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Review

# An overview of dermatological and cosmeceutical benefits of *Diospyros kaki* and its phytoconstituents

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ABSTRACT

*Diospyros kaki* L.f. belonging to family Ebenaceae, commonly known as persimmon is used as a medicinal plant in Chinese traditional medicine since many years for different ailments including cosmetics and dermatologic applications. Traditionally this plant is used to treat different skin conditions including pimples, skin eruptions and eczema. Present interest has been focused toward use of natural bioactive compounds in various curative and beautifying applications in dermatological and cosmeceutical disciplines. The objective of this article is to present cumulative data on potential use of *D. kaki* for its possible role in dermatologic and cosmetic applications. Scientific data has revealed an excellent position of *D. kaki* in both dermatology and cosmetic discipline making it a valuable choice in respective field. Active principles from different plant parts have shown to possess anti-inflammatory, antiallergic, photo-protective, and anti-wrinkle effects with appreciable activities against tyrosinase, elastase, and collagenase enzymes. Promising antioxidant activity and skin whitening potential, augmented by reduction in sebum contents, and reduction in size and number of skin pores make it a suitable choice as cosmetic ingredient. Data has been summarized and presented on available molecular mechanism that can contribute toward phytoconstituents usage in cosmetics and dermatology mediated by different cellular pathways. Crude extracts and some of phytochemical obtained from this plant such as isoquercitrin and hyperin have better reported activities than well-known cosmetic ingredients viz., arbutin, kojic acid and hydroquinone with possibility of having no side effects. Photo protection against degenerative effects of UVA, UVB and gamma radiation can help skin to fight well against oxidative stress and reactive oxygen species. Further investigation need to be directed toward human subjects for evaluation of these reported activities for obtaining optimum commercial and industrial benefits from this valuable plant.



## Introduction

Different factors contribute toward changing skin and beauty-care product industry including a strict regulatory control, cost and enhanced customer expectation with minimal side effects of active constituents in cosmetics. During the first decade of 21st century total expenditure on beauty and personnel care products increased from 166.1 billion USD to 382.3 billion (Łopaciuk and Łoboda, 2013) with a 25.9% sale share of Asia at the end of 2007. Ingested or applied bioactive molecules interact with different targets in our body modulating different biological functions. As the skin ages, these metabolic processes also change resulting in cellular damage and poor maintenance of skin. Cellular damage and aging is linked with a change in certain metabolic enzymes, amino acids, lipids, antioxidants and nutrients levels. The natural bioactive molecules present in botanical extract are shown to have positive regulating effects on aging process and other skin and dermatological conditions (Mukherjee et al., 2011; Ye et al., 2014; Shin et al., 2015). Currently the research in field of skincare and other dermatological conditions have been shifted considerably toward use of natural products and their bioactive constituent after establishing scientific validation, assuring safety and efficacy.

*Diospyros kaki* L.f. commonly called as persimmon or Japanese persimmon, is a deciduous plant native to China, Korea and Japan, however now it is being grown in many East Asian countries and southern Europe. *D. kaki* belongs to family Ebenaceae and is considered as one of most important species from genus *Diospyros* because of yielding exotic fruits (Zhu et al., 2016). This plant can be categorized into two distinct varieties including astringent (*e.g.* "Hachiya, Tamopan, Tanenashi, Triumph, Homan Red, Ormond, and Taubata") and non-astringent (*e.g.* "Fuyu, Imoto, Izu, Jiro, Okugosho, Suruga and others") based on chemical nature of tannins present in

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**Table 1**
Production statistics of *Diospyros kaki* in 2014 and various varieties produced by top 10 producer countries.

| Country | Production in 2014 (million tons) | Persimmon cultivars produced |
|---|---|---|
| China | 3.804 | Hachiya, Tamopan, Tanenashe, Ormond, Fuyu, Imoto |
| Korea | 0.428 | Hongosi, Hachiya, Dan Gam (Fuyu) |
| Spain | 0.245 | Homan red |
| Japan | 0.241 | Hachiya, Tamopan, Tanenashe, Taubata, Fuyu, Imoto, Jiro, Suruga |
| Brazil | 0.182 | Sibugaki, Hachiya, Trakoukaki, Hatemya |
| Azerbaijan | 0.140 | Gosho, Ghibrid-27235, Kiakume |
| Uzbekistan | 0.066 | Hachiya, |
| Italy | 0.039 | Kaki Tipo, Vaniglia, Cioccolatino, Zellonafuyu |
| Israel | 0.037 | Triumph |
| New Zealand | 0.003 | Fuyu, Jiro |
| Others | 0.006 | – |
| World Total | 5.191 | – |

respective variety (Martinez-Las Heras et al., 2017). International commercial producers of *D. kaki* and various product varieties produced are presented in Table 1. According to Food and Agriculture Organization Statistics (FAO-STAT) department of United Nations, 5.191 million tons of *D. kaki* was produced globally in 2014 with 73.27% share of China alone in 2014 (FAOSTAT, 2014). This plant is not endemic to Brazil, however it is being cultivated with good propagation rate having a total growth of 0.182 million tons in 2014 (see Table 1). In Brazil *D. kaki* is cultivated in southeast, northeast and central-west regions (Janeiro, 2017).

