

Mineral content evaluation of some green tea assortments

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Abstract

All types of green tea are prepared from the dry leaves of *Camellia sinensis* L. The type of green tea depends on the level of oxidation of the leaves. Green tea is produced from non-oxidized leaves and is therefore rich in antioxidants and polyphenols that are so beneficial for health (improving brain function, supporting the weight loss process, protecting against cancer and reducing the risk of heart disease). The purpose of this study is to evaluate the mineral content of some green tea varieties using X-Ray Fluorescence analysis. In order to achieve the objectives, we purchased various assortments of green tea (plain or with ginger, lemon peel or sea buckthorn). The research results show that all samples have high values of potassium content calcium, manganese and iron. Of the nine varieties of green tea, lead was identified in three of them, but with values that do not exceed the maximum allowed limit. In conclusion, green tea can be consumed not only for its high content of polyphenols but also for covering the daily requirement of minerals, especially potassium and calcium.

Keywords: X-Ray Fluorescence, nutritional value, toxic elements

Introduction

All types of green tea are prepared from the dry leaves of *Camellia sinensis* L. The type of green tea depends on the level of oxidation of the leaves. There are many studies on the health benefits of green tea consumption [3, 4, 8, 14] such as: antioxidant effect, aids in digestive issues, prevents diabetes, improve the human immune system, intervenes in burns fat, improve cognitive and brain function, reduce the risk of cardiovascular diseases, even in combating some types of cancer.

These benefits are due to the high content of antioxidant substances (especially catechins), vitamins (C, E, B2 and niacin), and minerals (especially potassium, calcium and iron).

In green tea composition we also find: proteins (15–20% DW), aminoacids (1–4% DW), carbohydrates (5–7% DW), caffeine and theophylline, pigments, etc. [4]. Due to these beneficial effects on health, some researchers include green tea in the group of functional products [2, 4, 8, 9, 11].

But another aspect related to the consumption of green tea is that *Camellia sinensis* L. plant is known to accumulate toxic elements (cadmium and lead) from soil, which are collecting in tea leaves [1,3,5,6,7,10,12]. Lead and cadmium are toxic metals that have negative effects on human health, therefore in 2021 de EU Commission redefined the maximum levels allowed [11, 12]. From these considerations results the importance of monitoring the contamination of green tea leaves with regard to the content of these toxic metals.

The goal of this study was to evaluate the mineral composition of some assortments of green teas (plain or with ginger, lemon peel or sea buckthorn), using X-ray fluorescence method.

Material and Method

The study was made on nine assortments of green tea (T1-T9) found on the Romanian market. Green tea assortments T1, T2, T5, T8 and T9 are simple, without any addition, while assortment T3 contains ginger (30%), assortment T4 lemon peel (4%) and assortment T6 contains sea buckthorn (10.3%).

To determine the minerals in green tea samples powder, it was used X-Ray Fluorescence Spectrometry [13] and Hitachi X-MET8000 Analyzer, each value being the average of two determinations set. The results

regarding green tea assortments mineral content are expressed in mg/10g dry weight for K, Ca, Mn and Fe and in ppm (mg/kg dry weight) for Zn, Ba, Rb, Cu, Ni and Pb.

Results and Discussions

The research results show that all samples have high values of potassium content (between 415.91 and 678.26 mg/10g dry weight), calcium (136.01 and 257.74 mg/10g dry weight), manganese (27.99 and 66.61 mg/10g dry weight), iron (6.85 and 12.80 mg/10g dry weight), zinc (75 ppm and 389 ppm), barium (126 ppm and 191 ppm) and rubidium (90 ppm and 210 ppm).

Regarding the potassium content, the tea samples with ginger (T3), lemon peel (T4) and sea buckthorn (T6) recorded lower values than the *Camellia sinensis* samples.

The highest content of calcium was registered by the assortment of green tea with the addition of lemon peel (T4) (Figure 1).

T5 and T4 types recorded the lowest values of the manganese content. All the samples contain a significant amount of iron, the highest value of this parameter is the T9 sample. (Figure 2).

The T9 assortment has a zinc content more than three times higher than the other samples (Figure 3).

Regarding the copper content, samples T5 and T8 have the highest values and samples T1 and T6 the lowest. Of the nine varieties of green tea, lead was identified in 3 assortments: T2, T8 and T9, but with values that do not exceed the maximum allowed limit (2 mg/kg DW) [15, 16] (Figure 4).

Our results are in accord with other studies which highlights that the predominant minerals found in green tea are potassium and calcium [2, 3].

