

Historical Review

HISTORY AND PROSPECT OF TEA MEDICINE IN CHINA

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ABSTRACT

Tea was first used as medicine during the reign of "Emperor Shengnong" in ancient China. The period of more than 4000 years' of Chinese tea medication can be divided in 3 stages of development. In this paper we briefly discuss the history of medicinal uses of tea in China, review the stages of development, and focus upon the modern achievements. The trend and future direction in tea medical study in China are also briefly discussed.

Keywords: Tea medicine, health maintenance, history of development as medicine, achievements in medicinal uses, China

INTRODUCTION

Nowadays, tea is mainly used as a beverage. Its consumption ranks in the first place among all kinds of beverage in the world. However, the earliest utilization of tea in China was as an herbal medicine, which can be traced back to the ancient times of "Emperor Shengnong" 4000~5000 years ago (Chen, 1992). For a long time tea had been used simultaneously as medication and as a beverage. The medicinal functions and health protection effects of tea were confirmed repeatedly by modern scientific researches. The mechanisms of medicinal functions of tea were gradually revealed during the last several decades. The medicinal value of tea has aroused new interest not only amongst Chinese scientists but also amongst the scientists of western countries. Today, the relationship between tea and human health has become a subject of intensive studies by scientists throughout the world.

1. History of medical utilization of tea in China

China is the cradle land of tea plant (*Camellia sinensis*) (Yu, 1986), as well as, of the use of tea as medicine (Mao, 1992). Chinese, especially the practitioners of the Traditional Chinese Medicine, mainly carried out the study of early stages of tea medication. Many classic medicine books written by ancient Chinese doctors contained numerous descriptions, elucidations and prescriptions of tea as medicine (Lu Yu, 733--804), in Tang Dynasty and Li Shi Zhen (1518--1593), in Qing Dynasty).

Beginning with the time of "Emperor Shengnong", more than 4000 years' development of tea medicine has gone through three stages of development:

- A. The origin and stage of early development.
- B. The developing period when tea medicine was empirically studied and utilized by those who practiced The Chinese Traditional Medicine.
- C. The modern stage when tea medicine was studied and utilized based on the modern science and technology.

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A. The origin and early developing stage

This period of development began at about 2500 BC, which is the time of “Emperor Shengnong” in ancient China, and continued for a very long period, and ended at the beginning of Tang Dynasty. The ancient people of China were the first to discover the medicinal value of tea more than 4000 years ago. Several ancient Chinese books described how the ancient people first found tea plant and tasted fresh leaves of tea. Then they recognized that it could be used as a herbal medicine for curing some diseases and for maintenance of health (“Han Dynasty” by Shen Nong Ben Cao Jing, which was written in 200 A.D.).

Through a long period of practice, people accumulated rich experience of using tea as an herbal medicine. They gradually recognized that fresh leaves of tea are effective for detoxification, reducing fever, cooling the body heat, improving digestion, etc. At that time, such practices were not based on research and experiment, but the approach was rather empirical and the knowledge was not systematic. With the progress of such medical practice, the knowledge of tea medicine became richer. Gradually the exploration of tea medicine was combined with The Chinese Traditional Medicine, to usher a new stage of preplanned research by followers of The Chinese Traditional Medicine.

The main achievements in this developing stage can be sequentially identified as follows:

1. Discovery of the value of the tea plant as medication for the first time, and gathering some experiences of curing diseases by eating fresh leaves of tea.
2. Progressing from eating fresh tea leaves to processing fresh tea leaves into dry tea, which can be stored for later use.

3. Progress from eating fresh tea leaves for curing diseases to taking tea as a daily healthy beverage.

B. The period of development when tea medicine was empirically studied and utilized in The Chinese Tradition Medicine

The second developing stage also stretched for a very long time—from the later part of Tong Dynasty (617 A.D.—907 A.D.) to the middle of the 20th century. During this period, Traditional Chinese Medicine mainly studied the medicinal value of tea plant. The materials from tea plant (tea leaves, tea roots, tea seeds, etc.) were taken by Chinese doctors as herbal medicine to formulate prescriptions for medication purpose.

The achievements in this developing stage can be listed as follows:

Many medicinal effects of tea were discovered and systematically concluded including 20 different types of physiological functions: for example tea helps to increase digestion, improve sleep, relieve rheumatic pains and colds, dispel the hotness, reduce temperature, detoxicate, soothen the nerves, detoxify the effects of alcohol, strengthen teeth, brighten the eyes, effect weight-loss, relax the bowels, slake thirst and help produce saliva, eliminate phlegm, & C. (Lin Q L, 1998).

