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Phenolic Content of Selected Sumac Fruits from Iran, Extracted With Different Solvents

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Abstract: In this study, the phenolic content of three sumac (*R. coriaria* L.) samples were evaluated including, brown sumac fruit, brown sumac powder and red sumac. Methanol, ethanol, mixture of methanol-ethanol and distilled water were used for extraction. Phenolic content was determined by Folin–Ciocaltaeu procedure. The efficiency of the extraction varied considerably. The phenolic content of brown sumac powder, brown sumac fruit and red sumac powder were 2.906-2.997, 2.438- 2.529, 2.172- 2.263 gallic acid equivalents/100 g (GAE/100 g), respectively. According to the results, ethanol shows the best results and sumac had highest phenolic content as compared to other extracts.

Keywords: phenolic compounds, solvent extraction, sumac

INTRODUCTION

Lipid oxidation is a highly deteriorative process in foods, as it leads to unacceptable properties for the customer and a loss in nutritional value. In addition, oxidation leads to health disorders such as atherosclerosis and cancer genesis, hence the presence of antioxidants in foods is essential for their quality, retention and safety .Koleva et al., (2003).Antioxidants are often added to foods to prevent the radical chain reactions of oxidation, and they act by inhibiting the initiation and propagation step leading to the termination of the reaction and delay the oxidation process. Shahidi et al. (1992). On the other hand, the commonly used synthetic antioxidants such as butylatedhydroxyanisole (BHA) and butylatedhydroxy toluene (BHT) are restricted by legislative rules because of doubts over their toxic and carcinogenic effects [6]. Therefore, there has been a considerable interest in the food industry to find natural antioxidants to replace synthetic compounds in food applications, and a growing trend in consumer preferences for natural antioxidants, all of which has given more impetus to explore natural sources of antioxidants.

Many herbs and spices have been shown to impart antioxidant effects in food; the active principles are phenolics [4,5]. A wide variety of phenolic substances derived from herbs and spices possess potent antioxidant, anti-inflammatory, antimutagenic, anticarcinogenic and anti-tumor activities, which contribute to their chemopreventive potential [4, 5].

Sumac, *(Rhuscoriaria L., family Anacardiaceae)* which grows wild in the region extending from the Canary Islands over the Mediterranean coastline to Iran and Afghanistan, is native to the Mediterranean and Southeastern Anatolian regions of Turkey. [16] The fruits of sumac contain flavonols, phenolic acids, hydrolysable tannins, anthocyans and organic acids such as malic, citric and tartaric acids [11, 16]. Sumac is commonly used as a spice by grinding the dried fruits with salt for kebabs and salads in Middle East especially in Iran. Sumac extracts have been found to have antimicrobial, antioxidant and hypoglycemic activities [16]. Although several studies reported the phenolics content of sumac, the literature lacks information on Iranian sumac antioxidant activity. Therefore the main objective of this study was to determine the polyphenolic content of Iranian sumac and to examine the efficiency of different solvent systems for the extraction of polyphenols. The phenolic compounds were extracted from the sumac by using three conventional solvents, namely, methanol, ethanol, distilled water and mixture of methanol and ethanol.

MATERIALS AND METHODS

Selected sumac fruits *(RhuscoriariaL.Anacardiaceae)* with brown color and ground sumac with red color were bought in bulk from local market in Shahreza, Iran. Brown sumac fruits were cleaned and dried in a hot air oven at 50 ^{o}C for 2 hours. The dried plant materials were

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ground separately and passed through a 60 mesh sieve. All samples were kept in air tight containers at-18 ^{o}C until further use. Solvents, chemical reagents and standard phenolic compounds were purchased from Sigma–Aldrich Canada Ltd. (Oakville, ON, Canada).

Extraction of polyphenols

Brown sumac fruit, its powder and ground red sumac were extracted with organic solvents and distilled water, using Reflux method. Extraction was done at 40 ^{o}C for 2 h. After extraction, the mixture was filtered and the obtained extract was concentrated with a rotary evaporator under reduced pressure in a water bath at 40 ^{o}C .The crude extracts were collected after 3 h and stored at -18 ^{o}C in the dark. The extraction process was
carried out in triplicate, using three different samples each time. Four different extraction systems were used (methanol, ethanol, mixture of ethanol and methanol and 100% distilled water).Solvent to sumac ratio was 10:1 mL/g.

