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Chemical composition and pharmacological effects of *Sambucus nigra*

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ABSTRACT

Sambucus nigra is a species complex of flowering plants in the family Adoxaceaenative to most of Europe and North America. Common names include elder, elderberry, black elder, European elder, European elderberry and European black elderberry. It grows in a variety of conditions including both wet and dry fertile soils, primarily in sunny locations the aim of this study is to overview its therapeutic effects than its nutritive and industrial effects. This review article was carried out by searching studies in PubMed, Medline, Web of Science, and Iran Medex databases up to 2016. Totally, of 109 found articles, 40 articles were included. The search terms were "elderflower", "therapeutic", "pharmacological". Various studies have shown that elder flower (*Sambucus nigra*). Antioxidant effect, Photo-protective effect, Bone Mineral Density, Antivirus effect, Anti-allergy effect, Antiurolithiasic effect, Anti-Toxoplasma activities, and Antidiabetic effect .elderflower (*Sambucus nigra*) is widely used for therapeutic and purposes that trigger its significant value. Various combinations and numerous medicinal properties of its extract, essential oils, its stems and leaves demand further and more studies about the other useful and unknown properties of this multipurpose plant.

Keywords: elderflower (*Sambucus nigra*), herbal medicine, therapeutic, Pharmacognosy

INTRODUCTION

It is proved that herbal medicine is effective in the treatment of many diseases [1-10]. *Sambucus nigra* is a species complex of flowering plants in the family Adoxaceaenative to most of Europe and North America. Common names include elder, elderberry, black elder, European elder, European elderberry and European black elderberry. It grows in a variety of conditions including both wet and dry fertile soils, primarily in sunny locations [7, 11].

It is a deciduous shrub or small tree growing to 6 m [20 ft] tall and wide [rarely 10m tall]. The bark, light grey when young, changes to a coarse grey outer bark with lengthwise furrowing. The leaves are arranged in opposite pairs, 10–30 cm long, pinnate with five to seven [rarely nine] leaflets, the leaflets 5–12 cm long and 3–5 cm broad, with a serrated margin [7, 12].

The hermaphrodite flowers are borne in large, flat corymbs 10–25 cm diameter in late spring to mid-summer, the individual flowers ivory white, 5–6 mm diameter, with five petals; they are pollinated by flies [13].

The fruit is a glossy dark purple to black berry 3–5 mm diameter, produced in drooping clusters in late autumn; they are an important food for many fruit-eating birds, notably blackcaps. Natural range of North American *Sambucus nigra* subspecies [14].

The dark blue/purple berries can be eaten when fully ripe but are mildly poisonous in their unripe state. All green parts of the plant are poisonous, containing cyanogenic glycosides. The berries are edible after cooking and can be used to make jam, jelly, chutney and Pontack sauce [15, 16].

The flower heads are commonly used in infusions, giving a very common refreshing drink in Northern Europe and the Balkans. Commercially these are sold as Elderflower cordial. In Europe, the flowers are made into a syrup or cordial (in Romanian: Socată, in Swedish: fläder (blom)saft), which is diluted with water before drinking. The popularity of this traditional drink has recently encouraged some commercial soft drink producers to introduce elderflower-flavoured drinks (Fanta Shokata, Freaky Fläder). The flowers can also be dipped into a light batter and then fried to make elderflower fritters. In Scandinavia and Germany, soup made from the elder berry (e.g. the German Fliederbeersuppe) is a traditional meal [17].

Both flowers and berries can be made into elderberry wine, and in Hungary an elderberry brandy is made that requires 50 kg of fruit to produce 1 litre of brandy. In south-western Sweden, it is traditional to make a snaps liqueur flavoured with elderflower. Elderflowers are also used in liqueurs such as St. Germain, and in a mildly alcoholic sparkling elderflower 'champagne'. The Jelly ear fungus is frequently found on elder trees, and has medicinal and culinary uses. Sambuciflos: dried *sambucus nigra* flowers as used in herbal tea

This plant is used as a medicinal plant by native peoples and herbalists. Stembark, leaves, flowers, fruits, and root extracts are used in bronchitis, cough, upper respiratory cold infections, and fever [18-20].

Sambucus nigra fruits and flowers have been used in traditional Austrian medicine - internally (fruits as tea, jelly, juice, or syrup; flowers as tea or syrup) for treatment of disorders of the respiratory tract, mouth, gastrointestinal tract, and skin, and for viral infections, fever, colds, and influenza [21-26].

Antioxidant effect

The effects of the association between the renin inhibitor and the polyphenolic extract on biochemical parameters and systolic (TAS) and diastolic (TAD) blood pressure within an L NAME-induced experimental model of arterial hypertension was emphasized and it was shown that The combination of two different classes of substances, namely, renin inhibitors and natural polyphenol extracts, reduces arterial pressure and also might reduce the side effects of the major classes of antihypertensive agents and improve the quality of live [27].

Some of the natural polyphenolic extracts from common elder fruit (*Sambucus nigra*), and also on their effects in diabetes mellitus was examined. The results reveal that the glycosylated hemoglobin values are much higher in the diabetic group and they are significantly lower in the group protected by polyphenols [28].

