

## **Anticholinesterase activities from aqueous extract of different plant parts of *Erica manipuliiflora***

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Received: 30 April 2017 - Revised: 03 June 2017 - Accepted: 27 June 2017

**Abstract:** *Erica* species are generally spread along the coasts of Turkey. There are five *Erica* species in these regions, namely; *E. arborea*, *E. manipuliiflora*, *E. bocquetii*, *E. sicula* subsp. *Libanotica* and *E. spiculifolia* salisb. Among these species, *E. manipuliiflora* is commonly found in Muğla and southwest part of Turkey. *Erica* species are called as "funda", "püren" or "tree heath" locally in Turkey and contain biologically active compounds such as flavonoids, coumarins and triterpenoids. Since ancient times, these species have been used as herbal tea and folk medicine by local people in Turkey. In folk medicine, they are used for diuretic, antiseptic and anti-inflammatory purposes. Inhibition of acetylcholinesterase (AChE) and butyrylcholinesterase (BChE) is useful for the treatment of Alzheimer's disease. In this study anticholinesterase activity of aqueous extracts of leaves, flowers and aerial parts of *E. manipuliiflora* have been investigated spectrophotometrically. The aerial parts extract of *E. manipuliiflora* among the extracts (70.10%) showed the best inhibitory activity against AChE enzyme at 200 µg/mL concentrations. The extracts of leaves and flowers showed 44.42%, 49.91% inhibitions against acetylcholinesterase enzyme at 200 µg/mL concentrations respectively. The flowers extract of *E. manipuliiflora* (80.41%) exhibited the best BChE inhibitory activity at 200 µg/mL concentrations. At the same concentration, the galantamine showed 82.23% inhibitory activity. Leaves and aerial parts extracts showed 15,75%, 31.62% inhibitory activity against BChE respectively. Hence, aerial parts of *E. manipuliiflora* may be useful as a moderate anticholinesterase agent, and flowers of *E. manipuliiflora* may be useful as the butyrylcholinesterase agent.

**Keywords:** *Erica*, *Erica manipuliiflora*, acetylcholinesterase, butyrylcholinesterase, enzyme inhibition

### **1. INTRODUCTION**

Genus *Erica* belongs to *Ericaceae* family, which comprise 4250 species spread across 124 genera, and is a large family in the world [1]. *Erica* is represented by five species in Turkey and one of them is endemic. They are distributed in the coastal sides and South West Anatolia. These are *E. arborea* L., *E. manipuliiflora* Salisb., *E. sicula* Guss. subsp. *libanotica*, *E. spiculifolia* salisb and *E. bocquetii* [2]. These species are commonly known as "funda", "püren" or "tree heath," in Turkey [3]. The therapeutic functions of *Ericaceae* family members generally are attributed to a variety of polyphenolic derivatives [4, 5]. Species of *Erica* have been reported to possess various medicinal activities such as, antiulcer, cytotoxic [6], hyperlipidemia [7], antiseptic, diuretic, antiviral, astringent, sedative, wound-healing [8], anti-inflammatory and antinociceptive [9, 10]. These species contain many active components such as monoterpenes and condensed tannins, phenylpropanoid glycoside and flavonoids [11]. Moreover, heather honey is obtained from *Erica* species. Heather (*Ericaceae*) is an important melliferous plant for

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honey bees [12]. In the literature, heather honey which possessed high antioxidant activity and high phenolic composition make them valuable food items for human health [13].

Alzheimer's disease is characterized with impaired memory and behavior. Acetylcholinesterase (AChE) inhibitor has been used as a drug for the treatment of Alzheimer's disease because acetylcholine level is enhanced in the brain by using AChE inhibitors [14]. Recently, the searching for new AChE inhibitors from plant sources is of great interest among scientists [15]. AChE usually presents in the brain and BChE in the peripheral tissues [16]. Extracts of several medicinal plants have been reported to be effective in the inhibition of BChE and AChE [17]. Several plants from Ericaceae family have shown a very strong inhibitory activity against AChE and BChE [18].

