism are one of several reasons for cancer. Various viruses like HSV also cause cancer in oral cavity. Teratoma, Malignant melanoma, Squamous cell carcinoma etc are some of the oral cancers occurring in populations⁹. Cancers now days have a lot of treatments to cure it. Chemotherapy, Radiation therapy etc are some of the treatments of cancer. But their side effects are lot. In chemotherapy due to their cytotoxic effect, they not only kill tumour cells but also other normal cells. Hence there is hair loss, immune suppression etc. This not the case when green tea is taken orally. They don't have any side effects as that of cytotoxic drugs.

The polyphenolic component of green tea (i.e) catechins and their subtypes helps in formation of reactive oxygen species in cancer cells by acting on mitochondria¹². Mitochondria in turn produce more reactive oxygen species. The mitochondria even more lose its defence and gene break down occurs. Thus these weakened cancer cells die to these catechins. This anticancer effect of green tea was first observed against pancreatic cancer which was then found to prevent oral cancer¹². They also showed positive effects in treatment also. Researchers are planning to bring this green tea as a treatment of cancer and they are working on it. Hope soon we get green tea in form of medicine in treating cancers, a product from nature. Researchers also found their effect against other form of cancers such as breast cancer, prostate cancer etc.

9. GREEN TEA AS AN ANTIOXIDANT

Not me but also everybody wants to have their appearance young, no matter how old they may be. Once a person meets someone the first he/she sees is his/her face. So people want their face to be young as

well as good in appearance and dentist are of important in this as they are the smile architect. Also face is the index of mind. To keep our face young and charming we need what is called as an anti-oxidant. This anti-oxidant is plenty in green tea ¹⁷. Their bio component Catechin, theanine, vitamin E, vitamin C etc helps them in their anti-oxidant property. As said in cancer they are capable of producing reactive oxygen cells. Since green tea undergoes less oxidation compared to other tea they have high anti-oxidant power. These components search for damaged cell and detoxify them. They just detoxify the oxygen free radicals that cause aging and helps in maintaining the body young. Green tea is a safe product from nature which is healthier and has no side effects compared to other antioxidant creams, faces washes, scrubs etc.

10. OTHER USES OF GREEN TEA

Green tea not only helps in oral infections and diseases but also provides other, benefits like weight loss, decreased cholesterol level, alertness, diuretic, helps collagen formation, prevents neural damage, heart diseases like infarction, arteriosclerosis, reducing blood pressure, infections of bacterial, viral, fungal, as well as parasites ^{3,13}. The main cause for their action is their polyphenolic component catechins, which are more here due to their cover culture method of manufacturing. They are prescribed for diabetic patients. They prevent effects of sedation hence prevents hangover effect. When consumed with beta lactam antibiotics they have more bactericidal effect as they help in reaction of antibiotics against resistant bacteria. Moreover they are refreshing when had in the form of a drink.

11. THE TOXIC FACE OF GREEN TEA

“All things are poison, and nothing is without poison; only the dose permits something not to be poisonous” – statement by PARACELSUS- father of toxicology. ²⁶ This is also applicable to this green tea. Green tea

eventhough very useful, excess consumption of it causes various health problems. One such problem is hepatotoxicity. The same catechin by forming reactive oxygen species causes hepatocyte damage. This has been tested with rat hepatocyte and it is found to be toxic at high doses ²⁷. Green tea is also found to cause discoloration of teeth ²⁸. Two cups of green tea a day doesn't cause this but more number than this might cause discoloration. It doesn't damage the teeth, but cause esthetic problems as the teeth might stain yellow ^{28,29}. There was a debate once of this green tea causing esophageal cancers, but it was disproved and was found to have beneficial effect ³⁰. Only if the green tea consumed at very high temperature might cause esophageal cancer and that to not because of green tea but because of temperature ³¹.

12. CONCLUSION

Green tea is a nature's beverage. All age group of people can consume this green tea. Two to Three cups of green tea a day is healthier and nontoxic. When consumed in huge amount they might cause mild problems like acidity, tooth discoloration, staining etc. They are bitter when we drink but its use is more compared to its bitter taste. Companies have started manufacturing mouth washes made of this green tea. They are used as a substitute for chlorhexidine. It is said by the manufacturer that they provide twelve - hour germ protection and prevents plaque formation. These green tea mouth washes do not have burning sensation when used. They provide a long lasting fresh breathe. Green tea is now available in combinations with different flavors such as lime, elachi, cardamom, honey etc adding their benefits also to the green tea. They are available as tea bags as well tea powders for consumers. The benefit of this tea is as said before, they undergo less oxidation during manufacture and also milk is not used to prepare this tea. Hence milk free tea can be consumed. A person who aims for

weight loss, green tea is a choice as it is free from milk fat. When sugar is added to this tea they reduce the effect of the tea. Surveys say that these green tea consuming individuals have better oral health compared to those individuals who consume coffee and milk tea.

Green tea not only makes a body fit also our oral cavity in good hygiene .It is a choice of beverage for a diabetic too as it is free of sugar. Apple a day keeps a doctor away, this can be changed as **“A cup of green tea a day keeps a dentist away!!!** Also its ability to cure oral infections like decay, caries, bad breath etc makes it as a natural herb for a dentist to prescribe for varies oral infections.

Be natural be with nature the nature provides all we need!!!

Table 1: Benefits of Catechin To Our Body

Decreases blood cholesterol
Body fat reduction
Prevents cancer
Antioxidant
Tooth decay prevention, antibacterial
Bad breath prevention
Anti influenza effect
Inhibits high blood pressure
Anti-hyperglycemic effect

Table 2: Benefits of Caffeine

Increases alertness (decreases tiredness and drowsiness)
Increases stamina
Sedation prevention
Mild diuretic

Table 3: Benefits of Theanine

Neuronal cell protection
Relaxation effect
Lowering of blood pressure

Table 4: Vitamins and their Benefits to Our Body

VITAMIN C	<ul style="list-style-type: none"> Maintenance of healthy skin and mucus membrane (collagen formation) Antioxidant
VITAMIN B2	<ul style="list-style-type: none"> Maintenance of healthy skin and mucus membrane
FOLIC ACID	<ul style="list-style-type: none"> Prevention of fetal neural

	<ul style="list-style-type: none"> Prevention of tube defects (NTD) of arterial sclerosis
BETA CAROTENE	<ul style="list-style-type: none"> Maintenance of night time vision
VITAMIN E	<ul style="list-style-type: none"> Antioxidant

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