



Centaurea hypoleuca DC: Phenolic content, antimicrobial, antioxidant and enzyme inhibitory activities



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ABSTRACT

Centaurea hypoleuca is one of the plants have been traditionally used in treatments of many diseases in folk medicine in Turkey. In the present study, ethanol, methanol, and ethyl acetate extracts of the plant's aerial parts were examined and their antioxidant, antimicrobial, and enzyme inhibition activities were determined for the first time. The antioxidant assays were performed in vitro using ABTS and DPPH methods, whereas the antimicrobial efficiency was determined using disc diffusion and microdilution methods. Moreover, the enzyme inhibition activity was analyzed using calorimetric methods targeting the key enzymes used in the treatment of Alzheimer's disease (cholinesterase) and diabetes (glucosidase and amylase). Also, the phenolic contents were analyzed using HPLC. The biological activity of flower ethyl acetate extract was found to be significantly higher than those of other extracts. This extract was more prominent because of its strong antimicrobial activity with the MIC value of 8 $\mu\text{g mL}^{-1}$ against MRSA. Moreover, the main components of the extract were determined to be catechin and chlorogenic acid. In conclusion, these results indicate that *C. hypoleuca* can be pharmaceutically used as herbal remedies for its antioxidant, antimicrobial, and enzyme inhibitor effects.

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1. Introduction

It is thought that many of the chronic diseases such as cancer, diabetes, arteriosclerosis, and neurodegenerative and cardiac diseases, which are widely seen nowadays, arise from the oxidative damage caused by free radicals (Aktumsek et al., 2011; Erel et al., 2014). In this sense, antioxidants are very important compounds since they have protective effects against this damage. Due to their potential pharmaceutical effects, most of the plants and their extracts are important antioxidant sources and they have been used in treating many diseases since the ancient times (Koc et al., 2015). Industrial Revolution and the development of organic chemistry made synthetic products to be preferred in treatments (Rates, 2001). However, there are numerous limitations such as the possible adverse effects of synthetic drugs, the difficulties in purchasing them, and the antibiotic resistance developed against microorganisms (Özcan and Acet, 2018; Ghazali et al., 2019). As a result, the awareness of people regarding the products they use has increased, and the natural products have started being more widely preferred throughout the world (Zengin et al., 2018). From this aspect, in recent years, scientists focused on analyzing herbs traditionally used by local people, examining their biological activities, and developing new and natural alternative drug formulations (Lockowandt et al., 2019; Özcan, 2019).

Due to its geographic location, Turkey has a rich flora and there are many aromatic medicinal plants used by people (Sezik et al., 2001). One of the most important ones among these plants is *Centaurea* species from *Asteraceae* family. This genus is represented by approx. 192 taxa and it is known that its rate of endemism is higher than 60% (Erel et al., 2014). In studies performed on *Centaurea* species, they have shown numerous biological activities such as anticancer, anti-diabetic, anti-inflammatory, analgesic, antimicrobial, and enzyme inhibition activities (Korga et al., 2017; Zengin et al., 2018; Lockowandt et al., 2019).

In order to adapt to difficult conditions and to survive, the plants synthesize various biocompounds that are responsible for their biological activities (Faustino et al., 2019). Owing to fact that there is no study on *Centaurea hypoleuca* in literature, therefore, we aimed to analyze the biological activity (anti-cholinesterase, anti-glucosidase, anti-amylase, antioxidant, and antimicrobial) and phenolic compounds of *C. hypoleuca* plant collected from the high altitudes of Black Sea region having extreme conditions.

2. Materials and methods

2.1. Chemicals, plant materials and extraction

All chemicals and enzymes used in our study were purchased from Sigma-Aldrich (St. Louis, MO, USA) or Merck (Darmstadt, Germany).

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