UNIVERZITET U KRAGUJEVCU
AGRONOMSKI FAKULTET U ČAČKU

UNIVERSITY OF KRAGUJEVAC
FACULTY OF AGRONOMY
CACAK

XXII SAVETOVANJE O BIOTEHNOLOGIJI

sa međunarodnim učešćem

- ZBORNIK RADOVA 2 -

Čačak, 10 - 11. Mart 2017. godine

XXII SAVETOVANJE O BIOTEHNOLOGIJI

sa međunarodnim učešćem

- Z b o r n i k r a d o v a 2 –

O R G A N I Z A T O R I I Z D A V A Č

U n i v e r z i t e t u K r a g u j e v c u,
A g r o n o m s k i f a k u l t e t u Č a č k u

T i r a ž : 180 primeraka

Š t a m p a

Grafička radnja štamparija Bajić, V. Ignjatovića 12, Trbušani, Čačak

QUALITY AND CHEMICAL PROFILE ASSESSMENT OF DIFFERENT TEAS IN SERBIA

Pavle Mašković[1], Dragutin Đukić[1], Leka Mandić[1], Desimir Knežević[2], Milica Cvijović[1], Marija Radojković[3], Saša Đurović[3]

Abstract: *Satureja montana*, *Ocimum basilicum*, *Camellia sinesis*, *Saliva officinalis*, *Althaea officinalis*, *Thymus camphoratus*, *Rosmarinus officinalis*, *Mentha piperita* and Mountain tea were investigated for their quality (ash and moisture contents), as well as for chemical profile. HPLC analysis was applied to determine saccharide, vitamin C and caffeine contents in all teas samples. Obtained results demonstrated high quality of all tea samples (moisture of all samples was below 12%), while chemical analysis revealed presence of glucose, fructose, sucrose, vitamin C and caffeine in tested materials. Exception was *Ocimum basilicum*, where only glucose was detected and quantified.

Key words: teas samples, quality saccharide content, caffeine content, vitamin C content

Introduction

Different herbs have been used in human diet as a source of compounds which are highly beneficial for health (Čestić et al, 2016; Vidović et al., 2013). From such herbs, remedies are prepared and further used for the treatment of different types of infections, aliments and diseases (Čestić et al, 2016a). Remedies may be prepared using almost every part of the plant: dry and fresh fruits, leaves, flowers, seeds, stems, etc., by pouring them with boiling water and left 5-10 minutes to steep (Piljac-Žegarac et al., 2013). Herbal infusions have been also considered as a valuable source of antioxidant species (Alarcon et al., 2008). Antioxidants are capable of stabilizing, or deactivating free radicals before the latter attack cells and biological targets. They are therefore critical for maintaining optimal cellular and systemic health and well-being (Percival, 1998: Atoui et al., 2005). Today tea is used as a beverage and as a source of health benefit compounds. Due to the awareness of health benefit compounds, consumption of tea is becoming more and more popular in all world countries, including Serbia (Vidović et al., 2013). Many therapeutic properties such as neuroprotective, cardioprotective, chemoprotective, anticarcinogenic, hepatoprotective and anti-inflammatory have been attributed to herbal preparations (Campanella et al., 2003; Visioli et al., 2000), including teas. In Serbia, the production of teas and other herbal products have been increased at a rate of 10% annually (Vidović et al., 2013).

Such importance of herbal beverages on human health put them in the spotlight of scientific community these days. For such reasons, aim of this study was to estimate

[1]University of Kragujevac, Faculty of Agronomy, Cara Dušana 34, Čačak, Serbia (pavlem@kg.ac.rs)
[2]Univerzitet u Prištini, Poljoprivredni fakultet, Kosovska Mitrovica -Lešak, Kopaonička bb, 38219 Lešak, Kosovo i Metohija, Srbija
[3]University of Novi Sad, Faculty of Technology, Bulevar Cara Lazara 1, Novi Sad, Serbia

chemical profile and quality of different teas from Serbia, as well as to investigate and compare their biological activity. To accomplish this goals, modern and comprehensive analytical techniques were applied to determine saccharides, vitamin C and caffeine contents in teas. Quality parameters of plants material were ash and moisture contents.

Material and methods

Plant samples

Satureja montana, *Ocimum basilicum*, *Camellia sinesis*, *Saliva officinalis*, *Althaea officinalis*, *Thymus camphoratus*, *Rosmarinus officinalis*, *Mentha piperita* and Mountain tea (mixture of several herbs) were collected in November 2015. in the area of Čačak, Republic of Serbia. Collected material was dried naturally in the shade on draft for one month. Dried plants were grounded in the blender and kept in the paper bags prior the usage.

Determination of ash and moisture contents

Ash and moisture contents were determined using previously described standard methods (Ph.Jug.IV, 1987).

Determination of saccharides content

Determination of saccharides content was performed using Varian liquid chromatograph coupled with RI detector. Column was Zorbax Carbohydrate (150 mm x 4.6 mm), flow was 1.4 mL/min, mobile phase was mixture of acetonitrile and water (80:20, V/V), column temperature was 40 °C, while injected volume was 5.0 μL.

