The Truth in Tea

"Drinking Tea"
by
Tang Yin 唐寅 (1470-1523)
(Original in Palace Museum, Beijing, China)

What to do on a long day?
(Tea is for people of an affluent society)

Made tea for myself.
(Tea should be prepared with great care)

Picked leaves from beneath the southern window.
(Use fresh tea leaves to brew tea)

Let soothing fragrance fill my mind.
(Tea is for health, gratification in mind)

- Translation of poem contained in the painting by Sin Hang Lee, M.D., with interpretation in parentheses

Q: Where was the "Orange Pekoe" shipped to Holland in 1606?

A: *It never got there, because it was molded along with other rotten provisions on the tall ships. The first-grade green tea distinguished by the name of the Dutch monarch, Oranje, and Pekoe ("white fine hair" in Amoy dialect used to characterize the appearance of young green tea leaves) had turned into black tea now known as "pekoe."*

-Webster's New Collegiate Dictionary

Read on for more truth about tea

Re-introducing tea for health

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Q: Why do we need more information on tea?

A: The American public is confused with the half-true information published in the lay media. One of the latest articles titled "*Steeped in Confusion*" on green tea published in the **Wall Street Journal** (Monday, January 26, 2004, in the Personal Health section) by Jennifer Saranow illustrates the confusion the readers of these articles are facing. For example, the anticancer effects of green tea observed in the laboratories are not always reproducible among the human green tea drinkers. Few editors, authors or scientists attempted to address this discrepancy.

Tea was introduced to the American public through the British tea traders and the Chinese restaurants, which are usually operated by Chinese-Americans whose ancestors came from the villages of the southern province of Guangdong, Taiwan and Hong Kong where most residents still shun green tea as a beverage. These descendants of farm laborers from Southern China only drink oolong tea, as commonly served in the Chinese restaurants. As a result, the American tea drinkers have not been exposed to genuine green tea. All writings on green tea published in the US lay journals are based on second-hand information at the best. The Green Tea Movement is to disseminate reliable evidence-based scientific information to the consumers who are interested in drinking green tea as a conventional food for health protection. It is a global green tea movement for knowledge dissemination initiated by a medical doctor with a cross-cultural background and more than 40 years of experience in medical practice in this country.

Q: What kind of tea the Americans are drinking now?

A: The British brought black tea and the Chinese restaurants brought oolong tea to America. Some of the oolong teas are sold in special tea stores under the name of oolong green tea, or half-green tea. None of them are "typical" green tea as accepted by the National Cancer Institute (NCI) in cancer research.

Q: Why is it so important for the consumers to distinguish the different kinds of teas?

A: If one drinks tea beverage just for its aroma and its taste, it might not be important. However, it is very important if one wants to drink tea for health protection because green tea has the highest level of tea antioxidants, and the black tea almost none, with the oolong tea level in-between. In the past five years, most laboratory and experimental animal studies that supported the conclusion of a health benefit of tea drinking, especially in chemoprevention against cancer and obesity, have used fresh high-antioxidant green tea or the green tea antioxidant, (-)-epigallocatechin gallate, EGCG in short, as the bioactive testing material to conduct the research. Black tea is not that effective. While the epidemiological evidence is supportive of the benefits of drinking high-antioxidant green tea for cancer prevention, the data on black tea and oolong tea drinkers are not supportive of the benefits of tea drinking for this purpose.

Q: Can you explain how the different kinds of tea came about?

A: There are three major kinds of tea, namely green tea, black tea and oolong tea, all derived from the same species of tea tree, commonly known as *Camellia sinensis* or as *Thea sinensis* on the FDA list of generally recognized as safe (GRAS) substances.

Tea originated in China. As written in ancient medical texts, it was used as a health aid in 2737 BC. Tea became a major commodity in Tang Dynasty (617-907 AD) when tea drinking gradually evolved into a form of art, but was still largely confined to the privileged elite of the society. In the old days, fresh leaves directly plucked from the tea tree were boiled

in water to prepare tea drinks, primarily for "detoxification" and in religious or funeral ceremonies. Freshly plucked tea leaves were still used at least on special occasions among the intellect elite in the 1500's AD, as depicted in the poem written on a classic Ming dynasty Chinese painting titled "Drinking Tea" now on display in the Palace Museum, Beijing.