1. Thousands of prescriptions of The Chinese Traditional Medicine were developed with tea as an important ingredient (Chen Zhuan, 1987).
2. Along with the knowledge and experience of the practice of tea medicine, tea plant and tea beverage began to spread all over the world (Chen Wen, 2004).

- C. The modern development stage, in which medicinal properties of tea were studied and utilized, based on the modern science and technology.

Although there have been thousands of years history of tea medicine, the pharmacological research with modern science and technology is the development of only the last three or four decades in China. In the early 70's, The Tea Research Institute of Chinese Academy of Agricultural Sciences collaborated with Municipal Station of Health and Epidemic Prevention of Tianjing to extract polysaccharides from tea and study its pharmacological functions. As a result they confirmed and demonstrated the anti-radiation effect of tea with modern science for the first time in China (Chen. *et al*, 1989). After that, more and more scientists, not only in the field of tea science but also in the medical science field, carried out detailed studies on tea medication.

2. The modern achievements on the study of tea medicine

Through nearly 40 years' study with modern science and technology, more than 400 ingredients in tea were identified and several were confirmed to have medicinal effects. Many pharmacological functions of tea as well as their mechanisms were discovered. Among these, the following pharmacological effects of tea were studied in depth and progress ensued.

2.1 Anti-cancer effect

This subject is one of the most studied categories in the area of tea medicine (Zhu, 2003). The anticancer activities of tea and its components have been illustrated by many studies in China, including *in vivo*, animal, and epidemiological studies.

With animal studies, the preventive effect on several types of carcinogenesis has been validated. The experiment by Han *et al* (2003) showed that tea catechins and tea pigments are effective in inhibiting liver and colon carcinogenesis in rat. Several other animal experiments illustrated that tea and some tea ingredients are bioactive in curing or preventing other forms of carcinogenesis, such as oral, breast, gastric, esophageal, lung, and intestinal cancer, etc (Yang, 2000, Ohishi, 2002, Chen, 2003).

Many epidemiological investigations carried out by scientists of China and Western countries demonstrated that tea and some tea ingredients are helpful in preventing carcinogenesis. For example, Mu *et al* (2003) conducted a case-control study in Taixing, Jiangsu province and found that green tea drinking decreased gastric cancer risk by 40%~60%. Amongst drinkers of alcohol the reduction of risk was even higher (81%). A case-control study conducted in Yangzhou, Jiangsu province, involving 133 stomach cancer cases, 166 chronic gastritis cases and 433 healthy controls, found a protective effect of green tea not only against stomach cancer, but also against chronic gastritis (Setiawan *et al*, 2001).

In clinical studies, Li *et al* (2002) investigated the chemopreventive effects of tea on human oral precancerous mucosal lesions by daily oral administration of 3g of tea extract plus a topical treatment. The results showed a reduction in the size of leukoplakia, precancerous oral plaque, and a decrease in cell proliferation by 38% in treated patients compared to only 10% in placebo control patients. This study presents direct evidence of the protective effects of tea on cancers. A group of Chinese scientists (Yan *et al*, 1990) carried out a study in Shandong province to investigate the cancer-preventing effect of Chinese green tea extracts. The result showed that Chinese green tea extracts had significant

effects by blocking the formation of N-nitrosoproline in the human body. The blocking rate was 91% ($P < 0.001$) in the chronic superficial gastric group (11 cases), 92% ($P < 0.001$) in the intestine metaplastic group and 89% ($P < 0.001$) in the early gastric carcinoma and dysplasia group, respectively.

The potential molecular mechanisms of anticancer activity of tea have also been observed in a number of *in vitro* studies. These studies demonstrated that tea and tea constituents have various biological activities including anti-oxidation, induction of apoptosis of cancer cells, protection against metal ion-induced cytotoxicity, inhibition of virus infection and enhancement of the immune function and protection from irradiation.

2.2 Regulating blood lipid, blood pressure and blood sugar

Intensive studies have been focused on modifying effects of tea on blood lipid and blood sugar, and inhibitory effects of tea on cardiovascular diseases. Positive results were reported both in China and other countries.

Shen *et al* (1998) studied the ability of tea polyphenols in lowering blood lipid levels in aged rats. The results showed that tea polyphenols increase the ratio of high-density lipoprotein cholesterol (HDL-C) to total cholesterol (TC), and significantly lower the serum level of lipid peroxide in rats.