Determination of caffeine content

Determination of saccharides content was performed using Varian liquid chromatograph coupled with DAD detector. Column was Zorbax Carbohydrate (150 mm x 4.6 mm), flow was 1.0 mL/min, mobile phase was mixture of acetonitrile and KH_2PO_4 (20:80, V/V; pH 3.5), column temperature was 30 °C, while injected volume was 5.0 μL.

Determination of vitamin C content

Determination of saccharides content was performed using Varian liquid chromatograph coupled with DAD detector. Column was RP Chrompack C18 (150 mm x 4.6 mm), flow was 1.0 mL/min, mobile phase was mixture of acetonitrile and KH_2PO_4 (20:80, V/V; pH 3.5), column temperature was 30 °C, while injected volume was 5.0 μL.

Results and discussion

Quality parameters of investigated plants: *Satureja montana*, *Ocimum basilicum*, *Camellia sinesis*, *Saliva officinalis*, *Althaea officinalis*, *Thymus camphoratus*, *Rosmarinus officinalis*, *Mentha piperita* and Mountain tea (mixture of several herbs) are presented in Table 1. General requirements for moisture content is below 12%. Regarding this requirement, presented results showed that all samples fulfill it and is of good quality. Highest moisture content was noticed in *Saliva officinalis* and Mountain tea (10.20%), while the lowest was in *Ocimum basilicum* sample (7.60%).

Results for ash content revealed the highest percentage in *Ocimum basilicum* sample (27.57%). On the other hand, the lowest ash content was noticed in the *Althaea officinalis* sample (9.27%), followed by *Camellia sinesis* sample (9.35%). *Thymus camphoratus* and *Rosmarinus officinalis* showed similar results (17.38% and 17.16%, respectively).

Tabela 1. Sadržaj pepela i vlage u odabranim čajevima
Table 1. Ash and moisture contents in investigated teas

Biljni materijal *Plant material*	Sadržaj pepela (%) *Ash content (%)*	Sadržaj vlage (%) *Moisture content (%)*
Rtanjski čaj *Satureja montana*	13.65	8.70
Bosiljak *Ocimum basilicum*	27.57	7.60
Zeleni čaj *Camellia sinesis*	9.35	8.90
Žalfija *Saliva officinalis*	16.23	10.20
Beli slez *Althaea officinalis*	9.27	8.90
Majčina dušica *Thymus camphoratus*	17.38	8.30
Ruzmarin *Rosmarinus officinalis*	17.16	9.30
Nana *Mentha piperita*	15.84	9.20
Planinski čaj *Mountain tea*	10.48	10.20

Saccharides composition in the investigated teas is presented in Table 2. Presented results showed that fructose nor sucrose were not detected in *Ocimum basilicum* sample. The highest content of glucose was notice in *Camellia sinesis* sample (58.00 g/L), while lowest was in the *Mentha piperita* sample (21.00 g/L). In the case of fructose, the highest content was notice in *Rosmarinus officinalis* sample (91.00 g/L), while lowest was in the *Althaea officinalis* sample (11.00 g/L).

Sucrose was the dominant saccharide in the most cases with the exception of *Saliva officinalis*, *Rosmarinus officinalis* and *Mentha piperita*. The highest content of sucrose was reported in *Althaea officinalis* (206.00 g/L), followed by *Camellia sinesis* (114.00 g/L), while all other contents were far lower. The lowest content of this saccharide was noticed in *Rosmarinus officinalis* sample (20.00 g/L) followed by *Saliva officinalis* sample (29.00 g/L).

Tabela 2. Sadržaj šećera u odabranim čajevima
Table 2. Saccharides contents in investigated teas

Biljni materijal *Plant material*	Glukoza (g/l) *Glucose (g/L)*	Fruktoza (g/l) *Fructose (g/L)*	Saharoza (g/l) *Sucrose* (g/L)
Rtanjski čaj *Satureja montana*	36.00	34.00	40.00
Bosiljak *Ocimum basilicum*	35.00	/	/
Zeleni čaj *Camellia sinesis*	58.00	44.00	114.00
Žalfija *Saliva officinalis*	49.00	28.00	29.00
Beli slez *Althaea officinalis*	22.00	11.00	206.00
Majčina dušica *Thymus camphoratus*	45.00	36.00	48.00
Ruzmarin *Rosmarinus officinalis*	60.00	91.00	20.00
Nana *Mentha piperita*	21.00	57.00	47.00
Planinski čaj *Mountain tea*	22.00	34.00	57.00

Vitamin C and caffeine contents are presented in Table 3. Results showed that *Camellia sinesis* was the richest plant with the vitamin C (2.20 g/L), while *Thymus camphoratus*, with 0.26 g/L, was the poorest plant with this essential vitamin. Vitamin C is well known by its antioxidant activity, while lack of this molecule in organism leas to various disorders and diseases.