In this study, it was aimed to investigate the inhibitory activities on acetylcholinesterase and butyrylcholinesterase enzymes by using infusions obtained from three different parts of the *Erica manipuliflora* plant (leaf, flower and aerial parts) commonly growing in Muğla.

## **2. MATERIAL and METHODS**

### **2.1. Plant Material**

*Erica manipuliflora* were randomly selected and collected at the flowering period in October of 2016 from Muğla-Ula in Turkey. After collection, plant material was stored in a dry place, completely protected from sunlight. After drying, leaves, flowers and aerial parts of the plant were manually separated and stored at -4°C until extraction.

### **2.2. Preparation of Infusions**

Plant materials (20 g) were added to 50 mL of ultra-distilled water (at the initial temperature of 85 °C) for 15 min, with stirring. Infusions were filtered and their volume was made up to 50 mL. Aqueous infusions were finally transferred to flat bottom flasks. Water were evaporated by freeze-dryer and extracts were stored at -4°C.

### **2.3. Determination of anticholinesterase activity**

The AChE and BChE inhibitory activities were measured by slight modifications of the spectrophotometric method [19]. All conditions were identical to those described in the earlier publication [20]. Galantamine was used as a reference compound. The results are given as the percentage of inhibition concentration.

## **3. RESULTS and DISCUSSIONS**

In this study, aqueous extractions from three different parts (leaves, flower, aerial parts) of *Erica manipuliflora* were obtained by infusion. The obtained extracts have been investigated for their inhibitory activities on acetylcholinesterase and butyrylcholinesterase enzymes according to the method given above. Galantamine was used as reference standard. The results are given in Table 1 and Table 2.

**Table 1.** Acetylcholinesterase enzyme inhibitory activities of the infusions of *E. manipuliiflora* leaves, flowers, aerial parts

Aqueous Extracts	% Inhibition			
	25µg/mL	50µg/mL	100µg/mL	200µg/mL
Infusion of <i>Erica</i> leaves (ELT)	13.48±1.85	26.78±1.78	35.50±1.32	44.42±1.95
Infusion of <i>Erica</i> aerial parts (EAT)	35.36±1.20	51.22±1.64	64.84±1.52	70.10±1.79
Infusion of <i>Erica</i> flowers (EFT)	19.36±1.75	27.28±1.47	37.51±1.88	49.91±1.14
Standard (Galantamine)	75,99±0.05	78,08±0.47	78,76±0.08	80,41±0.05

**Table 2.** Butyrylcholinesterase enzyme inhibitory activities of the infusions of *E. manipuliiflora* leaves, flowers, aerial parts

Aqueous Extracts	%Inhibition			
	25µg/mL	50µg/mL	100µg/mL	200µg/mL
Infusion of <i>Erica</i> leaves (ELT)	3,46±3,49	11,83±1,84	12,92±5,17	15,75±2,93
Infusion of <i>Erica</i> aerial parts (EAT)	8,82±2,25	16,46±2,20	21,22±0,41	31,62±0,90
Infusion of <i>Erica</i> flowers (EFT)	43,62±9,37	57,64±1,73	69,10±0,35	80,41±0,98
Standard (Galantamine)	64,99±0.05	73,96±0.08	79,27±0.17	82,23±0.15

#### 4. DISCUSSION and CONCLUSION

The infusion of aerial parts of *E. manipuliiflora* at 200 µg/mL concentration has shown the highest inhibitory activity (70.10%) against acetylcholinesterase enzyme, while the infusion of flowers has exhibited maximum inhibitory activity (80,41%) against butyrylcholinesterase enzyme. All tests were compared to galantamine is used as a reference compound. According to this result, the infusion of aerial parts of *E. manipuliiflora* has exhibited a moderate inhibitory activity against AChE. On the other hand, infusion of flowers has shown almost the same inhibition value with the reference compound (galantamin) against the BChE enzyme. Thus, we can say that the infusion of *E. manipuliiflora* flowers has the best level inhibitory activity against the butyrylcholinesterase enzyme.

#### Conflict of Interests

Authors declare that there is no conflict of interests.

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