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The antioxidant activity of blackthorn fruits (*Prunus Spinosa* L.) review

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Abstract

In many developed countries, the interest of consumers for the nutritional quality of food, especially for healthy products is constantly growing [16]. *Prunus Spinosa* L. contains many biologically active polyphenolic compounds, such as: phenolic acids, flavonoids, anthocyanins, coumarins etc. [5]. Blackthorn fruits have long been used in folk medicine and processed by people in households [1]. In order to prevent the negative effects resulting from the action of free radicals on the body, are used food antioxidants which can reduce the risk of diseases related to redox processes in the body. Antioxidants are widely used in the food industry to extend the shelf life of foods. Several research groups have admitted blackthorn as a new source of antioxidants [17].

Keywords: antioxidant activity, chemical composition, *Prunus spinosa* L.

Blackthorn under the latin name *Prunus spinosa* L. is a thorny wild shrub originar from Scotland, also known as "wild plum", "blackthorn" and "sloe". It is part of the Rosaceae family and can be found naturally mainly in Europe, North West Africa and West Asia and has been used for many years in therapy.

For example, the leaves of *P. spinosa* in Turkey are used to treat constipation, the flowers are used as a diuretic and insecticide, and the fruit has long been used for its laxative properties. In some areas, the fruits of Prunus spinosa are consumed in the form of compote or candied, because it increases the resistance of the body, ensures hematopoiesis and relieves rheumatic pains [1,2,3,4]. Due to its anti-inflammatory effect, the juice obtained is used as a mouthwash for lesions of the mucous membranes of the mouth and pharynx. *Prunus spinosa* has traditionally been used to treat high blood pressure, diabetes and gastrointestinal disorders, as a diuretic, to regulate menstruation and also in the food industry for making yogurt [1].

Figure 1. Blackthorn fruits

Several scientists have demonstrated the antioxidant effects of blackthorn extracts and have also proven that they have antibacterial properties against some pathogenic bacteria [5]. In addition to these properties, *Prunus spinosa* fruits have also been shown in a study to have antitumor effects on a colorectal cancer cell line [6]. To date, a high consumption of fruits and vegetables has been shown to reduce the incidence of serious health disorders caused by oxidative stress, such as neurodegenerative [7], cardiovascular [8], diabetes [9] and cancer [10].

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Therefore, many plant species have been explored for natural bioactive compounds that can be used in the food, pharmaceutical and cosmetic industries. [11]. Even though these wild plants represent important sources of bioactive compounds, available and cheap, they are little exploited and used on a small scale (in human households) [5]. Blackthorn are a rich source of sugars, organic acids, carotenoids, tocopherols, chlorophylls, phenolic compounds, fatty acids [12]. Extracts from such plants rich in phenolic compounds have found applicability in food, pharmaceutical, cosmetic, textile and other industries [13]. *Prunus spinosa* has a multitude of uses, among which we can also list the fact that the juice obtained from the unripe fruits is used in laundries, the sap used to make ink is extracted from the bark of the dove tree, and the thin branches of the dove tree can be made into various braids and interesting shapes can be created, being also used to make walking sticks [4].

Protecting phenolic compounds from physico-chemical degradation and biological agents represents a great challenge, implicitly improving their shelf life and bioavailability. Encapsulation of these compounds is a possible protection mechanism, using different encapsulation agents and methods for this purpose [14]. To date, extracts of *Prunus spinosa* have been encapsulated in allyl methacrylate cross-linked polymers for testing cosmetic properties and anti-inflammatory and wound healing effects [15].

2. Fields of use of the blackthorn

Currently, in many developed countries, consumer interest in the nutritional quality of food products, which also offer them certain health benefits, is continuously increasing. It can be seen that people are beginning to realize that a regular consumption of certain foods influences health in a positive way. Consumers choose their products not only based on taste but also on the impact they have on their body. [16].

Fields of use of the blackthorn:

a)in the food industry

- additive and natural preservative
- antimicrobial and antioxidant agent
- natural dye
- functional food

b) in the cosmetic industry

- antimicrobial action
- antioxidant action
- anti-inflammatory action
- tyrosinase inhibitor
- UV protection

c) in the pharmaceutical industry as a therapeutic agent for

- diabetes
- cardiovascular diseases
- neurological diseases
- cancer, etc.
- d)in the textile industry:
- natural dye
- antifungal action
- antimicrobial action

Due to the fact that the fruits of *Prunus spinosa* are seasonal and have a rather late ripening, immediately after their harvest it is necessary to process or store them in optimal conditions so that the nutritional value is not affected.

