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ANTIOXIDANT AND ANTIMICROBIAL ACTIVITY OF HERBAL TEAS MADE FROM HUNGARIAN MEDICINAL PLANTS

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ABSTRACT
Total phenol content and antioxidant activity of herbal teas made from different Hungarian medicinal plants, chamomile (*Matricaria recutita*), rose hip (*Rosa canina*), stinging nettle (*Urtica dioica*) and yarrow (*Achillea millefolium*) were determined. Total phenol content and ferric reducing power was highest in rose hip samples (6216 mg GAE/100 g and 1984 mg AE/100 g) followed by yarrow, chamomile and stinging nettle. Radical scavenging activity of some rose hip and yarrow samples were very similar (78.5 and 77.8%). There were significant differences in the measured values of the same teas from different producers. We found strong correlation between total phenol content and ferric reducing power, and also good correlation between phenol content and DPPH radical scavenging activity, indicating that heat resistant phenolics were mainly responsible for the antioxidant activity of herbal teas. According to our results, herb teas with the highest phytochemical content and antioxidant activity were purchased from the same producer indicating the importance of adequate handling of the herbs.

Keywords: chamomile, rose hip, stinging nettle, yarrow, antioxidant

INTRODUCTION

Medicinal plants have been used in the treatment of various diseases since ancient times. Nowadays, the consumption of herbal teas is associated with a healthy lifestyle and fitness. Teas from medicinal plants are thought to prevent disorders arising from oxidative stress. The antioxidative activity of these beverages is attributed to their polyphenolic content which in turn depends on the growing conditions of the plant. Most medicinal plants growing in Hungary are common in whole Central Europe but the wild chamomile flower of Hungary's Great Plain received "protected designation of origin" status from the European Commission. This flower is "strong, aromatic, sweet-smelling, slightly bitter-tasting and, during processing, does not disintegrate, is less powdery and its essential oil preserves better than the herbal medicine made from cultivated chamomile", according to the application for the protected status. On the other hand, not only the origin but the time of harvest, and processing and packaging can all influence the amount and effect of phytochemicals found in medicinal plants. Our aim was to investigate the polyphenol content and antioxidant activity of herbal teas made from rose hip, chamomile, yarrow and stinging nettle produced and packaged by different companies.
Rose hip is known for its high ascorbic acid content but it is also rich in other, phenolic type antioxidants like flavonoids, tannins, phenolic acids, and non-phenolics like carotenoids and essential oils (ERCISLI, 2007). Rose hip tea with hibiscus is a popular beverage and it is often consumed to substitute black tea. It is used for strengthening the immune system. Chamomile tea is used to cure cold and to soothe inflammation in the gastrointestinal tract. Its pharmacological activity is associated with the essential oil and flavonoid content. The main components in the essential oil are α-bisabolol and bisabolol

oxids. Major phenolic compounds are chlorogenic acids, ferulic acid glycosides, dicaffeoyl quinic acids and apigenin glycosides (RAAL ET AL., 2012). *Achillea millefolium* (yarrow) is used in traditional medicine to treat ailments of the kidney and bladder. It also contains essential oils and phenolic compounds, like chlorogenic acids, dicaffeoyl quinic acid derivatives, luteolin and apigenin glycosids (VITALINI ET AL., 2011). Nettle tea is used as a diuretic, in joint diseases and against rheumatic pain. Main phenolic compounds in stinging nettle are chlorogenic and caffeic acid and their derivatives (KOMES ET AL., 2011).

MATERIALS AND METHODS

Teas from medicinal plants

Chamomile *(Matricaria recutita)*
Rose hip (*Rosa canina*)
Stinging nettle (*Urtica dioica*)
Yarrow (*Achillea millefolium*)

All teas were purchased from the same three companies.

Brewing teas

100 ml boiling distilled water was added to 1 g of each herb, and was left to brew for 20 min. Teas were filtered and after cooling to room temperature were used for the measurements.

