Identification and Quantification of Total Polyphenols in Plants with Bioactive Potentially

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Abstract. This meaning of this specific work is to identify and quantify the polyphenolic compounds that exist in plants with bioactive potentially. The study was monitoring 16 different plants: bilberry (*Vaccinium myrtillus*), artichoke (*Cynara scolymus*), chicory (*Cichorium intybus*), dumb (*Teucrium chamaedrys*), fennel (*Foeniculum vulgare*), thorn (*Xanthium spinosum*), juniper (*Juniperus communis*), mint (*Mentha*), cranberry (*Vaccinium vitis-idaea*), hawthorn (*Crataegus monogyna*), wormwood (*Artemisia absinthium*), willow herb (*Epilobium*), lemon balm (*Melissa officinalis*), St. John's wort (*Hypericum perforatum*), oregano (*Origanum vulgare*), centaury (*Centaureum erythraea*). The total polyphenolic compound was determined on spectrophotometric method, Folin-Ciocalteu. The polyphenols have a very wide range value starting on low amounts on centaury (*Centaureum erythraea*) 271.613 mg/L and reaching highest values of 5975.616 mg/L in wormwood (*Artemisia absinthium*). The results can be use in the design of digestive drinks in the food industry due to higher concentration of total polyphenols in the studied plants.

INTRODUCTION

Polyphenols are plant secondary metabolites and are generally involved in defense against aggression ultraviolet radiation or pathogens. In foods, polyphenols can give bitterness, astringency, color, flavor, odor and oxidation stability. Towards the end of the 20th century, epidemiological studies and meta-analyses have suggested passing a long-term consumption of diets rich in polyphenols in plant offers some protection against developing cancer, cardiovascular disease, diabetes, osteoporosis and neurodegenerative diseases. The outer layers of plants contain higher levels of phenolics than those located in their inner maturity. The degree of maturity affects significantly concentrations and proportions of different polyphenols.

The Bilberry (*Vaccinium myrtillus*) is a local tree located in mountain forests; his stems are 50 cm high. The bilberry leaves composition is: 10% tannins, myristic acid and palmitic derived flavonoid, thiamine and minerals.

The anthocyanins from the bilberry fruits have an retinal action by inhibiting monophosphate-6-glucose and antocianidele.

The anthocyanins have a positive impact on capillaries; they are vasodilators and fight against cancer [1, 2].

The Artichoke (*Cynara scolymus*) is a low temperatures sensitive herb, with globular large light purple flowers. The Artichoke leaves contain a bitter principle (cinaropicrin) cinaratriol, polyphenols, flavonoids, potassium, sterol and other bioactive compounds.

The Artichokes plant can be used in liver disease, atherosclerosis, hypercholesterolemia, indigestion, loss of appetite, anorexia, poisoning, bloating, cholesterol [3, 4].

The Chicory (*Cichorium intybus*) is a perennial, edible plant. It is used to treat renal and hepatobiliary diseases. The taste is a slightly bitter one. It is known for his antimicrobial activity and high anthelmintics [5, 6].

The Dumb (*Teucrium chamaedrys*) is having adverse effects on health if consumed improperly prepared. This plant is rich in terpene compounds and glycosides [7, 8]. The traditional medicine recommend this plant for treating rheumatic diseases, dyspepsia, chronic bronchitis, urinary tract infections, anorexia. In food industry it can be found in already prepared drinks.

The Fennel (*Foeniculum vulgare*) is a medicinal plant rich in essential oils, with antispasmodic anti-inflammatory and calming effects [9].

The Thorn (*Xanthium spinosum*) is a herbaceous plant. It can be found in grassland near the main roads. In Thorn composition we can observe: phytosterols, caffeic acid, flavonoids and essential oil [10]. Thorn plant is used to treat prostatitis, kidney stones of hyperthyroidism, the bogs, prostate adenoma and cystitis.

