

Medicinal Effects of *Heracleum persicum* (Golpar)

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Abstract: Because of the concerns about the side effects of conventional drugs, the use of natural products as an alternative to conventional treatment in Medicine and treatment of various diseases has been on the rise in the last decades. Therapeutic effects of several medicinal plants and vegetables, which are commonly used as food and in folk medicine against many diseases, are well known. Golpar is mixed with vinegar into which lettuce leaves are dipped before eating. Pimpinellin, isopimpinellin, bergapten, isobergapten and sphondin are furanocoumarins which are reported from roots of this plant. Hexyl butyrate (56.5%), octyl acetate (16.5%), hexyl 2-methylbutanoate (5.2%) and hexyl isobutyrate (3.4%) were identified as the major constituents of *Heracleum persicum* essential oil. Due to presence of these components, the plant is used medicinally to relieve flatulence, stomachaches as well as flavoring as a digestive and an antiseptic. The plant essential oil and hydroalcoholic extract have analgesic and anti-inflammatory effects. Furthermore, its antioxidant activities are also an important subject.

Key words: Actioxidant activity • Medicinal plant • Antimicrobial effect

INTRODUCTION

Heracleum persicum, commonly known as Golpar or Persian Hogweed, is a flowering plant in the family Apiaceae, native to Persia or modern day Iran. The fruits of *Heracleum persicum* are widely used as spices and the young stems are also used for making pickles and in Iranian folk medicine. Pimpinellin, isopimpinellin, bergapten, isobergapten and sphondin are furanocoumarins which are reported from roots of this plant. Hexyl butyrate (56.5%), octyl acetate (16.5%), hexyl 2-methylbutanoate (5.2%) and hexyl isobutyrate (3.4%) were identified as the major constituents of the *Heracleum persicum* essential oil [1, 2]. Owing to presence of these materials, antioxidant, anticonvulsant, antimicrobial, antifungal and immunomodulatory activities of this plant were reviewed.

Antioxidant Activity: Free radicals play a major role in the pathogenesis of many diseases including atherosclerosis, ischemic heart disease, cancer, Alzheimer's disease, Parkinson's disease and even in the aging process [3], in consequence of atherosclerosis antioxidant capacities of *Heracleum persicum* Desf, species from Apiaceae family were evaluated by determining their effects on DPPH radical scavenging and lipid peroxidation inhibition as well as their total phenolic contents [4-6].

Also, antioxidant activity has been reported for some furanocoumarins isolated from *Heracleum persicum* [7] and based on the well-known involvement of free radicals in inflammatory processes [8] it seems that at least a part of anti-inflammatory effects of HPHE may be attributed to its antioxidant constituents. The hydroalcoholic extract and essential oil of *Heracleum persicum* revealed antinociceptive and anti-inflammatory effects and these results support the traditional use of this plant in relieving pain and inflammation [9, 10].

Hydroalcoholic extract of *Heracleum persicum* contains several furanocoumarins including sphondin [7, 11] and it has been reported that sphondin inhibits IL-1 beta-induced cyclooxygenase-2 expression [12]. Since this enzyme has a key role in pain and inflammation, it may explain the observed effects of HPHE.

Anticonvulsant Activity: The observed pharmacological effects could be due to alkaloids, terpenoids and triterpenes present in the plant. Sayyah *et al.* [13] have reported that acetone extracts of *Heracleum persicum* seeds were effective anticonvulsants. Triterpenes are reported to possess anticonvulsant activity in some experimental seizure models like PTZ, MES and electrical kindling [14]. Some alkaloids have also shown anticonvulsant activity.

Some terpene compounds such as eugenol, cineol and linalool have anesthetic, muscle relaxant and inhibitory effect on locomotion [15]. Therefore, the terpene compounds present in the seeds may be responsible for the sedative effect of extract.

Antimicrobial Effects: A screening of Iranian plants for antimicrobial activity showed that extracts from the roots and from aerial parts of the plant completely inhibited the growth of *Bacillus anthracis* [16].

The essential oil from fruits of *Heracleum persicum* was investigated by means of LSC, GLC and GC-MS. Co-chromatography of synthesized compounds was also applied for identification of components. The oil contains about 95% of aliphatic esters, 4% of aliphatic alcohols and 1% of monoterpenes; 37 esters and 17 monoterpenes were identified [17].

Essential oils of *H. persicum* have shown the most cytotoxicity with LC50 values 0.007 microg/ml. None of aqueous extracts showed significant cytotoxicity. The analysis of the essential oil of *H. persicum* showed the hexyl butyrate and octyl acetate as the main compounds [18].

Antifungal Activity: Anti-*C. albicans* effect of plant oils, amphotericin B, nystatin and ketoconazole were determined by disc diffusion and broth macrodilution methods. Candidiasis caused by *Candida* species has increased dramatically in recent years. Among the various species, *Candida albicans* is the major causative agent associated with serious fungal infection, accounting for more than 90% of cases. Candidiasis is known as the most common invasive fungal infection in critically ill non-neutropenic patients [19, 20].

The management of *Candida* infections may be challenging due to limited number of effective antifungal drugs, toxicity of the available antifungal drugs, resistance of *Candida* to commonly use antifungal drugs, relapse of *Candida* infections and the high cost of antifungal drugs [21].

In general, the cytotoxic activity of essential oils is mostly due to the presence of phenols such as thymol, carvacrol, aldehydes such as geranial, citronellal and alcohols such as geraniol, linalool, citronellol, lavandulol [22]. Main constituents of *Heracleum persicum* are Anethole, terpinolene [23]. These results suggest some limitations for using these spices in diet. Furthermore, these plants could be considered as sources of cytotoxic compounds [18].

Immunomodulatory Activities: The immune system is involved in the etiology, as well as pathophysiologic mechanisms of many diseases. Medicinal plants are a rich source of substances which are claimed to induce paraimmunity, which is the non-specific immunomodulation of essentially granulocytes macrophages, natural killer cells and complement functions [24]. Studies have demonstrated that plant extracts possess various biological characteristics including immunomodulatory activity.

H. persicum might stimulate both humoral as well as cellular arms of the immune system.

In the HT test, the plant showed an increased response with all the tested doses, but this increase was only significant dose of 100 mg/kg. This activity could be due to the presence of flavonoids or coumarins, which can augment the humoral response by stimulating the macrophages and B-lymphocytes involved in antibody synthesis [25].

An increase in DTH response indicates that the *H. persicum* extract may have a stimulatory effect on lymphocytes and the accessory cell types required for the expression of the reaction [26].

Recent reports indicate that several types of flavonols stimulate human peripheral blood leukocyte proliferation. They significantly increase the activity of helper T cells, cytokines, interleukin2, gamma-interferon and macrophages and are thereby useful in the treatment of several diseases caused by immune dysfunction. Based on the published studies, furanocoumarins and flavonoids seem to be the most likely candidates eliciting immunostimulating effects [27, 28].

Finally, reports suggest that *H. persicum* has potential for newer therapeutic applications in the future.

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