TOTAL PHENOLIC COMPOUNDS AND TANNINS CONTENT OF BANCHA GREEN TEA (CAMELLIA SINENSIS) DEPENDING ON EXTRACTION CONDITIONS

Kaloyan Georgiev¹, Iliya Zhelev², Svetlana Georgieva²

¹Department of Preclinical and clinical sciences, Sector Pharmacology and Toxicology, Faculty of Pharmacy, Medical University of Varna, ²Department of Pharmaceutical technologies, Faculty of Pharmacy, Medical University of Varna

ABSTRACT

The effect of different extraction conditions of prepared infusions on the content of bioactive compounds of Bancha green tea (Camellia sinensis L.) were investigated. The content of total phenols, tannins and methylxanthines were determined spectrophotometrically. The highest content of total phenolic compounds and tannis were determined on the 30th minute of infusion – 7,71% and 4,49% respectively. The conditions with the most valuable (higher content of polyphenols) and the most healthy (lowest of tannins) combination is in the 10th minute of extraction – 7.47% and 3,84%. The tea also contained low percentages of methylxanthines (0,66%) and caffeine (0,09%).

Keywords: Bancha green tea, total phenols, flavonoids, methylxanthines, caffeine

INTRODUCTION

Green tea is a regularly consumed traditional drink in Japan and China and is characteristic to their culture. Although produced from the same plant, Camellia sinensis L., differences in the manufacturing process specify that green tea has a higher catechin content than black tea (1), which may contribute to its beneficial effects on cancer, cardiovascular diseases and other conditions (9). Tea contains large amounts of various phenolic compounds as flavonoids, phenolic acids, tannins and others. Based on data in literature, higher content of total phenols are connected with beneficial effects of the tea, while higher content of polymer phenolic - tannins is associated with adverse effects, mainly gastro-intestinal disorders (5). Another interesting group of phenolic compounds are the flavonoids. A class of tea flavonoids – catechins, include epicatechin (EC), epigallocatechin (EGC), epicatechin-3-gallate (ECG), and epigallocatechin-3-gallate (EGCG) (1,5) (Fig. 1). Other classes of compounds, important for their biological activity are methylxanthines. The main methylxanthine is caffeine, which has attracted much scientific and public attention during the past years. The caffeine content of tea leaves varies with tea type, but the normal range goes from 2–5% (dry weight, w/w) together with small amounts of theobromine and theophyllin. Caffeine is chemically 1,3,7-trimethylxanthine (C₈H₁₀N₄O₂), which is an alkaloid found in tea, guarana, kola nuts, coffee, cocoa beans and other plants. Caffeine acts as a stimulant for the heart, respiratory and the central nervous system, and is a vasodilator as well as a diuretic (Fig. 1) (7).
The main objectives of the present study is to determine the correlation between different extraction time and the content of total phenolic compounds and tannins in *Bancha* green tea as well as estimate the content of methylxanthines and especially the caffeine in it.

**MATERIAL AND METHODS**

**Plant materials and chemicals**

Whole *Bancha* green tea leaves (*Camellia sinensis* L.) were purchased from a local market. All chemicals used in the spectrophotometric methods were purchased from *Sigma-Aldrich*.

**Quantification of total phenols and tannins**

The determination of total phenols in the plant drugs was performed according to the *European Pharmacopoeia* 6 involving Folin-Chiocalteu reagent and pyrogallol as standard (4). The measurements were carried out using an S-22, UV/VIS spectrophotometer (Germany) at 760 nm.

**Quantification of total methylxanthines and caffeine**

Accurately weighed amount of the drug (±0.0001g) were boiled in water for 15 minutes. The combined aqueous extracts were acidified with sulfuric acid and concentrated. The solution was extracted with chloroform in a separating funnel. Chloroform extract was washed with sodium hydroxide and then with water. After the evaporation of chloroform a mixture of methylxanthines was obtained. From this mixture the caffeine was prepared by sublimation then the percentage of caffeine in the plant substances was calculated (in w/w).

**Statistical analysis**

All experiments were done in triplicate and data in tables and figures represent mean values ± standard deviation (n = 3). Results were evaluated for statistical significance using one-way ANOVA using SigmaPlot (Version 11.0). The confidence level for statistical significance was set at a probability value of 0.05.

**RESULTS AND DISCUSSION**

Increasing interest in the health benefits of tea has led to the inclusion of tea extracts in dietary supplements and functional foods. *Bancha* green tea (third or fourth flush of green tea; that is, the late seasonal picking) (Fig. 2) is the one main types of green tea consumed in Japan, and is usually prepared by steeping the tea leaves in hot water (6).
Total phenolic compounds and tannins content of bancha green tea (*Camellia sinensis*) depending on extraction conditions respectively). In the other investigated conditions the level of extracted polyphenols increased insignificantly from 7.47% (w/w), to 7.55% (w/w) while the rise of tannins was more elevated - 3.84% (w/w) to 4.28% (w/w). The conditions with the most valuable (higher content of polyphenols) and the most healthy (lowest of tannins) combination is at the 10th minute of extraction where the content of total polyphenols was 7.47% (w/w) and tannins only 3.84% (w/w). Similar data for total polyphenols content were established in our previously study (8) with other types of tea (at the 30th minute) - black and green tea, where phenolic compounds were 7.32% (w/w) and 5.97% (w/w) respectively. While the content of tannins is mainly associated with unpleasant taste - astringent feeling inside of your mouth and no beneficial systemic effects, the higher content of polyphenols provide for antioxidant, anti-inflammatory and cancer protective activity (Fig. 3) (10).

Methylxanthines, in particular caffeine, is the world’s most popular drug and is found in many beverages including tea. Although caffeine is commonly ingested to enhance alertness and improve performance, its use should be avoided by pregnant women, children, and people with cardiovascular diseases and anxiety disorders (3). In a further study, we have determined the content of total methylxanthines and caffeine. The results have shown that in Bancha tea total methylxanthines are 0.66% (w/w), and caffeine is only 0.09% (w/w) (Fig. 4).

In the above mentioned study (8), the content of total methylxanthines and caffeine in black and green tea made in the same extraction, conditions were almost twice higher (1.15% (w/w) and 1.31% (w/w) respectively) and caffeine content 8-9 times higher (0.67% (w/w) and 0.80 % (w/w) respectively).

**CONCLUSION**

The findings of the present study indicate that Bancha tea is a good source of plant polyphenols which may possess antioxidant, anti-inflammatory and cancer preventive action. The low content of caffeine allows its use by pregnant women, children, and people with cardiovascular diseases and anxiety disorders as a stimulant beverage with proven health properties. All these topics are under investigation and show a high potential for this tea species.

**REFERENCES**

6. Iwasaki M, Inoue M, Sasazuki S, Sawada N, Yama-ji T, Shimazu T, et al. Green tea drinking and sub-