The Juniper (*Juniperus communis*) is a resinous tree that grows in the mountain area. The leaves are dark green needle-shaped. This plant is rich in essential oils and in other kind of compounds such as: cadinene 1-4-terpineol, β -pinene, diterpene, mircens, iuniperină, invert sugar, camphene, α -pinene, fats, organic acids (glyceric, glycolic acid, ascorbic him, acetic, formic, oxalic acid, malic acid), sucrose, waxes, resins, salts of potassium, calcium [11, 12]. The Juniper is usually used for treating bladder stones, rheumatism, hepatitis epidermal bronchitis, enteritis, enterocolitis, as adjunctive in diabet therapy, eczema; it stimulates the secretion of gastrointestinal juices, anorexia, kidney edema.

The Mint (*Mentha*) is a plant widespread in the world. The mint leaves contains a significant quantity of volatile oils, tannins, flavonoids, polyphenolic substances. The volatile oil of the peppermint is having menthol, caracole, methane, thymol, menthofuran. It is highly recommended for treating diarrheal diseases, gastrointestinal. It has antiseptic and analgesic effects [13, 14].

The Cranberries (*Vaccinium vitis-idaea*) is a bushy shrub from acidic mountain grasslands area. The branches are harvest in spring and they are used to obtain macerates.

Its branches and fruits have in their composition tannins, [15] with a strong antioxidant effect, formic acid, valeric acid, salicylic acid, starch, dextrin, sucrose, mineral salts.

The active compounds identified by [16] lead to the treatment of diabetes, being also used in the treatment of gout, cystitis, rheumatism, diarrhea, cough, diseases of the urinary tract.

The Hawthorn (*Crataegus monogyna*) is a local shrub that grows through the forests, meadows, pastures, from the steppe to the mountains. Hawthorn leaves and flowers have in their composition between 1 and 3% procyanidin flavonoids, amines, sterols, carboxylic acids, volatile oil that may have in its composition minerals, pectin, tannins. His fruits have in their composition vitamins tannins, anthocyanins, citric acid, oxalic acid, tartaric acid, choline, fructose, fatty oil, pectin, glucose, minerals [17, 18].

Hawthorn helps muscle to contract- especially myocardium muscle-by using the leaves and flowers. It is also used as a dilator of heart vessels. Hawthorn alcohol-based extracts helps to regulate the heart rate, to removed cardiac arrhythmias, to increase blood flow and the blood pressure. The Hawthorne's is well known natural remedy of sedative and diuretic effects.

The Wormwood (*Artemisia absinthium*) is a perennial plant with many purposes such as stimulant of gastric secretions, diarrhea, inflammatory, anthelmintic, with disinfectant properties, anthelmintics, diuretics, anti-inflammatory, depurative, laxative, acting as healing internally and externally [19, 20].

Willow Herb (*Epilobium*) plant is a widespread with pharmaceutical applications in the treatment of BPH, a cystitis, prostate cancer and genital or even viral hepatitis type A, B or C, peptic ulcer, nephritis or urinary lithiasis [21].

The Lemon balm (*Melissa officinalis*) prevalent spontaneously in Romania with a lot of beneficial effects on stomach problems used frequently on treatin the headaches, dizziness obesity or stress. The volatile oils contained are rich in compounds such as bioflavonoids, caffeic acid, ursolic acid or oleanolic acid [22, 23].

St. John's Wort (*Hypericum perforatum*) is a plant known in traditional and natural medicine It contains volatile oils, flavonoids, hyperin, resins, choline, organic acids (caffeic, chlorogenic

acid), tannins, beta-carotene, hypericin, pseudohypericin, fitoncides. The plant has anti-inflammatory, antiseptic, painkillers and sedatives properties [24, 25].

Oregano (*Origanum vulgare*) is a plant rich in essential oil, anthocyanide, flavonoids, thymol, carvacrol, tannins, minerals. It is having antispasmodic, antiseptic, sedative, bronchodilator benefits. It can be successfully used in the treatment of various diseases such as: diseases stomach, dysentery, bronchial asthma, bronchitis, anorexia, asthenia, colitis, insomnia, flu-stomatitis, tracheitis, pharyngitis, intestinal disorders, but also in the treatment of burns, headache, eczema, periodontitis, gingivitis, otitis [26, 27].