Determination of total phenol content

The Folin-Ciocalteu method was used. Teas were diluted before measurement as necessary. The measuring solution contained: 0.2 ml diluted tea, 0.2 ml ethanol (95%), 1ml distilled water, 0.1 ml reagent. After 5 minutes, 0.2 ml sodium carbonate was added to the mixture and was incubated for 60 min at room temperature. Absorption was measured at 725 nm in a Beckman DU-65 spectrophotometer. Total phenolics were expressed as mg gallic acid equivalent (GAE)/100 g weight of the herb.

Determination of ferric reducing power with a modified FRAP method

Reagent solutions: 0.2% of iron (III) chloride, and 0.5% of α,α'-dipyridyl solutions in absolute ethanol. Measuring solution: 2.00 ml of diluted tea sample + 6.00 ml of absolute ethanol + 1.00 ml of α,α'-dipyridyl + 1.00 ml of iron (III). Absorption was measured at 520 nm, strictly 2 min after mixing the ingredients. Ferric reducing capacity was expressed as mg ascorbic acid equivalent (AAE)/100 g herb.

Determination of radical scavenging activity by the DPPH method

1,1-diphenyl-2-picryl-hydrazil (DPPH•) was solved in absolute ethanol (100 µM). Then, 1 ml of this solution was added to 5 ml diluted tea sample. The discoloration of DPPH• was measured at 517 nm after incubation in dark at room temperature for 30 min. DPPH radical scavenging activity was calculated using the following equation:

$$\text{DPPH• scavenging effect (\%)} = (A_c - A_s)/A_c \times 100,$$

where A_c was the absorbance of the control and A_s was the absorbance in the presence of the sample.

RESULTS AND DISCUSSION

The highest total phenol content was measured in rose hip samples followed by yarrow, chamomile and stinging nettle (*Fig. 1*). There were significant differences in phenol content of the herbal teas from different producers. According to the data by ERCISLI ET AL. (2007), total phenolics in lyophilized samples of *Rosa canina* hips had the concentration of

9600 mg GAE/100 g. Our best result was about 6000 mg GAE/100 g showing that during tea making we have lost some ingredients.

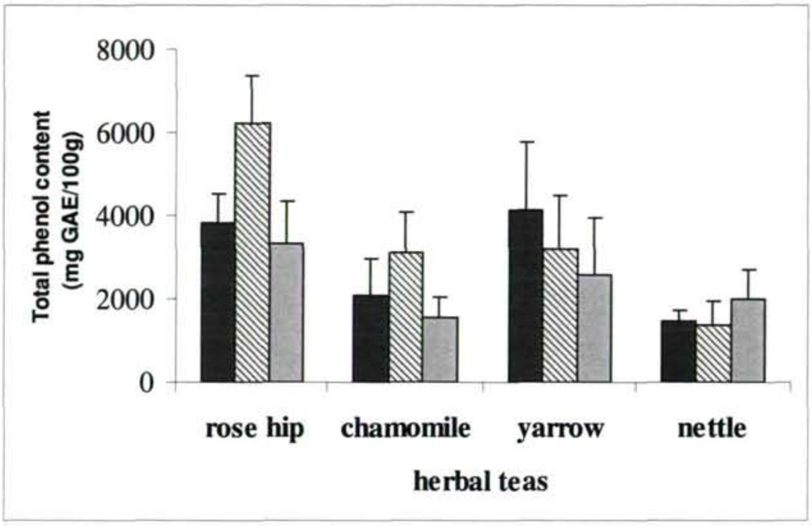


Figure 1. Total phenol content in herbal teas. Samples from different producers are indicated by the column filling pattern

Antioxidant capacities determined as ferric reducing power or free radical scavenging activity showed a similar picture to total phenol content, with rose hip having the highest value: 1984 mg AAE/100g and 78.5%, respectively. AOSHIMA ET AL. (2007) had similar results for DPPH radical scavenging activity of rose hip (82.5%), but obtained a very low value for chamomile (6.7%). Our results for chamomile ranged from 9 to 47% similar to the data of MILIAUSKAS ET AL. (2004) who measured values of 6.4% to 44.7% depending on the extraction method. These differences indicate that chamomile samples have highly variable content of active ingredients.

