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Research Paper

Persimmon (Diospyros kaki L.): Nutritional importance and potential pharmacological activities of this ancient fruit

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ABSTRACT: *A lot of research has highlighted the importance of diet to keep our organism healthy. Consumers today are much more careful in the search for foods with characteristics of natural authenticity, without the addition of artificial additives and preservatives. Greater attention is paid to the chemical composition and nutraceutical properties of food to prevent metabolic and inflammatory diseases resulting from the modern lifestyle. Therefore the consumption of fruits and vegetables has become very important for the protection of health for the presence of different bioactive molecules that show activity in the prevention of many pathologies. Persimmon is a fruit much appreciated since ancient times for the richness of bioactive substances such as carotenoids, tannins, flavonoids, anthocyanins, catechins.... effective in mitigating the harmful effects produced by reactive oxygen species, metabolic disorders, cardiovascular diseases, cancer.*
KEYWORDS: *fruit, food, nutraceutical substances, pharmacological activities, astragaline*

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I. INTRODUCTION

Persimmon (Diospyros kaki L.f., 1782) is an ancient fruit tree, of the family Ebenaceae, among the first to be cultivated by man. Originally from China, it then spread to the Far East, from Korea to Japan, where it is also known as the Loto of Japan. In the land of the Rising Sun this beautiful plant is also called the Tree of Peace, as some specimens managed to survive the atomic bomb dropped on Nagasaki in 1945. Among the various names used to indicate it, there are also Apple of the East, Tree of Seven Virtues and Food of the Deis.

The plant was widespread in Europe and America in the mid-nineteenth century; in Italy it arrived at the end of the 1800s and is cultivated mainly in Campania, Emilia Romagna, Veneto and Sicily. The most common varieties are Loto di Romagna, Vanilla of Campania, Fuyu, Kawabata, Suruga; one of the best known is the Sicilian variety of Misilmeri exported all over the world [1].

The trees of Diospyros kaki can reach 15 m in height, they are wood-leafed, with gray-dark and wrinkled bark, with thick foliage; the leaves are large, enlarged oval, glabrous and shiny; the fruit is a bright orange berry that is harvested between October and November. The most widespread variety of khaki is characterized by a very creamy pulp, while the vanilla species is more compact. The fruits of the common kaki are not consumable immediately after harvesting, but must be matured until the content of tannins that impart an astringent taste is lost.

To speed up ripening, the fruits can be put together with apples or pears, which release ethylene and following this maturation a production of sugars is obtained that makes this fruit very sweet. Mature kaki should be consumed in a short time as they last for a limited time, even if stored in the refrigerator. A new technology has been developed using inert gases such as nitrogen or carbon dioxide, which make the fruit completely non-astringent without altering its nourishment, physico-chemical and sensory qualities. The extension of the retention date is very important since this fruit is an important potential for export [2-4].

Although kaki is included among the minor fruits, it cannot be neglected as a food fruit given its chemical composition rich in substances not only of high biological value but also with therapeutic potential in the prevention of many pathologies.

II. FOOD USE AND CHEMICAL COMPOSITION

As a food the fruit is consumed in a fresh state, well ripe, very soft to the touch and with a very bright orange coloring; if it is hard and/or bears yellow shades or is uniform yellow in color, then it is unripe and certainly not pleasing to the taste for its astringency. Rarely in Italy, but commonly in eastern countries the

fruits are subjected to processing products. Some drying tests have also been carried out using a fruit that is not yet ripe, which can be dried in the sun or in dryers after it has been peeled, pitted and cut into wedges.

The optimum temperature for air drying was 45°C for 18 hours for the whole fruit, while for peeled and quartered fruits the temperature was 65°C for the same time. The process was completed when weight loss was 80% of the initial weight, giving rise to a pleasant dehydrated, highly energetic product [5,6].

For its sweetness, in the kitchen it is destined to be an excellent dessert in the fresh state, but it is also possible to prepare the kaki jam simply by adding to the pulp peel and lemon juice and little sugar, then thickening the mixture on the fire until a gelatinous consistency, suitable for spread on bread, to stuff tarts or to prepare puddings. More recently the fruit of Kaki has also been proposed for the preparation of sorbets [7]

In Japan kaki is used for the manufacture of alcoholic beverages, including certain varieties of sake. Kaki vinegar is a traditional fermented product used in both medicine and nutrition: it has the potential for reducing cholesterol and triglycerides in the blood in addition to liver cholesterol.

The chemical composition of the fruit is very varied, contains: 80% water;18% sugars;0.80% protein; 0.40% fat; 2.5% fiber; among the most abundant minerals is potassium, followed by phosphorus, magnesium, calcium and sodium, zinc and copper. There are also many vitamins: vit C,vit A,Vit E ,vit K, complex B.

Both in the fruit and in the leaves there are phytochemicals such as Carotenoids: the content of cryptoxantantline is the highest (50%), followed by lycopene (10%), β- carotene (10%), zeaxanthyne (5%) and lutein (5%) . Flavonoids and Tannins. 100 g of Kaki develop 65 calories. [9,10]

The seeds are rich in fatty acids, of which palmitic, oleic and linoleic are the most important, contained from 70.4% to 78.3% of the total lipids present [11] .

III. PHARMACOLOGICAL ACTIVITY

Persimmon is a fibrous fleshy tropical fruit that has recently garnered great interest in awareness of the health benefits. The presence of antioxidant substances such as polyphenols, carotenoids and tocopherols and other bioactive molecules such as proanthocyianidine, tannins, flavonoids, play an important role in the prevention of many pathologies.