As tea became a commodity for trading, it was necessary to preserve the quality of the fresh tea leaves by a brief heating and drying process for transportation and for storage. Tea leaves must undergo an initial heat treatment for quality preservation. Now, we know its purpose was to inactivate the polyphenol oxidase in tea leaves to stop the oxidation process in order to preserve the antioxidant tea catechins. The tea leaves which were not processed immediately would turn brown, just like a sliced apple undergoing discoloration when exposed to the air. The brown tea leaves were treated with high temperature heating and pressed into cakes and bricks as salvage products, which were considered of low grade teas and were mostly sold to the minority Chinese living in the North or to foreign traders. Historically, "tea" always referred to green tea in the Middle Kingdom.

The Portuguese sailors were the first Europeans to trade tea in China in the 1500's A.D. The first shipment of tea to Western Europe was made by the Dutch East India Company in 1606. They were all green teas when the merchandise was loaded on board in Amoy, a major seaport in Southern China. The term "Orange Pekoe" referred to a first grade green tea imported to Europe by a company bearing the royal family name of the Dutch monarch, "*Oranje*". The word "Pekoe" which now means black tea in the English dictionaries is the phonetic spelling of the Amoy dialect word "white fine hair", still used in China among the tea traders to describe the appearance of the dry green tea leaves composed of the buds and the first two young leaves. However, after a long sea journey with constant agitation over the choppy warm ocean water in humid hot weather, the high quality "Pekoe" green tea probably had turned into half-black tea with its characteristic bitter taste as a result of oxidation and degradation when the ship arrived in Holland. It is no wonder that some Europeans would put sugar and milk into the bitter tea from China.

Shortly before and after the downfall of the Ming Dynasty in 1644, oolong tea that was purposely briefly oxidized (half-black tea) and the fully oxidized black tea were introduced for the often hungry peasants in the South as a calorie-preserving beverage and for foreign exports, in about 1650 A.D. As the society turmoil in China led to repeated famines, the poor peasants learned quickly that they should avoid drinking green tea which is an irritant to an empty stomach, and started to drink the half-degraded oolong tea or the fully oxidized black tea instead, in order to preserve the badly needed body fat to survive. The fat-depleting effect of green tea was only recently re-discovered in animal experiments. The terms of oolong tea and black tea (red tea in Chinese) were introduced to the Chinese vocabulary in the mid 1600's A.D. The Western tea drinking habit of adding sugar and milk into black tea was initiated by the British in about 1657 A.D. The Chinese and Japanese tea drinkers never put sugar or milk into their green tea.

Q: Can green tea be used to reduce obesity based on the old experience of the Chinese peasants?

A: Scientific research of the past few years has shown that green tea has thermogenic properties and promotes fat reduction in experimental animals. Green tea may play a role in the control of body fats via sympathetic activation of thermogenesis, fat oxidation, or both. It also inhibits the absorption of lipids in food and lowers the blood cholesterol level. Green tea has been proposed to be used as an

adjunct to control obesity and to be consumed with meals.

In 2002, it was reported in France that a green tea extract under the name of AR25 (Exolise) was marketed in some European Union member states for the treatment of obesity. The extract was an 80% ethanolic dry extract standardized at 25% catechins expressed as epigallocatechin gallate (EGCG). In an open study, the effects of extract AR25 were evaluated in moderately obese patients. After 3 months, body weight was reduced by 4.6% and waist circumference by 4.48%. However, this product has been recalled since year 2003 for causing liver toxicity in some women users. Apparently, extraction with ethanol may release some toxic substances from the tea leaves that normally would not be soluble in hot water or are in such dilute concentrations that they are not harmful in the tea drinks brewed according to the traditional method.

Q: Who is Dr. Lee? Why is Dr. Lee in such a unique position to start this Global Green Tea Movement?

