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內文：

INTRODUCTION:

“Miswak”

1. effective
2. cheap
3. efficient way of maintaining oral hygiene

“Green tea”

(Botanical name of tea plant is *Camellia Sinensis*) belonging to the family Theaceae (Table 1) has been explored in the recent years for its beneficial effects on oral health. It can be available as a shrub or evergreen tree. According to an estimate, daily consumption of tea is more than 3 billion cups; almost 75 percent consumption by China.

Kingdom	Plantae
Subkingdom	Tracheobionta
Super-division	Spermatophyte
Division	Magnoliophyta
Class	Magnoliopsida
Sub-class	Dillenidea
Order	Theales
Family	Theaceae
Genus	<i>Camellia L.</i>
Species	<i>Camellia Sinensis</i>

GREEN TEA EFFECT ON ORAL TISSUES

The standard method defined in Chinese culture is illustrated Fig. (1).

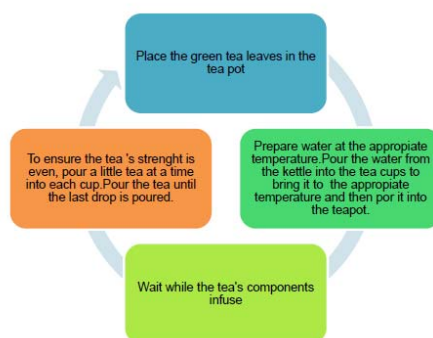


Fig. (1). Standard method to make green tea in chinese history.

Tea leaves are available in a variety of forms depending on processing techniques illustrated in Fig. (2)

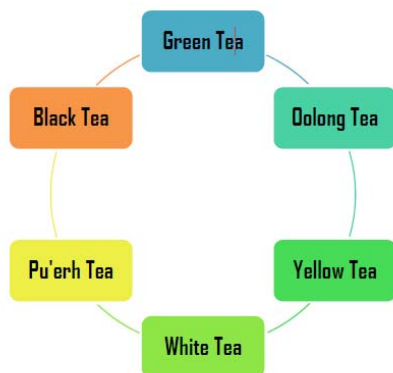


Fig. (2). Different kinds of tea according to their processing.

CLASSIFICATION OF TEA (by processing methods adopted during manufacturing)

1. fully fermentation(red tea)
 2. semi-fermentation(oolong)—monomeric and oligomeric catechins and is in semi fermented form
 3. non-fermentation(green tea)
- “catechins”(兒茶素) (i.e. polyphenols with molecular weight less than 450Da) are oxidized and condensed A third type of tea.

Distinctive composition of green is listed in Table 2

Protein	Peptides and enzymes
Carbohydrates	Fructose, sucrose, cellulose, pectin and glucose
Vitamins	Vitamins (B, C, and E)
Xanthic bases	Caffeine, Theophylline
Pigments	Chlorophyll, Carotenoids
Minerals and trace elements	Calcium, Magnesium, Sodium, Chromium, Manganese, Copper, Cobalt, Nickel, Iron, Molybdenum, Selenium, Phosphorus, Potassium, Fluoride, Zinc, Aluminum

“polyphenols”(茶多酚)

1. one third part of bioactive compounds in green tea
2. main type- catechins (flavan-3-ols) also known as tannins serve as astringency constituent.

Dr. Michiyo Tsujimura extracted the catechins from tea leaves in 1929 and studied their functions (Fig. 3) for the first time during his work at The Institute of Physical and Chemical Research, Japan.

Most important kind of catechins include

1. epigallocatechin-3-gallate (EGCG; 59%)
2. epigallocatechin (EGC; 19%)
3. epicatechin-3-gallate (ECG; 13.6%)
4. epicatechin (EC; 6.4%)

including EGCG and EGC are reported for their presence in green tea. Both the types along with ECG exhibit antimicrobial activity. ECG reveals the possibility of protection against urinary tract infections (UTI) as it is reported to be excreted by kidney while it is also extracted in bile along with EGCG. Large variations can be observed in the chemical structures of catechins due to dissimilar composition (Fig. 4). Green tea also serves as a great source of anti-oxidants.

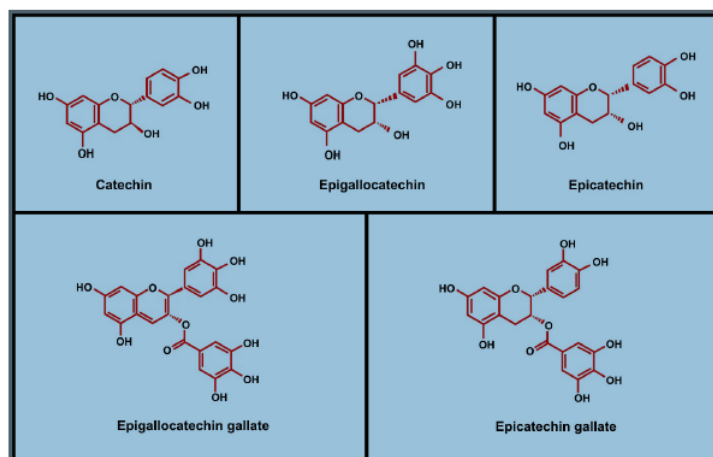


Fig. (4). Chemical structures of catechin and its family.