Determination of total phenolic content

Total phenolics content of sumac fractions was determined according to the Folin–Ciocaltaeu procedure [15]. All samples and Gallic acid were dissolved in 50% (v/v) of specific solvent. Samples(0.5 mL) were placed into test tubes and then 2.5 mL Folin–Ciocaltaeu reagent (10%, v/v, in water) solution and 7.5 mL sodium carbonate (20%, w/v, in water) solution were added. The tube contents were mixed and allowed to stand for 2 h at room temperature. Absorbance was measured at 750 nm and the total phenolic content was expressed as gallic acid equivalents (GAE) in mg per g dry material.

STATISTICAL ANALYSIS

Data were analyzed using SPSS software. Analysis of variance (ANOVA) and Duncan's multiple range method were used to compare any significant differences between solvents and samples. Values were expressed as means± standard deviations. Differences were considered significant at $P< 0.05$. All the analyses were carried out in triplicates.

RESULTS AND DISCUSSION

Polyphenol content

Table 1 shows the total phenolic content (TP) of the samples extracts measured using Folin-Ciocalteu's colorimetric method.TP of the samples ranged from 2.453GAE/100 g to 3.277GAE/100 g for brown sumac powder, while it ranged from 2. 318GAE/100 g to 2.637GAE/100 g for brown sumac fruit and from 0.811 GAE/100 g to 3.188 GAE/100 g for red sumac powder. Therefore, brown sumac powder extracts had higher polyphenol contents when compared with the other samples.

Table 1: Total phenoliccontent of fruits extracts obtained from different solvent extraction systems.

Sample	Solvent	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Brown Sumac fruit	ethanol	2.454	0.044	2.364	2.545
	methanol	2.637	0.044	2.546	2.728
	ethanol-methanol	2.524	0.044	2.433	2.615
	water	2.318	0.044	2.227	2.408
Brown Sumac powder	ethanol	3.157	0.044	3.066	3.248
	methanol	2.918	0.044	2.827	3.009
	ethanol-methanol	3.277	0.044	3.186	3.367
	water	2.453	0.044	2.362	2.544
Red Sumac powder	ethanol	3.188	0.044	3.097	3.279
	methanol	2.093	0.044	2.002	2.184
	ethanol-methanol	2.779	0.044	2.688	2.870
	water	0.811	0.044	0.720	0.902

Effect of solvent system

Earlier, solvents, such as methanol, ethanol, acetone, propanol, thyl acetate and dimethylformamide, have been commonly used for the extraction of phenolics from fresh produce at different concentrations in water. [19,8]. The recovery of polyphenols from plant materials is influenced by the solubility of the phenolic compounds in the solvent used for the extraction process. Furthermore, solvent polarity will play a key role in increasing phenolic solubility [2, 10, 21]. Therefore, it is hard to develop a suitable standard extraction procedure for the extraction of all plant phenols. The least polar solvents are usually considered to be suitable for the extraction of lipophilic phenols unless very high pressure is used. From the results shown in Table 1, it is evident that the recovery of phenolic compounds was dependent on the solvent used and its polarity (for all three

samples). For brown sumac fruit extracts, methanol gave the highest yield of TP. Mixture of ethanol and methanol could recover the highest yield of TP (3.277 GAE/100 g) in brown sumac powder with significant difference when compared with all other used solvent systems. The highest yield of red sumac powder TP was obtained using ethanol.

CONCLUSIONS

The extraction of the sumac (R. coriaria L.) was carried out with water, ethanol, methanol and mixture of ethanol and methanol separately. The present study indicated that phenolic content of ethanol extract was significantly higher than other extracts. Also amounts of total phenolic contents of brown sumac powder were higher than other samples. Therefore, it is hard to develop a suitable standard extraction procedure for the extraction of all plant phenols. the least polar solvents are usually considered to be suitable for the extraction of lipophilic phenols unless very high pressure is used.