Pharmacokinetic variables of several dietary anthocyanins and consumption of elderberry (*Sambucus nigra L.*) extract were evaluated in urine and plasma. The result showed that the low dose-normalized area under the concentration-time curve (AUC) and the fraction of orally administered anthocyanins recovered unchanged in urine indicate a low bioavailability of these compounds [29].

A field experiment and two oxidation experiments in the laboratory were carried out. Findings demonstrated that Ascorbic acid protected the anthocyanins, but not quercetin from oxidative degradation. Mixing of fruits with air during processing and even a low content of oxygen in the juice before tapping must be avoided by appropriate steps during processing [30].

Dried and fresh fruits of four cultivated and six wild growing plants were investigated for their anthocyanin pattern and content as well as their bioactive compounds. a radical scavenging compound affecting *A. fischeri* and acting as acetylcholinesterase inhibitor was tentatively assigned by its protonated molecule at m/z 456 as either ursolic or oleanolic acid by HPTLC-ESI-MS. HPTLC and bioprofiling of elderberry samples as well as quantitation and confirmation of bioactive compounds therein [31].

The activities of *Ferula hermonis Boiss. EtAc* (Ferula) and *Sambucus nigra L.* aqueous (Elder) extracts, and their potential active isolates was investigated; Without the use-limiting-side-effects of existing therapies, Ferula, Elder and their active isolates have shown significant results in ameliorating DM and long standing diabetes-induced complications(32).

The polyphenolic composition and the *in vitro* antioxidant activities (ABTS, DPPH, BCB and FRAP-ferrozine) of *S. nigra* berries, collected in four different Sicilian areas (Italy) was investigated. Results found that Elderberries are considered one of the fruits with highest anthocyanins content, the amount of phenolic compounds, other than anthocyanins, is approximately 1.5 times greater than the latter. Sicilian *S. nigra* berries are appealing for its antioxidant potential and for its particularly high content of anthocyanins [33].

Photo- protective effect

In an *in vitro* study, the photo protective activity and photostability efficacy of sunscreen formulations containing *Helichrysum arenarium*, *Sambucus nigra*, *Crataegus monogyna* extracts was investigated. The results obtained show that the formulations containing polyphenols fulfill the official requirements for sunscreen products due to their broad spectrum of UV protection combined with their high photostability and remarkable antioxidant properties. Therefore *H. arenarium*, *S. nigra*, *C. monogyna* extracts represent useful additives for cosmetic formulation [34].

Bone Mineral Density

In an animal study, antioxidant, anti-inflammatory, antiglycosylation activity, and antiosteoporosis effects of The *Sambucus nigra* fruit extract were examined. Results highlight a significant improvement ($P < 0.001$) in the antioxidative capacity of the serum in diabetic rats treated with natural polyphenols, bringing back to normal the concentration of reduced glutathione (GSH), as well as an important decrease in the serum concentration of MDA, with improved osteoporosis status [35].

Antivirus effect

Some parameters of interaction between the receptor and *S. nigra* lectin was determined. The result showed that receptor isolation was monitored by means of bound sialic acid (BSAc) detection. A major band of protein at 66.7 kDa was clearly visible. Their immobilization in active form, was not described previously, and may have wide application in designing biosensors or virus removal from areas or contaminated samples [36].

Sera obtained in the acute and convalescent phases were tested for the presence of antibodies to influenza A, B, respiratory syncytial, and adenoviruses. Considering the efficacy of the extract *in vitro* on all strains of influenza virus tested, the clinical results, its low cost, and absence of side-effects, this preparation could offer a possibility for safe treatment for influenza A and B [24].

Anti-allergy

The responsible allergens in extracts from elderberry pollen, flowers and berries, and cross-reactivity with allergens from birch, grass and mugwort were investigated. The elderberry plant *S. nigra* harbours has shown to have allergenic potency. Besides, it found that this protein is a candidate for a major elderberry allergen with designation Sam n 1 [37].

Antiuro lithiasic effect

In an animal study, the effect of a botanical formulation of *Herniariaglabra*, *Agropyronrepens*, *Equisetum arvense*, and *Sambucus nigra* was determined. It showed that Treatment with PEF prevents deposits of calcium oxalate crystals formation and of micro calcifications in the kidney, and reduces the risk of fibrosis sub capsular. 125 mg/Kg of PEF is the dose that has a greater effect on the studied parameters [38].

Anti-Toxoplasma activities

The efficacy of methanolic extracts from the fruits and leaves of *Sambucus nigra* against tachyzoite of *T gondii* was investigated. Results showed that *S. nigra* has acceptable efficacy *in vitro* and the parasiticidal effect of fruit extract was significantly better than leaf extract. However, *in vivo* efficacy of this extract needs further investigation (39).

Antidiabetic activity

The isolation and characterization of a metallothionein-like mRNA identified as a consequence of differentially screening a cDNA library for messages up-regulated during abscission was described. The protein exhibited greatest homology to other metallothioneins belonging to the Type 2 family including those from *Mimulus* (62%) and *Arabidopsis* (57%). This homology was greatest around the cysteine-rich amino and carboxytermini (40).

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