There has been a long history of using coarse tea to treat diabetes in China. The modern research has documented this function and elucidated some of the mechanisms as well. Polysaccharides in tea play a key role in the treatment of diabetes. Wang *et al* studied the effect of tea polysaccharides (TPS) on lowering blood lipid and glucose levels. Results suggested that tea might be useful in the treatment of diabetes.

Wang and his colleagues (1991) studied the effect of tea polysaccharides (TPS) on vascular system in mice and rats. Their results showed that TPS could reduce blood pressure and enhance survival rate of rats under anoxia conditions. Another Chinese research group studied the medicinal effect of 'Gabaron Tea'. They found that γ -amino-butyric acid (GABA) from 'Gabaron Tea' could lower blood pressure in rats through inhibition of angiotension I-converting enzyme (ACE) (LIN Zhi, *et al*, 2002).

In a clinical trial involving 310 subjects in Fujian, China, Chen *et al* investigated the effects of Oolong tea on reducing arteriosclerosis, lowering blood pressure and lipids, reducing body fat, and delaying aging (Chen, 2002). During a period of 1~3 months, the treatment of 8g Oolong tea a day resulted in 52 of the 80 (65%) patients' serum total cholesterol (TC) and total triglyceride (TG) level decreased by 19.2% and 17.5% on an average, respectively, and HDL-C increased by 17.6% on an average. The regulating effects of Oolong tea on lipid metabolism and lowering of blood pressure were also evident in the study.

2.3 Effects of anti-oxidation on delaying the onset of aging

The aging process is closely related to the concentration of free radicals and super oxidation of lipids in an organism. It has been shown that tea is a good antioxidant, as one of the most effective components in tea, EGCG, has very strong ability as an excellent antioxidant and scavenger of free radicals, even stronger than vitamins C and E. As concentrations of free radicals are decreased and oxidation of cells is avoided, a cell's life is prolonged. Therefore, tea drinking is good for postponing the onset of aging process.

Scientists from Tea Science Department, Zhejiang University investigated the scavenging effects of EGCG and GCG on singlet oxygen with electron spin resonance

(ESR). The results showed that their scavenging effects were very strong. At high concentrations, both EGCG and GCG have high antioxidant ability. Deng Zeyuan *et al* (1996) carried out an experiment with houseflies to test the effect of tea on aging process. Results showed that the life of houseflies was prolonged significantly by drinking green tea or black tea, and the uninterrupted swarming time of houseflies also increased.

The main effective antioxidant ingredients in tea are catechins, such as EGCG, GCG, and ECG. Recent studies showed that polysaccharides, theanine and vitamins also contribute to the anti-oxidation function. Many of the health protection effects of tea are based on the mechanism of oxidation-prevention and of scavenging the free radicals.

2.4 Strengthening immunity

The immunity of humans or animals is one of the most important defenses against diseases. The immunity can be distinguished as blood immunity and intestinal immunity. Tea drinking can strengthen both blood immunity and intestinal immunity.

Experiments by Chinese scientists showed that tea drinking increased the numbers of leukocytes and lymphocytes in blood. This indicated that the blood immunity is strengthened. Recently, American scientists also reported that theanine in human blood can strengthen the ability of γ - δ Ts as much as 8 times against invading microorganisms. In addition, the level of beneficial microbes (such as bead like biforked *bacillus*) increased by tea drinking, and that of harmful microbes decreased. This indicated that intestinal immunity had been strengthened by tea.

Polysaccharides also play an important role in raising immunity. Scientists gave polysaccharides to mice through abdominal

injection and showed that the immunity and self-protection ability of the mice were significantly enhanced with polysaccharides at dosages of 25 mg/kg and 50 mg/kg. A series of studies revealed that many ingredients in tea such as polysaccharides, theanine, polyphenols, contributed to the immunity-enhancing function.

2.5 Radiation protection

Radiation pollution is one of the most concerning problems faced by the urban population. There are so many radiation sources in modern life that we suffer radiation exposure all the time. It is well known that tea possesses anti-radiation effects, and is praised as 'a health protection beverage in the atomic-age'.

An investigation into the survivors of the atom-bomb exploding in Hiroshima was carried out by Japanese scientists. Results showed that for those who drank tea for a long time, the degree of damage was light and the survival rate was high. As found in clinical studies, radiation treatment for curing cancers usually causes side effects such as naupathia, inappetency and diarrhea. These side effects are significantly reduced by tea drinking during the radiation treatment. In China a medical procedure named as "Shen Bai Ji" has been developed, with tea as its main-stay. This medical procedure was proved to effectively raise white blood cells of patients who received radiation treatment (Ji *et al*, 2002).