Caffeine is alkaloid compound, and is well known by its application in Coca Cola and other drinks, as well as the main compound of coffee. It affects the hearth rate and pulse, as well as blood pressure, and is widely used against somnolence. Result of HLC analysis showed that *Camellia sinesis* possessed the highest amount of this compound (41.00 mg/L), followed by *Thymus camphoratus* (17.60 g/L), *Satureja montana* (17.50 g/L), Mountain tea (16.70 g/L) and *Mentha piperita* (14.30 g/L). on the other hand, the lowest content of caffeine was notice in *Althaea officinalis* (0.03 g/L).

Tabela 3. Sadržaj vitamina C i kofeina u odabranim čajevima
Table 1. Vitamin C and caffeine contents in investigated teas

Biljni materijal *Plant material*	Vitamin C (g/l) *Vitamin C (g/L)*	Kofein (g/l) *Caffeine (g/L)*
Rtanjski čaj *Satureja montana*	0.90	17.50
Bosiljak *Ocimum basilicum*	1.10	0.49
Zeleni čaj *Camellia sinesis*	2.20	41.00
Žalfija *Saliva officinalis*	0.56	0.33
Beli slez *Althaea officinalis*	0.35	0.03
Majčina dušica *Thymus camphoratus*	0.26	17.60
Ruzmarin *Rosmarinus officinalis*	0.38	1.43
Nana *Mentha piperita*	0.55	14.30
Planinski čaj *Mountain tea*	0.67	16.70

Conclusion

Satureja montana, *Ocimum basilicum*, *Camellia sinesis*, *Saliva officinalis*, *Althaea officinalis*, *Thymus camphoratus*, *Rosmarinus officinalis*, *Mentha piperita* and Mountain tea were investigated regarding their quality and chemical profile. Obtained results demonstrated high quality of tested plants, which is important data for the market in Serbia and abroad. Investigation of chemical composition showed the presence of vitamin C and caffeine in all teas. Saccharide analysis proved existence of glucose, fructose and sucrose in all teas, with the exception of *Ocimum basilicum*, which lacked in fructose and sucrose. Presence of vitamin C is especially valuable due to its significant effect on human health, while caffeine justifies application of some teas instead of coffee.

References

Alarcon E., Campos A.M., Edwards A.M., Lissi E., Lopez-Alarcon M. (2008). Antioxidant capacity of herbal infusions and tea extracts: A comparison of ORAC-fluorescein and ORAC-pyrogallol red methodologies. Food Chemistry, 107, 1114-1119.

Atoui A.K., Mansouri A., Boskou G., Kefalas P. (2005). Tea and herbal infusions: Their antioxidant activity and phenolic profile. Food Chemistry, 89, 27-36.

Campanella L., Bonanni A., Tomassetti M. (2003). Determination of the antioxidant capacity of samples of different types of tea or of beverages based on tea or herbal products, using superoxide dismutase biosensor. Journal of Pharmaceutical and Biomedicinal Analysis, 32, 725-736.

Čestić S., Radojković M., Cvetanović A., Mašković P., Đurović S. (2016). Influence of steeping time on biological activity of black mulberry tea. Acta Periodica Technologica, 47, 177-191.

Čestić S., Radojković M., Cvetanović A., Mašković P., Đurović S. (2016a). Phytochemical profile and biological potential of mulberry teas (*Morus nigra* L.). Acta Agriculturae Serbica, 21 (41), 25-35.

Percival M. (1998). Antioxidants. Clinical Nutrition Insight, 31, 1-4.

Piljac-Žegarac J., Šamec D., Piljac A. (2013). Herbal teas: A focus on antioxidant properties. Published in: Tea in health and disease prevention, Preedy V. (eds.), pp. 129-140, London, England: Academic Press.

Vidović S., Cvetković D., Ramić M., Dunjić M., Malbaša R., Tepić A., Šumić Z., Velićanski A., Jokić S. (2013). Screening of changes in content of health benefit compounds, antioxidant activity and microbiological status of medicinal plants during the production of herbal filter tea. Industrial Crops and Products, 50, 338-245.

Visioli F., Borsani L., Galli C. (2000). Diet and prevention of coronary heart diseases: the potential role of phytochemicals. Cardiovascular Research, 47, 419-425.

CIP - Каталогизација у публикацији
Народна библиотека Србије, Београд

63(082)
60(082)

САВЕТОВАЊЕ о биотехнологији са међународним учешћем (22 ; 2017 ; Чачак)
Zbornik radova. 2 / XXII savetovanje o biotehnologiji sa međunarodnim učešćem, Čačak, 10-11. mart 2017. godine ; [organizator] Univerzitet u Kragujevcu, Agronomski fakultet u Čačku = [organized by] University of Kragujevac, Faculty of Agronomy, Cacak. - Čačak : Univerzitet u Kragujevcu, Agronomski fakultet, 2017 (Čačak : Bajić). - Str. 479-780 : ilustr. ; 24 cm

Radovi na srp. i engl. jeziku. - Tiraž 180. - Napomene i bibliografske reference uz radove. - Bibliografija uz svaki rad. - Abstracts.

ISBN 978-86-87611-48-1
ISBN 978-86-87611-49-8 (niz)
1. Агрономски факултет (Чачак)
a) Пољопривреда - Зборници b) Биотехнологија - Зборници
COBISS.SR-ID 230071820