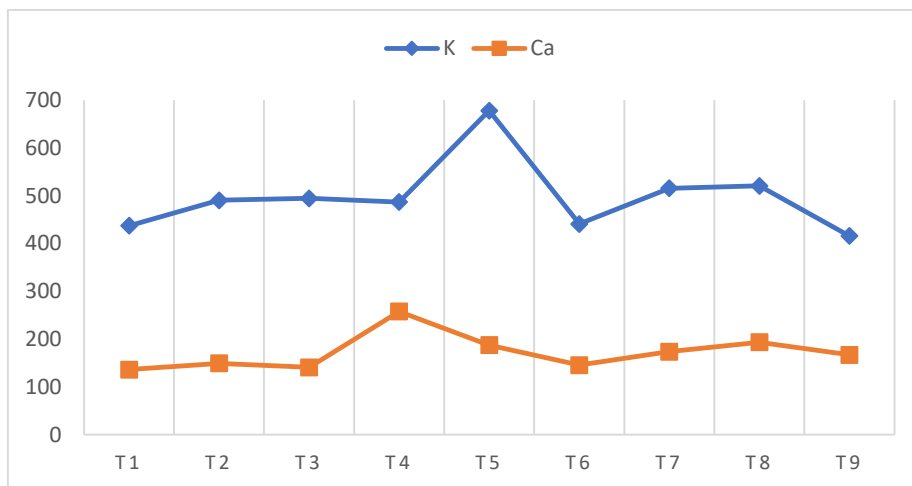


Figure 1. K and Ca (mg/10g dry weight) in green tea assortments

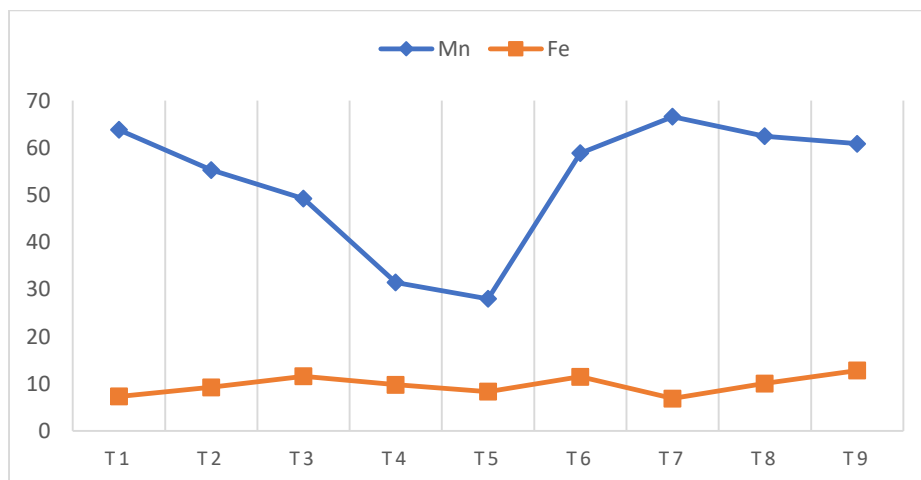


Figure 2. Mn and Fe (mg/10g dry weight) in green tea assortments

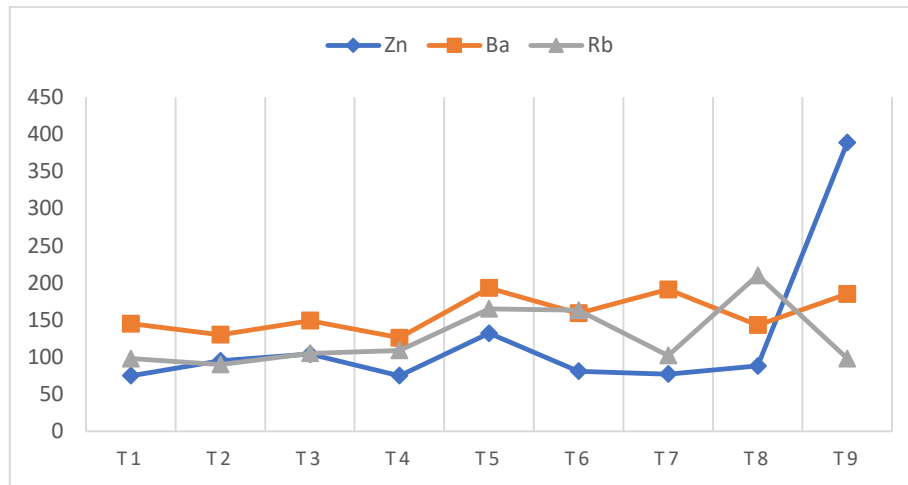


Figure 3. Zn, Ba and Rb contents (mg/10g dry weight) in green tea samples

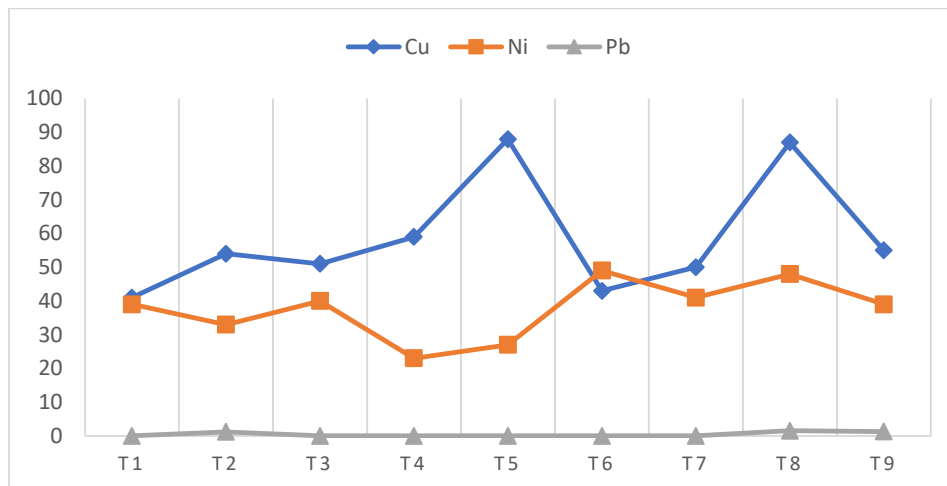


Figure 4. Cu, Ni and Pb contents (mg/kg dry weight) in green tea samples

Conclusions

Although the mineral content varies from one assortment of green tea to another, all the samples registered high values of potassium, calcium, manganese, iron and zinc contents. The X-ray fluorescence analysis of the samples shows that they do not contain cadmium and the lead levels found in three assortments does not exceed the maximum allowable limit. So, the XRF method is a fast analysis that can determine the levels of contaminants in green tea or other foods. In addition to the beneficial health effects due to the antioxidant compounds, green tea can be also consumed in order to cover the body's daily mineral needs especially potassium and calcium.

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