THERAPEUTIC EFFECTS OF GREEN TEA:

1. oral health
2. decreases the chances of cardiovascular diseases & cancer
3. anti-hypertensive, anti-bacterial, anti-viral agent
4. protection against ultraviolet radiations
5. weight loss
6. bone mineral density
7. neuro-protective power
8. stomach discomfort, indigestion, vomiting, diarrhea and flatulence
9. maintaining blood glucose balance and body weight

GREEN TEA EFFECT ON ORAL TISSUES

a) Role as Antioxidants

Polyphenols have shown anti-oxidative activity by neutralization of free radicals in the body. They are also known to reduce or prevent their detrimental (有害的) effects and restrain ROS (活性氧 reactive oxygen species) generation to inhibit the lysosomal (溶酶體) secretions. The hydrogen releasing property of catechin and epicatechin results in scavenging effects [16]. Polyphenols have following processes that reduce oxidation level (Fig. 5).

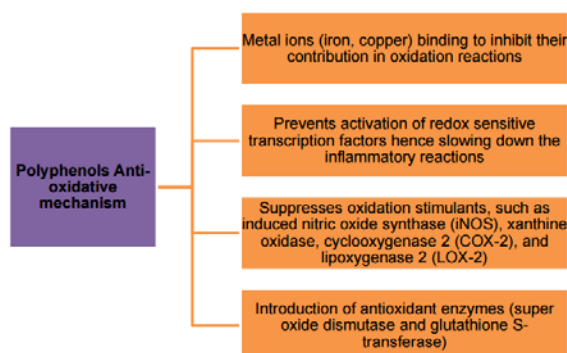


Fig. (5). Representing steps of oxidative reduction mechanism by polyphenols.

b) Therapeutic Effects on Periodontal and Gingival Health

The gingival crevice is a physiological zone surrounded by gingiva and tooth margins. A colony of microorganisms resides in this space and most common of that are anaerobes. In pathological conditions, these spaces extend and periodontal pockets filled with serum exudates and large colonies of polymorphs. Additionally,

oxidative stress supports the development of diseased conditions. The microbes commonly present in such conditions are *Prevotella* spp and *Porphyromonas gingivalis* (black pigmented anaerobes).

Periodontal health is inversely related to consumption of green tea, an epidemiological(流行病學) study proves that people have better periodontal health if they drink green tea very often for example during meals or at breaks from work [19]. Green tea plays supportive role in the maintenance of periodontal health, as suggested by an in vitro (試管內)study catechins (e.g. EGCG) restrict the development and colonization of harmful bacteria such as *Porphyromonas gingivalis*, *Prevotella intermedia*, and *Prevotella nigrescens*. These bacteria cause severe harm to periodontal tissues for example *Porphyromonas gingivalis* develop adhesion to buccal mucosa and cause destruction.

Recently, Nadeem et al studied the influence of green tea consumption versus black tea on periodontal health of 240 dental students and noticed that students who were consuming green tea had good periodontal health status with minimal plaque accumulation in comparison with consumers of black tea. Literature exhibited that better periodontal health status of regular green tea using individuals is mainly due to catechins, as these are steric structures of 3-galloyl radical, ECG, EGCG and gallic acid gallate (GCG) (major polyphenols) and responsible for restrain release of toxic end metabolites from *Porphyromonas gingivalis*.

c) Dental Caries

Dental caries is a pathological condition resulting due to demineralization of tooth structure because of bacterial infections and/or deficiency of nutrients. Oral microbes are responsible for caries development, out of which mainly streptococcus mutants are most active

“Green tea”

1. fluoride and other components such as
2. polyphenols (catechins)

Cariogenic bacteria(致齲菌) release glucans with the help of glucosyltransferase (GTase) which are branched and facilitate adherence of microbes to tooth surface. GC and EGC are the catechins that restrict the growth of 10 types of caries causing bacteria. Otake et al showed that total amount of catechins, mainly EGCG and its epimer gallic acid, EC and ECG present in one cup of green tea prevent streptococcus mutants from adhering to tooth surfaces. The catechins were extracted from green tea with concentration of 100mg/L and their effects on bacterial adhesion to salivary coated hydroxyapatites were observed. Other studies also exhibit that consumption of tea constrains the release of salivary enzyme, amylase as observed by Kashket and Paolino. Later it was supported by Zhang and Kashket proving that tea, either black or green restrains the enzymatic activity of *Streptococcus mutans*' amylase on tooth structure preventing demineralization.

d) Bad Breath (halitosis)

The main reagents responsible for halitosis (bad breath) are volatile sulfide compounds such as hydrogen sulfide (H₂S), dimethylsulfide [(CH₃)₂S] and methyl mercaptan (CH₃SH). These reagents degrade in the oral cavity by proteolytic reactions primarily by anaerobic gram negative bacteria consuming numerous sulfur-containing substrates including saliva, food debris, epithelial cells and blood.

