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Short communication

Evaluation of antioxidant and antibacterial activity of some plants

Eljona Chilku[1*], Snezana Ivic Kolevska[2],
Darinka Gjorgieva Ackova[1], Tatjana Kadifkova Panovska[3]

[1]*Faculty of Medical Sciences, Goce Delcev University, Krste Misirkov 10-A, 2000 Stip, N. Macedonia*
[2]*Department of Microbiology, PZU Re-Medika, 16th Macedonian Brigade 18, 1000 Skopje, N. Macedonia*
[3]*Faculty of Pharmacy, Ss. Cyril and Methodius University in Skopje, Majka Tereza 47, 1000 Skopje, N. Macedonia*

Introduction

Antioxidants prevent the radical chain reactions of oxidation by inhibiting the initiation and propagation step leading to the termination of the reaction and a delay in the oxidation process (Islam et al., 2018). Due to the toxicological concerns associated with the synthetic antioxidants, the natural antioxidants, more recently, have attracted the considerable attention of users and researchers. In this context, medicinal plants are being viewed as an easily available and potent source of antioxidants as they contain a mixture of different chemical compounds (Saiah et al., 2016). Medicinal plants represent a rich source of antimicrobial agents, as well. Because microorganisms have developed resistance to many antibiotics, plants have been investigated as potential alternative remedies for the treatment of various infectious diseases. Medicinal plants are of great interest as sources of natural compounds (Al-Rifai et al., 2017).

The aim of this study was to evaluate the biological activities of *Hypericum perforatum, Agrimonia eupatoria, Teucrium chamaedrys, Achillea milefolium, Thymus serpyllum*, and *Polygonum aviculare*, to assess the total phenolic contents of the extracts and to investigate whether there is a correlation between phenolic content and antioxidant activity.

Materials and methods

Dried herbs of *H. perforatum, A. eupatoria, T. chamaedrys, A. milefolium, T. serpyllum*. and *P. aviculare* were purchased from the botanical departments of Macedonian manufacturers. The dried herbs were grinded and extracted with 70% ethanol. Total phenolic content was quantified by Folin-Ciocalteu method as described by Singleton, and the results were expressed as milligrams of gallic acid equivalents (GAE), per gram of dry weight (Singleton et al.,1999). The total flavonoid content was measured by aluminum chloride method and expressed as mg quercetin equivalents per gram of extract (mg QE/g extract)/ (Swamy et al., 2012). The ability of the plant extract to scavenge DPPH free radicals was assessed by method of Gyamfi (Gyamfy, 1999). The antioxidant activity of the extracts was expressed as IC_{50} (µg/mL). Antibacterial activity was carried out by the agar well diffusion method and qualitatively assessed based on the presence or absence of inhibition zones.

Results and discussion

*ecilku@yahoo.com

The total phenolic content varied among the different extracts. The values were following: *H. perforatum* (192.48± 0.166 mg GAE/g), *A. eupatoria* (182.81 ± 0.464 mg GAE/g), *T. chamaedrys* (152.96±0.751 mg GAE/g), *A. milefolium* (145.4 ± 0.084 mg GAE/g), *T. serpyllum*. (129.47 ± 0.682 mg GAE/g), and *P. aviculare* (127.94 ± 0.441 mg GAE/g).

From the plant extracts tested, the highest total flavonoids were found in *A. eupatoria* (25.58 ± 0.218 mg QE/g), *T. chamaedrys* (25.58 ± 1.019 mg QE/g), *P. aviculare* (25.24 ± 9.355 QE mg/g), and *H. perforatum* (20.07 ± 1.219 mg QE/g). Low values showed *A. milefolium* (4.19 ± 0.398 mg QE/g) and *T. serpyllum.* (2.28 ± 5.028 mg QE/g).

High value for the antioxidant activity showed the extract of *A. eupatoria* 5.52 µg/mL, *H. perforatum* 24.01 µg/mL, and *T. chamaedrys* 73.02 µg/mL, followed by *P. aviculare* 216.71 µg/mL, *T. serpyllum* 243.1 µg/mL, and *A. milefolium* 259.96 µg/mL. The results suggest a positive correlation between the phenolic content and antioxidant activity of the investigated plant extracts.

The antibacterial activity of the plant extracts was investigated against six bacterial strains: *Escherichia coli* ATCC 8739, *Escherichia coli* ATCC 25922, *Pseudomonas aeriginosa* ATCC 9027, *Klebsiella pneumoniae* ATCC 700603, *Staphylococcus aureus* ATCC 25923, and *Enterococcus faecalis* ATCC 19433. The results shown that the extracts have inhibiting action on gram-positive and gram-negative bacteria. Extracts of *A. eupatoria* and *H. perforatum* showed the highest antibacterial activity. Among the tested bacterial strains *E. faecalis* ATCC 19433 was the least susceptible overall. However, *P. aviculare* and *T. chamaedrys*, exhibited no antibacterial activity against *E. coli* ATCC 25922, indicating reduced susceptibility of this strain to these two extracts. *P. aeruginosa* ATCC 9027 was susceptiblee to all tested extracts, although the antibiotic clindamycin showed no activity against this strain. The antibacterial activity of *T. serpyllum*. K. *pneumoniae* ATCC 700603 was comparable to that of clindamycin.

The observed antioxidant and antibacterial activity, as well as the phenolic and flavonoid contents are in agreement with previous studies, however, differences in the reported values may be attributed to variations in plant material, geographical origin, environmental conditions, and post-harvest processing (Wendakoon et al., 2012).

Conclusion

The investigated plant extracts showed antioxidant and antibacterial activity, and could be considered as potential antioxidant and antibacterial sources against gram-positive and gram-negative bacteria. The observed positive correlation suggests that the phenolic compounds contribute to the antioxidant activity. Nevertheless, additional research is needed to clarify the underlying mechanisms and metabolic pathways responsible for the antioxidant effects of the investigated plant extracts.

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