Comparative Assessment of Total Polyphenols and Antioxidant Activity of Commercial Green Tea from Tuzla Markets

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ABSTRACT

Green Tea, made from Camellia sinensis plant leaves, is one of the most popular drinks in the world. For the past decades, scientists have studied this plant in terms of potential health benefits. Research has shown that green tea helps prevent stroke, malignancy and infections. In this paper, antioxidant activity and total phenol content of 4 samples of green tea from local Tuzla stores were investigated, of which two were of foreign origin. The antioxidant activity of the samples was analyzed using FRAP and DPPH methods. The obtained results show that the highest content of total phenols and the largest antioxidant capacity has a sample of foreign origin. The content of total phenols in the samples ranges from 60.01 to 79.34 mg GAE/g. The highest FRAP value is 3.34 mmol/g. The antioxidant capacity was also confirmed by the DPPH method. The IC50 value ranges from 0.014 to 0.030 mg/mL.

Keywords-- Phenol, FRAP, DPPH, Green Tea

I. INTRODUCTION

Green tea (Camellia sinensis Theaceae) was discovered in China 3000 BC or earlier and is known to have various medical effects. It has been proven that green tea ingredients have a certain level of efficiency against cancer, obesity, bacterial and viral infections (Suzuki et al., 2012). The main components of green tea are polyphenols that are responsible for the antioxidative and other health benefits of green tea. The main polyphenols in green tea are flavonoids. Four major flavonoids are catechin, epicatechin, epigallocatechin, epicatechin gallate and epigallocatechin gallate. Epigallocatechin gallate is considered to be the most significant active component (Sinija and Mishra, 2009).

The structures of these components are shown in Figure 1. (Hodgson et al., 2013). Several studies have noted the positive effects of green tea extract on fat metabolism during and after exercise, and after shorter and longer intake. However, in general, the literature is unconvincing. The fact is that not all the effects are related to differences in study design, bioavailability of green tea extract and variations in measurement (oxidation of fat) (Hodgson et al., 2013). Green tea acts as a cyclooxygenase inhibitor, lipoxygenase, a factor of tumor necrosis and interleukinic pathways and ultimately controls the development and progression of tumors (Rahmani et al., 2015). The chemical composition of green tea is complex. Protein content is 15-20% dry weight, amino acids 1-4% dry mass (5-N-ethylglutamin, glutamic acid, tryptophan, glycine, serine, aspartic acid, tyrosine, valine, leucine, threonine, arginine and lysine), carbohydrates 7% dry weight (cellulose, pectin, glucose, fructose and sucrose), minerals and trace elements 5% (calcium, magnesium, chromium, manganese, iron, copper, zinc, molybdenum, selenium, sodium, phosphorus, cobalt, strontium, nickel, potassium, fluoride and aluminum). The composition of certain bio components in green tea is shown in Table 1.

![Figure 1: Chemical structures of catechin, epicatechin, epigallocatechin, epicatechin gallate and epigallocatechin gallate](image-url)
Table 1: Content of Individual Components (%) in Green Tea and Its Solution

<table>
<thead>
<tr>
<th>Component</th>
<th>Green Tea</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proteins</td>
<td>15</td>
<td>traces</td>
</tr>
<tr>
<td>Amino acid</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Fibers</td>
<td>26</td>
<td>0</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>7</td>
<td>4</td>
</tr>
<tr>
<td>Lipids</td>
<td>7</td>
<td>traces</td>
</tr>
<tr>
<td>Pigments</td>
<td>2</td>
<td>traces</td>
</tr>
<tr>
<td>Minerals</td>
<td>5</td>
<td>4.5</td>
</tr>
<tr>
<td>Phenolic components</td>
<td>30</td>
<td>4.5</td>
</tr>
<tr>
<td>Oxidized phenolic components</td>
<td>0</td>
<td>4.5</td>
</tr>
</tbody>
</table>

II. METHODOLOGY

All chemicals were of high purity grade, purchased from Aldrich and used without further purification.

Total Phenolic Content

The content of polyphenols was determined according to the procedure previously published (Tawaha et al., 2007). Appropriate dilution was prepared for each of the extracts. Absorbance of the resulting blue colored liquids was measured at 765 nm, using a Shimadzu UV-mini-1240 UV/Vis Spectrophotometer. Quantitative analysis was performed based on the standard calibration curve of gallic acid, using the concentration range between 3 mg/mL and 150 mg/mL (y = 0.0049x + 0.0449; R² = 0.9982). Calibration curve of the gallic acid is shown in Figure 2.

DPPH Radical Scavenging Activity

2,2-diphenyl-1-picryl-hydrazyl (DPPH) method was performed according to the method described earlier (Benvenuti et al, 2007). The radical scavenging effect (%) or percent inhibition of DPPH radical was calculated according to the equation:

\[
\text{Inhibition} = \left( \frac{A_{control} - A_{sample}}{A_{control}} \right) \times 100
\]

where Asample is the absorbance of the solution containing the sample at 517 nm and Acontrol is the absorbance of the DPPH solution. The results are expressed as the IC50 value (mg/mL) or the concentration of extract that caused 50% neutralization of DPPH radicals.

III. RESULTS AND DISCUSSION

The content of total phenol in samples of commercial tea is shown graphically at Figure 4. Samples of foreign origin (sample 1 and 3) showed the greatest deviations in the content of total phenols. Sample 1 contains the highest polyphenol (79.34 mg GAE / g), while sample 3 is the lowest (60.01 mg GAE / g). These values are significantly higher than the results obtained by other researchers for this type of tea (Taheri et al., 2011; Nibir et al., 2017).
The results of the antioxidative capacity obtained by the FRAP method are shown at Figure 5. Values ranged from 3.34 mmol/g for a sample with a maximum of 2.41 mmol/g for a sample with the lowest FRAP value. The results obtained by the DPPH method (Figure 6) confirm the results obtained by the FRAP method. The summarized results of the research are shown in Table 2.

IV. CONCLUSION

The results of this investigation showed that commercial green tea from Tuzla markets have high content of polyphenols and high antioxidant capacity. Probably the price is dictated by the quality in the case of tested tea samples. The displayed results of TPC, FRAP and DPPH for each sample of tea in this analysis may differ from other published values due to differences in tea variety, type of soil, height of cultivation, post harvest storage, processing conditions and ontogenetic factors.

REFERENCES