A: Dr. Lee is a medical doctor qualified to practice medicine in the USA, Canada and the British Common Wealth. He was born in Hong Kong and educated in China and the USA. He has been on the faculty of several leading medical schools in the US and Canada, practicing medicine, teaching and doing scientific research for more than 40 years in the US, specializing in cancer pathology and medical microbiology. He has published many original research articles in professional journals, and owns several US and worldwide patents. His qualification and professional experience are in public records, such as the **Marquis Who's Who in the World** 1984-2004; **Who's Who in Frontiers of Science and Technology**; and **Who's Who in America**.

With his interest and background in medical science and in Chinese history, Dr. Lee was able to re-examine some of the classic Chinese literature in context of the new research findings on green tea as an anticancer agent in laboratory and experimental animal studies and in human observations and in context of some new archeological findings near a historical tea trading center. Dr. Lee discovered that the technology of brewing high quality green tea, especially the utensils used to prepare the tea, has always been considered to be as important as the quality of the tea leaves in the art and science of tea drinking since ancient times in China. The demand for non-metallic tea utensils which started in the late Tang dynasty stimulated the development of the celadon porcelain wares, now known as china, shortly before 900 A.D. Based on the recent discoveries in scientific research, a new tea brewing technology is now needed to maximize the health benefits of drinking green tea, especially in reducing the risk of cancer, as the life span of the human race continues to increase. Dr. Lee's Global Green Tea Movement is to disseminate reliable scientific information on green tea research and the new technology in tea preparation to the consumers. It is to drink tea for health. This re-introduction of green tea to the West is about 400 years late. However, it is better late than never.

Q: Why is there so much emphasis on green tea chemoprevention against cancer?

A: Cancer is the most common disease that will end the life of an aging body if the latter is lucky enough to avoid heart attack and stroke in its advancing years. There is no medication to prevent cancer. All drugs known to kill cancer cells are poisons. We cannot eliminate cancer if we want longevity in the industrialized society. But we can adopt a healthy lifestyle and a healthy diet habit to delay the occurrence of cancer. Green tea is such a beverage,

which is non-toxic and may reduce cancer risk in our life if used properly.

Q: What is the scientific evidence that drinking green tea may reduce the risk of cancer?

A: You may find the evidence detailed in a monograph "Green Tea in the Fight against Cancer" by Dr. Lee and in the web site www.greenteahaus.com. A brief summary is presented as follows.

1. Laboratory and experimental animal studies: The anticancer activities of green tea or its components, especially the antioxidants, for example, EGCG, are widely ranged, starting at inhibition of the formation of exogenous carcinogens in the stomach to interference with tumor initiation, promotion and progression.

2. Human population studies (cancer epidemiology): These were primarily performed in Japan and China where there is a tradition of drinking green tea as the major beverage. High consumption of green tea associated with reduced cancer rates of the breast, esophagus, stomach, colon, rectum, pancreas, urinary bladder, prostate, lung, liver, and ovary, has been observed among the residents living in the areas near the tea plantations in Japan and China. The women drinking 10 Japanese cups (1200-1500 ml) or more green tea a day enjoy an average 8.7 more cancer-free years than low volume tea drinkers do. The benefits were reported to be dose-dependent. However, similar beneficial results were not observed in population of northern rural Japan where no tea plantations are in existence. Only one epidemiological study has been reported in the US involving a population of green tea drinkers, namely on a group of Asian women living in Los Angeles. The result showed a reduction of breast cancer rate in association with drinking green tea and their dose-dependent relationship. All other epidemiological studies in US were performed on participants who primarily drink black tea and did not show a protection of tea drinking against cancer.
   The human studies indicate that the quality of the tea leaves and the daily volume of the green tea consumed by the study participants play a pivotal role in determining the outcome of chemoprevention against cancer.

3. Stage I and Stage II breast cancer patients: Heavy green tea consumption was found to be associated with reduced recurrence of breast cancer in patients after surgical removal of the tumor. However, similar benefits were not observed in patients with stage III cancer.

4. Experimentally, green tea and its components were found to enhance the anticancer effects of certain chemotherapeutic drugs, like 5-fluorouracil and doxorubicin. Thus green tea as dietary supplement may reduce the required dosage of certain anticancer drugs and minimize their adverse side effects.

Q: What kind of green tea is used for chemoprevention against cancer?