The best way to preserve fruit is to freeze it, a process used for many fruits. Following some research studies, it was proven that the process of freezing and storing dove fruits did not have a significant effect on the changes in nutrients and antioxidants in them. It was also noted during this storage process that there was a minimal, statistically insignificant decrease in the antioxidant activity of the fruit.

Therefore, frozen storage of blackthorn for several months can be considered a good way to make it available for processing and for consumer use, including during the off-season [16].

3. Antioxidant activity

To prevent the negative effects resulting from the action of free radicals on the body, food antioxidants are used that can reduce the risk of diseases related to redox processes in the body. Antioxidants are widely used in the food industry to extend the shelf life of foods. Today, natural antioxidants cannot be used on a larger scale in various industries due to their high prices and limited sources. Instead, synthetic antioxidants are frequently used in the food industry.

It is aimed at the use in the food and pharmaceutical industry, by recovering new sources of safe and cheap natural antioxidants and eliminating as much as possible synthetic antioxidants, with the aim of avoiding certain health risks and toxicity [17].

Several research teams have accepted blackthorn as a new source of antioxidants [18].

Fruits and vegetables are excellent sources of anthocyanins. Their absorption by the body is done naturally without any modification and they are integrated in cell cultures, both in the plasma membrane and in the intracellular fluid. Anthocyanins are one of the main classes of flavonoids that contribute significantly to the antioxidant activity of compounds and are known for their ability to impart red, blue and purple colors to plants.

There is a possibility that anthocyanins interact with biological assemblies and confer antibacterial, antioxidant, enzyme-inhibiting and cardiovascular protective effects.

A group of researchers found a close link between antioxidant capacity, total phenolics and anthocyanins, some studies, on the other hand, suggested that this link between anthocyanins and antioxidant properties may be less significant.

Based on some experimental data obtained, it has been suggested that anthocyanins may exert therapeutic activity against human diseases related to oxidative stress, such as coronary heart disease and cancer. Following the experimental results carried out in vitro and in vivo, these effects are mainly related to the antioxidant properties of anthocyanins. In order to better understand and explain the antioxidant activity of anthocyanins, various mechanisms have been recommended, such as the inhibition of lipoprotein oxidation, the formation of complexes with DNA, the chelation of metal ions, the capture of free radicals.

Since oxidative stress is believed to play a role in many chronic and degenerative diseases, considerable efforts are being made to find natural antioxidants in edible plants and fruits to prevent their occurrence and counteract the progression of these diseases.

3.1. Determination of antioxidant activity

The determination of antioxidant activity focuses on two aspects: one that contains quantitative tests to determine individual antioxidants, and another that evaluates (quantifies) the total antioxidant activity of a certain product. These methods are applicable both for food products, plants, nutritional supplements, cosmetics and for biological fluids, such as blood, serum, urine, etc.

Establishing a unified method for evaluating antioxidant activity is one of the concerns of scientists in this field [19].

Antioxidant activity can be determined spectrophotometrically using a 1,1-diphenyl-2-picrylhydrazine (DPPH) radical scavenging assay [20].

The antioxidant activity of fruits has a significant contribution in the process of combating a significant number of degenerative diseases [21]. This can be performed from extracts of branches, leaves and fruits of *Prunus spinosa*. Using the stable free radical 1,1-diphenyl-2-picrylhydrazyl (DPPH) is a quick and easy method to evaluate antioxidant activity. The mechanism of DPPH radical reduction is based on the ability of certain compounds to donate hydrogen. Some plants are rich in derived secondary metabolites such as coumarins, flavonoids, anthocyanins, phenolic acids and tannins. These phenolic compounds are able to donate hydrogen, so they have anti-radical activity [20].

The content of phenolic compound, organic acid and vitamin C can be determined by high performance liquid chromatography (HPLC) method [20].

According to a research study, blackthorn has a high antioxidant capacity approximately of 50 μg/mg equivalent ascorbic acid [22].

4. Conclusion

- Blackthorn, like other wild species, has a higher biological potential than other fruits that are grown commercially;
- *Prunus spinosa* has a high tannin content and has beneficial properties for the body;
- Blackthorn has a high content in vitamin C and polyphenols, including anthocyanins.
- Frozen storage of blackthorn for several months can be considered a good way to make it available for processing and for consumer use, including during the off-season.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human or animal subjects (if exist) respect the specific regulation and standards.

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