Centaury (*Centaureum erythraea*) is a plant of 10-40 cm height. Its composition is having bitter substances like secoiridoids, glucosides, gentiopicrină, centauroside, gentianină and phenolic acids - p-coumarin, ferulic acid, protocatechinic acid, and minerals. The specific studies on this plant revealed an anti-inflammatory antipyretic and anti tumor necrosis action [28].

MATERIALS AND METHODS

Plants with bioactive potential: blueberries, artichoke, chicory, dumb, fennel, thorn, juniper, mint, cranberry, hawthorn, wormwood, willow herb, lemon balm, St. John's wort, oregano, centaury. The plants were dried and ground. The powder was homogenized in ethanol 50% for extraction of bioactive components in a ratio of 1:10 for 24 hours. The samples were filtered and brought to dryness. The extract was dissolved in ultrapure water 1:1.

The quantitative evaluation of the polyphenols has been provided by the Folin Ciocalteu method modified.

The Folin-Ciocalteu method is based on the oxidation of polyphenols using a molybdo-wolfram solution ($\text{Na}_2\text{WO}_4 / \text{Na}_2\text{MoO}_4$).

O₂ result from this reaction. This is reacted with molybdate in order to form an ion (Mo_4^+) (blue), whose absorbance is followed spectrophotometrically in the range 420-1000.

The maximum absorbance was detected at 765 nm.

This reaction took place in a basic medium. Like reference AO gallic acid was used.

RESULT AND DISCUSSION

After performing the measurement on 16 samples we can notice that the values of polyphenols expressed in gallic acid were between 271.613 mg/L and 5975.616 mg/L (Figure 1).

The Wormwood (*Artemisia absinthium*) plant has reached the maximum value-5975.616 mg/L, followed by artichoke (*Cynara scolymus*) with 4673.128 mg/L and juniper (*Juniperus communis*) with 3172.662 mg/L.

The polyphenols values situated between 1000 mg/L to 3000 mg/L on mint (*Mentha*) with 2667.486 mg/L, cranberry (*Vaccinium vitis-idaea*) with 2483.004 mg/L, blueberry (*Vaccinium myrtillus*) with 1607.733 mg/L and hawthorn (*Crataegus monogyna*) with 1067.275 mg/L.

Another group of plants is presenting an accumulation of polyphenols in amounts between 700 mg/L and 900 mg/L.

We can notice that the fennel (*Foeniculum vulgare*) and the thorn (*Xanthium spinosum*) with values very close to 856.170 mg/L respectively 856.975 mg/L, together with Dumb (*Teucrium chamaedrys*) with 871.775 mg/L.

Willow herb (*Epilobium*) and chicory (*Cichorium intybus*) average values are 8% -10% lower than the thorn and fennel, values that reached 773.100 mg/L, respectively 795.360 mg/L polyphenols expressed in gallic acid.

The minimum values of polyphenols had oregano (*Origanum vulgare*) with 582.000 mg/L, St John's wort (*Hypericum perforatum*) with 434.634 mg/L, lemon balm (*Melissa officinalis*) with 345.540 mg/L and centaury (*Centaureum erythraea*) with 271.613 mg/L.

Figure 1. The identification and quantification of polyphenols from plants with bioactive potentially: bilberry (*Vaccinium myrtillus*), artichoke (*Cynara scolymus*), chicory (*Cichorium intybus*), dumb (*Teucrium chamaedrys*), fennel (*Foeniculum vulgare*), thorn (*Xanthium spinosum*), juniper (*Juniperus communis*), mint (*Mentha*), cranberry (*Vaccinium vitis-idaea*), hawthorn (*Crataegus monogyna*), wormwood (*Artemisia absinthium*), willow herb (*Epilobium*), lemon balm (*Melissa officinalis*), St. John's wort (*Hypericum perforatum*), oregano (*Origanum vulgare*), centaury (*Centaurium erythraea*)

CONCLUSIONS

Polyphenols occupies a very wide range of values based on low amounts for centaury (*Centaurium erythraea*) several hundred mg/L and reaching values of several thousand mg/L for wormwood (*Artemisia absinthium*).

The studied plants contain significant amounts of polyphenols. The studied plants can enter into different drink recipes with antioxidant properties, drinks especially recommended for digestive disorders.

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