Tea polyphenols have strong effect against ultraviolet radiation. So, they are considered as a "filter of ultraviolet radiation". Research result by Zhang Jun *et al* (2004) showed that the damage level of DNA in human lung fibroblast cells (HLF) by ultraviolet radiation was greatly reduced by treatment with tea polyphenols.

It has now been demonstrated by scientists that the constituents responsible for the anti-

radiation effect of tea are polyphenols, polysaccharides, vitamin C & B, amino acids, etc.

2.6 Effect on harmful microbes

Microbes exist with us all around the world and are closely interlinked with human health. The harmful microbes are the most important factor in causing human diseases. It is a proven fact that tea drinking can help maintain a better balance of microbes in the intestine, and therefore, to raise the intestinal immunity.

Some components of tea, such as catechins and theasaponins, are very effective in eradicating some harmful microbes. Patients with diarrhea can be treated by drinking strong tea, as is often done in Russia. Scientists of Japan and America have proved that EGCG has strong inhibiting effect on flu virus. In China, Peng Hui-qin *et al* (2003) confirmed the anti-influenza-virus effect of tea polyphenols. There are also reports that tea and tea ingredients can inhibit the activity of AIDS and corona virus.

2.7 Prevention of dental caries

It was known as early as in Tang Dynasty (618 A.D.—907 A.D.) that tea drinking is helpful in preventing dental caries. In China, experiments carried out in the 1970's had proven that the rates of children's dental caries were lowered by 50% by drinking a cup of tea each day. Polyphenols (include catechins, theaflavins etc) and fluorine are the main ingredients contributing to prevention of dental caries. Catechins in tea can inhibit the activity of gingivitis and caries-causing bacteria *S. mutans*. Epidemiological studies and *in vitro* studies have also shown that catechins significantly inhibit the growth of anamorphic *Streptococcus. mutans*, and therefore, prevent dental caries.

There are many ingredients and factors that contribute to the inhibition of caries by tea, and

the polyphenols (including catechins, theaflavins, etc) and fluorine are possibly the main contributors.

2.8 Effect on beauty

Tea polyphenols, especially catechins can protect the skin from the damage caused by ultraviolet radiation. So, catechins are considered as a "filter of ultraviolet radiation". Their anti-radiation function is stronger than that of vitamin E. Modern research also revealed that catechins can inhibit the activity of 5- α reductase, and therefore depress the excretion of sebum. So, tea drinking is also beneficial to skin beauty. Now many cosmetics contain tea polyphenols to enhance their health preserving function.

Because tea manifests bioactivities of antioxidants, radiation protection, free radical scavenging, anti-microbial, obesity preventing and nutritional properties, consistent tea drinking may result in good health and a beautiful body.

3. Trend and direction in tea medical research in China

According to the developing trends of tea medication study, the following trends are discernible:

3.1 Developing research on medicine or health-preserving products with tea or tea functional components

Studies on tea and health in the last several decades have contributed to our understanding of the potential beneficial effects of tea on human health. These studies suggest that tea is a strong candidate for the prevention and treatment of several human diseases, especially cancer. Now, focused researches on development of tea medicines and health promoting tea products are expected. The combination of tea with the Chinese traditional medicines may enhance the effectiveness of tea in the treatments of

diseases. Therefore, more health preserving products will be developed through formulating Chinese herbal medicine with tea or tea ingredients from now on.

Exploitation of the medicinal value of tea as a health-promoting beverage, food & feeds, and health beneficial additives in other commodities, is also expected.

3.2 Chemical or physical modification of tea ingredients

For the bio-effective ingredients in tea, the early studies mainly involved extraction, separation and purification of the active compounds in tea and determination of their activities. Further development would place emphasis on reconstruction of these components through chemical or physical modification, so as to enhance their bioactivity and/or increase the absorption efficiency by the human body.

3.3 Anti-cancer studies

The results of anticancer effect of tea were mainly based on *in vitro* and animal studies. However, some epidemiological investigations were conducted in large human populations. Clinical studies with humans are still a weak area for anticancer investigations. In coming years, such carefully designed epidemiological and clinical studies are urgently needed to further confirm the positive effects of tea on curing or prevention of some types of cancers. Through these studies, practical utilization of the anti-cancer effects of tea and the development of tea medicinal products for curing some types of cancers might become a reality, in not too distant a future.

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