A: The NCI protocol recognizes that a typical cup of green tea contains 710 micrograms/ml EGCG. This concentration of green tea has been used in experimental cancer research successfully to suppress human cancer cell growth in rodents and has been used in some cancer centers in the US for phase I clinical studies. The volume of tea to drink is at least 1,200 ml, or about 40 ounces a day.

Usually most light tea drinkers use a 1:100 w/v leaf-to-water ratio for tea preparation. Therefore, at least a 7% extractable EGCG content in dry weight is a minimum requirement for green tea leaves. For lack

of a proper name, we refer to this tea as high-antioxidant green tea to distinguish it from the green teas on the market which usually contain only 2-4 % EGCG, if not lower.

Q: How to find high-antioxidant green teas?

A: Ask the vendor that sells green teas if the tea leaves have been assayed for its EGCG level. Try to buy a green tea that has been certified to contain at least 7% natural EGCG (not polyphenols or catechins).

Q: How does green tea maintain its high antioxidant levels?

A: First, the fresh tea leaves must be selected from the tea plantations that do not use synthetic chemical pesticides to grow their tea trees and that are far away from industrial regions to avoid heavy metal contamination. Then the harvests are generally confined to two crops a year, once in the early spring and once in the late fall when the leaf-eating insects are not active in the tea plantation. The fresh tea leaves plucked are quickly heated to above 70°C for immediate inactivation of the intrinsic polyphenol oxidase, then further processed for preservation. The final dried tea leaves are vacuum packaged with nitrogen flushing at the plantation site to avoid further oxidation before transportation out of the plantation. Samples of the packaged tea leaves are sent to certified laboratories for independent quality testing before release to the end consumers. The EGCG levels in the packaged tea are periodically assayed to assure stability of the antioxidants in the tea leaves before expiration date.

Q: How should one prepare high-antioxidant green tea drinks for health protection?

A: Most people know that both tea and china wares originated in China. But few realize that high quality ceramic and porcelain utensils were initially developed around the tea trading center in the late Tang dynasty, especially in a town called Fuliang, which is now known as Jingdezhen since about 1000 A.D. High quality non-metallic utensils were needed for preparation and serving of tea because the final quality of tea drink can be markedly influenced by the utensils and the water used to prepare the tea. Leachable metal ions, especially iron and lead, may be detrimental to the quality of the tea in pots or in cups during tea brewing at high temperature. Residues of chlorine or its derivatives in the water, detergents, alkaline chemicals, and oxidizing agents in the dish washing fluid can make the green tea extract turn brown in a few minutes, resulting in loss of its antioxidant activity. This change in color in tea liquid will never be noticed when oolong and black tea, or a low-grade dust green tea is brewed because the color of the tea liquid is brown or brownish from the beginning.

The water used to brew green tea should be boiling hot at about 212°F, or 100°C. Boil the clean water in a copper or plastic kettle, glass pot, high grade stainless steel kettle, or lead-free porcelain ware.

Try to brew tea in a non-metallic steeper with no free air to reduce oxidation of the antioxidants at high temperature for maximum preservation of the antioxidant ingredients in the drink.

Never put water and dry tea leaves in a mug for microwave heating because the temperature in the partially wet tea leaves may exceed 100°C to a temperature that would destroy the antioxidants.

The brewing time should be 20 minutes, in contrast to the recommended method for the dust grade green tea, which usually limits a brewing time to 3-4 minutes. When the boiling hot water first fills a tea steeper at room temperature, the temperature of the water usually drops down to about 90-92°C immediately. It would take about 20 minutes for the

hot tea to cool down to about 60°C. One should avoid drinking any scorchingly hot liquids.

Do not drink green tea with an empty stomach. Green tea and EGCG may be an irritant to the gastric lining without food in the stomach.

Q: What are other health benefits of drinking green tea?

A: In the old days, the Chinese emperor only rewarded the court physicians when his subjects stayed healthy. Prevention of diseases was the health policy of the nation. One mandate was that water must be boiled before use for drinking. A good Chinese medicine must be non-toxic to the body and preferably can be used against many diseases, or with many benefits. This is in contrast to the medical practice in the US in which the HMOs only pay the doctor to see a sick person and the FDA only approves a purified chemical for the treatment of one specific disease as drug.