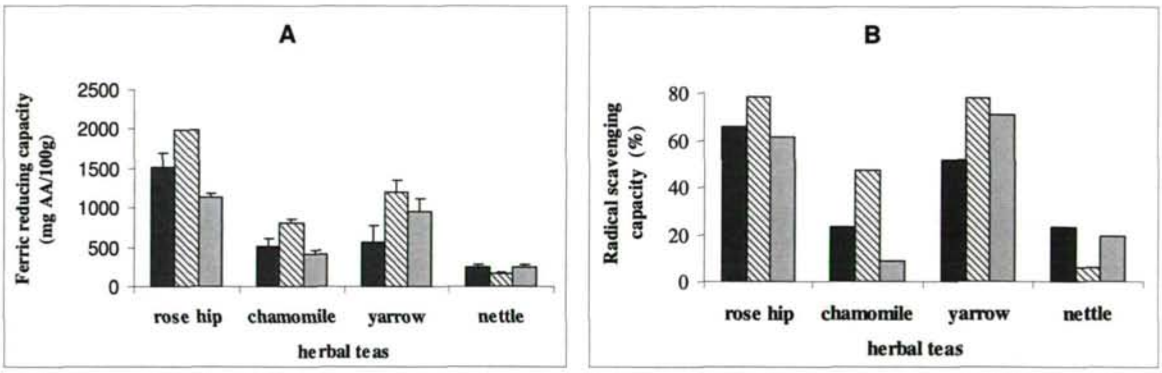
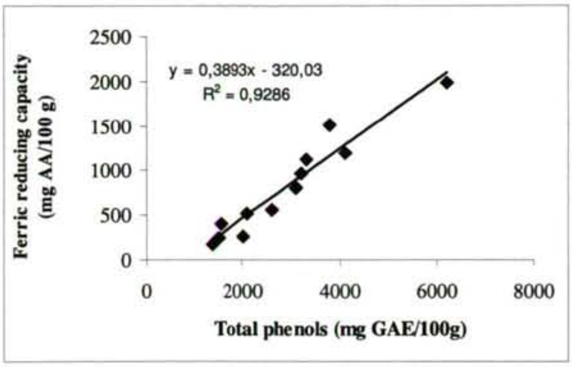


Figure 2. Antioxidant capacity determined as ferric reducing power (FRAP) (A) or radical scavenging activity (B) in herbal teas of different producers

We found strong correlation between total phenol content and FRAP (*Fig. 3*) and also good correlation between phenol content and DPPH radical scavenging activity (*Fig. 4*), indicating that mainly heat resistant phenolics are responsible for the antioxidant activity of herbal teas.



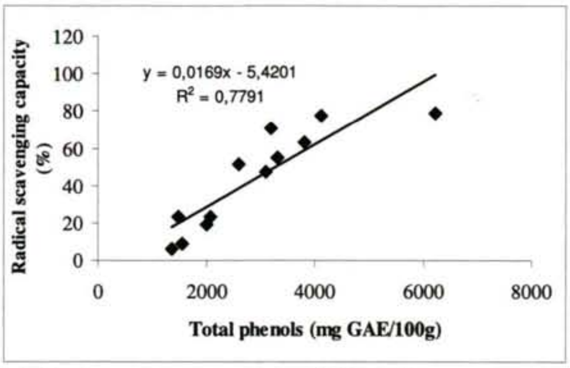


Figure 3. Correlation between total phenol content and FRAP
Figure 4. Correlation between total phenol content and DPPH radical scavenging activity

CONCLUSION

Herbal teas from Hungarian medicinal plants have good antioxidant properties but this varies greatly according to the producer company. It raises the necessity of standardizing the growing, harvesting and drying conditions for the herbs to achieve a more unique quality.

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