Carotenoids are fat-soluble compounds recognized as natural dyes in fruit with the typical orange, red, yellow and purple colors. Color is the fundamental qualitative parameter, to indicate the freshness of the fruit and therefore they, precisely because of the characteristic of conferring color, can be used as quality parameters. They also have many bioactive features for the prevention of chronic diseases such as cardiovascular diseases, atherosclerosis and cancer diseases, protect the epithelial system and eye health by absorbing ultraviolet radiation and also enhance the immune system. Recently carotenoids have aroused a lot of interest in the prevention of alterations in cognitive function and memory [15-17].

The antioxidant activity of Kaki is mainly linked to the presence of high molecular weight tannins that have highlighted the ability to reduce the risk of cardiovascular diseases, hypertension, diabetes and a wide range of tumors. Tannins are polyphenolic compounds capable of binding to the nitrogen of proteins and alkaloids to form insoluble complexes. Depending on the chemical structure, the hydrolysable tannins to which the gallotannins and ellagitannins belong and the condensed tannins to which anthocyanins and catechins that do not decompose by heating with diluted acids are known. In the fruit there are both hydrolyzable tannins and condensed tannins or proanthocyianidins and the latter are attributed the astringency of the flavor when the fruit is unripe. During the ripening process, in fact, they turn into sugars, allowing the fruit to acquire sweetness. All tannins are strongly antioxidant substances and act synergistically even with ascorbic acid. They lower blood pressure, reduce platelet aggregation, can help reduce the risk of coronary artery damage, are antiviral, antibacterial, and prevent free radical damage [18-20].

Some researchers using extracts of the fruit rich in tannins, have highlighted their ability to bind biliary salts, thus facilitating cholesterol excretion, with a significant reduction in LDL cholesterol levels, without modification for triglycerides and HDL cholesterol. They are therefore recommended in the treatment and prevention of hyperlipidemias and diseases of the cardio-circulatory system [21-24]. Much research has also shown that kaki tannins have an inhibitory effect on enzymes that hydrolyze carbohydrates (particularly pancreatic α–amilase and intestinal α–glicosidase in a dose-dependent manner. This inhibitory capacity delays the absorption of carbohydrates by reducing post-prandial hyperglycaemia mainly through the inhibition of α-amilase [25-27].

Extracts obtained from kaki leaves, which in some countries are added to tea, are also rich in substances that have beneficial effects against oxidative stress hypertension, diabetes mellitus with its complications and atherosclerosis.

The extract of the stems of the leaves of a wild variety of Diospyros kaki with astringent flavor is used as a medicine in the treatment of nocturnal enuresis, vomiting and hiccups due to its anti-inflammatory properties, due to the presence of tannic acid.

Ethanol leaf extract has proven effective in glaucoma, a progressive optical neuropathy characterized by the loss of retinal ganglion cells that causes damage to the field of vision and, in the absence of care, leads to complete blindness. Current treatments are focused on lowering intraocular pressure through medication or surgery. Due to the undesirable side effects produced by such treatments,research has been directed towards preparing an effective agent to lower eye pressure, easy to administer and safe, with minimal side effects, for long-term use.

In many experiments, ethanol extract showed protective effects on retinal ganglion cells both in vitro and in vivo: the vitality of these, in fact, after exposure to cytotoxic substances, increased in relation to the dose of extract administered. In a mouse model of partial optic nerve crushing, there were improvement effects on retinal degeneration due to mechanical damage suffered. The presence in the extract of substances with an anti-inflammatory action such as carotenoids, the satisfactory results obtained in the various experiments, therefore suggest proposing Diospyros kaki extract as a therapeutic potential against degenerative rhetin disorders, including glaucoma. [29-31]

Modern pharmacological studies have shown in the leaves the presence of seven triterpene saponins called kakisaponins and have evaluated the protective effects of them on human neuroblastoma cells using the MTT cell vitality test (tetrazolio salt). [32]. An ethanol extract of the leaves delayed the time of thrombin and prothrombin in the human plasma, highlighting antithrombotic activity. In it the presence of astragalin, a flavonoid capable of hindering the activity of the angiotensin conversion enzyme (ACE), responsible for the increase in blood pressure, has been demonstrated, also inhibiting cyclo-oxygenase, which induces the formation of inflammatory prostaglandins. Some in vitro studies have described the inhibitory actions of flavonoids in the prevention of platelet aggregation and thrombosis formation. Astragalin has been shown to promote blood clotting, increasing the number of platelets, so it could be used as a hemostatic drug for hemorrhagic diseases [33-35].

Inflammatory effects and DNA damage to the skin are known as a result of excessive exposure to solar radiation. Exposure to UVB rays produces not only visible DNA damage for premature aging of the skin tissue, but also contributes above all to the formation of precancerous lesions, actinic keratosis. Astragalin has been shown to act specifically and directly on the ulcerative lesion induced by UVB radiation and therefore could be considered as a new therapeutic agent, of natural origin, with high specificity and free from toxicity [36].

IV. CONCLUSIONS

Diospyros kaki is a fruit rich in molecules of high biological value both in pulp and leaves that have anti-inflammatory, anti-atherosclerosis, hypocholesterolemic, antioxidant, antidiabetic, anticancer activities. However, it has not been established in the commercial sector because of a number of factors: limited availability to a few months of the year, October-December; specialization of the supply chain, cultural techniques, bad applications of artificial techniques for early maturation; management of post-collection and marketing, consumer preferences. In fact, despite possessing this fruit a high value both food and nutraceutical, due to its acidic and astringent flavor due to incomplete maturation, the presence of seeds, its consistency, too compact or soft, is not accepted by everyone.

In the future, in addition to increasing research in the pharmacological field in order to deepen the mechanism of action of the many active compounds, it will be desirable to make greater efforts on the part of operators in the fruit sector to enhance this product.

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