Initially tea was used as a drug for the purpose of "detoxification" according to ancient records, probably to counter the pathological effects of the chronically ingested heavy metals, which were invariably present in the primitive cookware and easily extracted in boiling hot water. Traditionally the Chinese have always relied on drinking boiled water for prevention of waterborne communicable diseases. In ancient China, tea was described as a "bitter liquid", characteristic of any old medicine, until porcelain was invented.

In about 200 BC, the world's first "paper-back" pharmacology, *Shennong's Herbal Classic*, asserted that "Tea tastes bitter. Regular consumption of tea boosts mental function, reduces need for sleep, trims extra body weight, and improves eyesight." The function of detoxification was de-emphasized by the time paper was invented and the early celadon porcelain was available for tea preparation.

The primarily meat-eating Mongolians and the nomadic minority Chinese found drinking tea was associated with longevity and they were willing to trade a good horse for about 20-26 tea bricks. Now, we know that green tea can provide the needed vitamin C, reduce the lipid absorption and the LDL cholesterol level in the blood. Tea was one of the mandatory provisions to the 27,000 sailors on the ships during the long sea expeditions from China to Africa when China was the sea power of the world in the Ming Dynasty in the early 1400's.

Recent medical research has provided evidence that drinking green tea may reduce the risk of fatal heart attack, stroke, Alzheimer's disease, Parkinson's disease, help reduce body fat and help fight viral infection.

Viral infection is a special group of diseases other than cancer for which no effective specific medications are currently available. All antiviral medications are associated with high toxicity to the human body. Green tea is non-toxic and has been shown to be potentially beneficial in the fight against viral infections through the following mechanisms:

1. Antimutagenic at the molecular level - to reduce the chance of virus mutation. Viral mutation has been a big problem in treating SARS and HIV patients.
2. Antiviral at the cellular level (inhibit replication of viral particles, e.g., by interfering with HIV attachment to CD4 lymphocytes).
3. Boosting the immunity of the human body (an old concept in Chinese medicine, but quite new in western medicine) against viral and bacterial infections.
4. Enhancing the antimicrobial activity of the antibiotics against secondary bacterial infections-reducing the chance of developing drug

resistance and working synergistically with the antibacterial drugs, such as restoring the MRSA sensitivity to methicillin.

Q: Should one worry about the caffeine in green tea?

A: When properly prepared, the content of caffeine in green tea is about one third (1/3) of that in black tea, and is about one fifth (1/5) of that in brewed coffee. If a new tea drinker is sensitive to caffeine, he or she should consult their doctor for precaution. However, the small amount of caffeine in green tea was found to be also beneficial in achieving the collective anticancer effect of the whole green tea in laboratory studies. Therefore, decaffeinated green tea may not function as well as the whole green tea in chemoprevention against cancer. Besides, the decaffeination process may remove other important, but not yet identified beneficial ingredients from the tea leaves.

Q: Can one use tea extracts and tea bags in place of loose green tea leaves?

A: As mentioned above, at least one brand of tea extract marketed for weight reduction has been found to cause liver damage in several young women in Europe. Therefore, one should be cautious in consuming tea extracts or green tea preparations other than natural tea leaves. The side effects of EGCG or any other green tea ingredients, when swallowed in concentrated forms, have not been evaluated.

To make infusion tea bags, the manufacturers use dust-grade tea leaves or reduce the relatively intact tea leaves to duct-grade sizes for filling the tea bags. The fragmented tea leaves in dust size have a large total cut surface exposed to the air which would facilitate the oxidation process of the antioxidants in the tea leaves. Therefore, the tea in infusion bags generally has very low levels of the antioxidant EGCG. In addition, in order to prevent the tea bag tissue from disintegrating during tea brewing in hot water, the tissue has been treated by a cross-linking agent(s) containing formaldehyde derivatives. It has been shown that some formaldehyde-like molecules are released from the tea bag during hot water steeping in the tea cups. These formaldehyde-like molecules may not be toxic *per se*, but their effect on the bioactivity of the green tea is unclear. Therefore, it is inappropriate to put high-antioxidant green tea into infusion tea bags.