“Green tea ‘

1. antibacterial properties against anaerobic microorganisms.

2. abolish bad breath by suppressing anaerobic bacteria
 3. eliminating the production of volatile sulfur compounds
 4. Deodorant(除臭劑) action of ingredients decreases in the following order: EGCG > EGC > ECG > EC. The deodorizing action of EGCG is based on a chemical reaction of EGCG and MSH and introducing methylsulfinyl/methylthio group into the B ring of EGCG. During this reaction, a methylthio group is supplemented in orthoquinone form of the catechin produced by oxidation, hence eliminating the halitosis.
- e) Cigarette Smoke Induced Inflammation
- Smoking affects the homeostasis and injurious to oral health. The effects of smoking range from simple mucosal erythema to premalignant conditions and oral cancer. Smoking intensifies oral malignancies in response to oral inflammatory diseases due to compromised status of salivary antioxidants [39].. In addition, smoke coming from tobacco comprised of reactive oxygen species (ROS) including superoxides, hydroxyl radical/hydrogen peroxide. The toxicity is further added due to the formation of nitric oxide (NO). Superoxide reacts chemically with NO to form peroxynitrite (ONOO). The inflammatory transcription factor pathway (NFkB) is triggered by ONOO due to activation of Ikb kinase (IKK). The cascade of changes results in the intensification of expressions, iNOS activity and chronic inflammation in tissues even by exposing to a very minute dose of smoke.
- Green tea can be beneficial for cigarette smokers
1. Catechins are capable of scavenging superoxide oxide, NO, and ONOO
 2. EGCG has the ability to suppress activation of NF-kB that leads to inhibition of phosphorylation. It can further trigger the collapse of the inhibitory sections Ikb-a in human pulp cells. The IkbA is also accountable for overturning nuclear transfer of NF-kB operating subunits (p65 and p50) and stimulation of pro-inflammatory genes.
 3. EGCG resulted in decreased NF-kB expression and reduction of proteins facilitated including matrix metalloproteinase9 (MMP-9). The MMP-9 is implicated in the breakdown of extracellular matrix, nterleukin-8 (IL-8) and iNOS present in bronchial epithelium.
 4. Nicotine stimulates apoptosis across ROS generations of human gingival fibroblasts (HuGF). The metabolites of nicotine such as tobacco specific nitrosamines (TSNAs) are considered major carcinogens.
Weitberg et al. treated cultured human pulmonary cells through EGCG prior to introducing to TSNA 4-(Nmethyl-N-n-trosamino)-1-(3-pyridyl)-1-butanone (NNK). EGCG exhibited the ability to protect against the initiation of genetic injury to DNA of cultivated human pulmonary cells.
 5. EGCG can extinguish acrolein and other unsaturated aldehydes, hence reducing acrolein toxicity

CONCLUSION

There are numerous beneficial effects of green tea on oral health. Green tea has valuable effects on oral conditions such as dental caries, periodontal disease and halitosis. Research suggests that green tea helps to reduce the bacterial activity in the oral cavity that in turn, can reduce the aforementioned oral afflictions. Furthermore, the antioxidant effect of the tea may reduce the chances of oral cancer in tobacco users. However, more clinical data is require to ascertain benefits of using green tea for oral tissues and prevention of oral diseases

題號	題目
1	就目前所知，下列有關牙周炎與根管感染微生物的敘述，何者正確？ (A) 牙周炎為多種微生物 (poly microbial) 所引起的感染，根管感染則否 (B) Fusobacterium species 常可於牙周囊袋及根管內被鑑定出來 (C) Actinobacillus actinomycetemcomitans 及 Fusobacterium species 常可於牙周囊袋及根管內被鑑定出來 (D) 牙周囊袋與根管內的感染菌株屬不同菌種
答案 (B)	出處：102 年第一次專門職業及技術人員高等考試牙醫師考試分試考試、藥師、醫事放射師、助產師、物理治療師、職能治療師、呼吸治療師、獸醫師考試
題號	題目
2	依據齲齒病因學的假說，下列何種治療是不切實際且無法達成的？ (A) 減絕全部牙菌斑 (total plaque elimination) (B) 壓制特殊致齲細菌 (cariogenic bacteria) (C) 置換成非致齲細菌 (noncariogenic bacteria) 的牙菌斑 (D) 改變口腔生態 (oral ecology)
答案 (A)	出處：102 年第一次專門職業及技術人員高等考試牙醫師考試分試考試、藥師、醫事放射師、助產師、物理治療師、職能治療師、呼吸治療師、獸醫師考試