REFERENCES

1. M.Alothman , Rajeev Bhat, A.A. Karim, 2008, Antioxidant capacity and phenolic content of selected tropical fruits from Malaysia, extracted with different solvents, J. Food Chemistry, Volume 115, Pages 785-788.
2. Saeedeh Arabshahi-D, D. Vishalakshi Devi, Asna Urooj, 2005, Evaluation of antioxidant activity of some plant extracts, j.Food Chemistry, Volume 100, Pages 1100–1105.
3. Biljana Bozin, Neda Mimica-Dukic ,Isidora Samojlik, Anackov Goran, RuzicaIgic, 2008, Phenolics as antioxidants in garlic (Allium sativum L., Alliaceae), J. Food Chemistry, Volume 111, Pages 925-929.
4. N.Deepa , Charanjit Kaur, Balraj Singh, H.C Kapoor, Antioxidant activity in some red sweet pepper cultivars, 2004, Journal Of Food Composition And Analysis, Volume 19, Pages 572-578.
5. Naciye Erkan, Guler Ayranci, Erol Ayranci, 2007, Antioxidant activities of rosemary (RosmarinusOfficinalis L.) extractblackseed (Nigella sativa L.) essential oil, carnosic acid, rosmarinic acid and sesamol, J. Food Chemistry, Volume 110, Pages 76-82.
6. Attari, 2007 Antimicrobial activities of Iranian sumac and avishan-e shirazi (ZatariamultiXora) against some food-borne bacteria, j .food control ,18 (2007) 646–649.
7. Ilhami Gulcin, I. Gungor Sat, Sukru Beydemir, Mahfuz Elmastas, O. Irfan Kufrevioglu, 2003, Comparison of antioxidant activity of clove (Eugenia caryophylataThunb) buds and lavender (Lavandulastoechas L.) , J. Food Chemistry, Volume 87, Pages 393-400.
8. Gülten Tiryaki Gündüz, Şahika AktuğGönül, Mehmet Karapinar, 2009, Efficacy of sumac and oregano in the inactivation of Salmonella Typhimuriumon tomatoes, International Journal of Food Microbiology, Volume 141, Pages 39-44.
9. Abdullah IjazHussain, Farooq Anwar, Syed Tufail Hussain Sherazi, Roman Przybylski, 2007, Chemical composition, antioxidant and antimicrobial activitiesof basil (Ocimumbasilicum) essential oils depends on seasonal variations, J. Food Chemistry, Volume 108, Pages 986-995.
10. G.K. Jayaprakasha, P.S. Negi, B.S. Jena, L. Jagan Mohan Rao, 2005, Antioxidant and antimutagenic activities of Cinnamomum zeylanicum fruit extracts, Journal Of Food Composition And Analysis, Volume 20, Pages330-336.
11. JakobekL.Seruga, M. Novak.I, 2007, Flavonols, Phenolic acid and antioxidant activity of some red fruit, J.Food Technology, NO.51, Pages 369-378.
12. Rima Kossah, Hao Zhang and Wei Chen, 2011, Antimicrobial and antioxidant activities of Chinese sumac (Rhustyphina L.) fruit extract, J.food control, Volume 22, Issue 1, Pages 128-132.
13. Sweetie R.Kanatt, Ramesh Chander, Arun Sharma, 2007, Chitosan and mint mixture: A new preservative for meat and meat products, J. Food Chemistry, Volume 107, Pages 845-852.
14. Eileen M. Kwee, Emily D. Niemeyer, 2010, Variations in phenolic composition and antioxidant properties among 15 basil, J. Food Chemistry, Volume 128, Pages 1044-1050.
15. M. Kosar, B. Bozan, F. Temelli and K.H.C. Baser, 2007, Antioxidant activity and phenolic composition of sumac (Rhus coriaria L.) extracts, J. Food Chemistry, Volume 103, Pages 952-959.
16. S.M. Nasar-Abbas, A. Kadir Halkman, 2003, Antimicrobial effect of water extract of sumac (Rhus coriaria L.) on the growth of some food borne bacteria including pathogens, International Journal of Food Microbiology, Volume 97, Pages 63-69.
17. Nilesh Pawar, Sandeep Pai, Mansingraj Nimbalkar, Ghansham Dixit, 2010, RP-HPLC analysis of phenolic antioxidant compound 6-gingerol from different ginger cultivars, J. Food Chemistry, Volume 126, Pages 1330-1336.
18. Catalina S. Romano, Karina Abadi, Victoria Repetto, Adrin A. Vojnov, Silvia Moreno, 2008, Synergistic antioxidant and antibacterial activity of rosemary plus, J. Food Chemistry, Volume 115, Pages 456-461.
19. Gurdip Singh, Sumitra Maurya, M.P. deLampasona, Cesar A.N. Catalan, 2005, A comparison of chemical, antioxidant and

antimicrobial studies of cinnamon leaf and bark volatile oils, oleoresins and their constituents, J. Food and Chemical Toxicology, Volume45, Pages1650-1661.
20. Sasikumar J.M, Maheshu V, Jayadev R, 2009, Invitro antioxidant activity of methanolic extracts of Beberis Tinctorialesch, root and root bark, Journal of Herbal medicine and Toxicology, Volume 3, Pages 53-58.
21. I. Stoilova, A. Krastanov, A. Stoyanova, P. Denev, S. Gargova, 2005, J. Food Chemistry, Volume 102, Pages 764-770.
22. Eiji Yamazaki, Minoru Inagaki, Osamu Kurita, TetsujiInooue, 2005, Antioxidant activity of Japanese pepper (Zanthoxylum piperitum DC.) fruit, J.Food Chemistry, Volume 100, Pages 171-177.