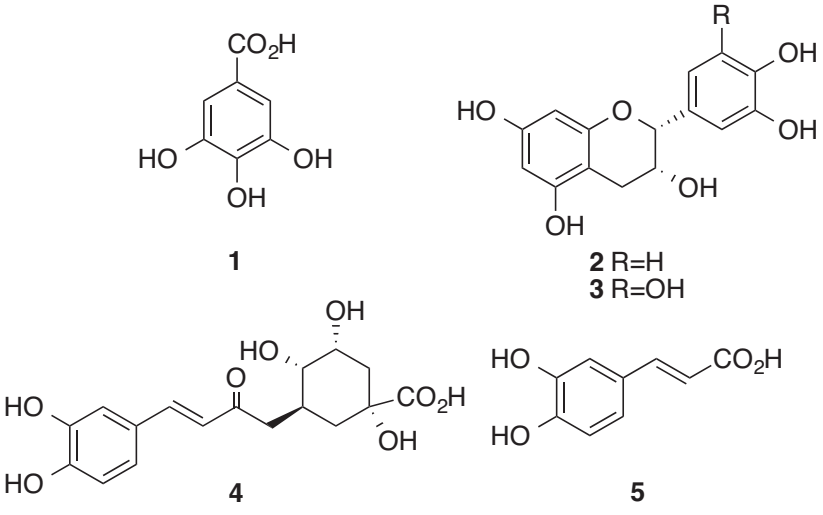
Persimmon is enriched with many nutritious and bioactive components including proteins, sugar, lipids, vitamin A, vitamin B6, vitamin B12, vitamin D, ascorbic acid (AA), vitamin E, polyphenols, flavonoids and carotenoids (Kim and Kim, 2003). Elemental micronutrients present in persimmon fruit include potassium, sodium, iron, calcium and many others. The fruit have been used as a key ingredients in some marketed cosmetic products including soaps, deodorizing and purifying body lotion, body wash, skin toner and body serum (Mirai Clinical, 2017). Different reviews have been published about reported pharmacological activities and phytoconstituents profile of various parts of this plant, with very limited or no emphasis on its potential use in dermatology and cosmetics (Piretti, 1991; Giordani et al., 2011; Xie et al., 2015). This review describes available data about potential utilization of different parts of *D. kaki* and its bioactive phytoconstituents in different dermatological and cosmeceutical applications.

## Phytochemicals of dermatological and cosmetics interest obtained from *Diospyros kaki*

### *Phenolic acids*

Phenolics (or phenolic acids) are widely distributed aromatic secondary metabolites in plant kingdom. They contain an aromatic hydrocarbon and one or more than one functional hydroxyl (or carboxylic acid) group attached to it. They can be categorized into simple phenols bearing one phenol unit or polyphenols having multiple phenol units in chemical structure. They perform a range of different functions in plants and human being including structural maintenance and protection against oxidative stress disorders such as coronary heart disease, stroke and cancer (Robbins, 2003). Phenolic acids are present in fruits, vegetables, seeds, grains, leaves, roots and stem (Robbins, 2003).

In a recent report 32 low molecular weight phenolics have been detected from the pulp of persimmon and most important ones include gallic acid (**1**) (its glycoside and acyl derivatives), glycosides of *p*-coumaric, vanillic and cinnamic acids and different flavone di-*C*-hexosides. Catechin ($5.81 \pm 0.12$ mg/100 g of dry sample: DW), epicatechin (**2**) ($0.61 \pm 0.023$ mg/100 g DW), epigallocatechin (**3**) ($0.28 \pm 0.02$ mg/100 g DW) chlorogenic acid (**4**) ($3.67 \pm 0.07$ mg/100 g DW), caffeic acid (**5**) ($2.83 \pm 0.07$ mg/100 g DW), and gallic acid ($19.11 \pm 0.61$ mg/100 g DW) were separated from ethanol extract of Mopan persimmon and their antioxidant activity was found to be higher than that of white apple, grapes, and tomato (Chen et al., 2008). Among these six phenolics (contributing not more than 20% of total phenolic), gallic acid showed highest antioxidant activity.




The other polyphenolics investigated from persimmon fruits include ferulic acid, tannic acid, protocatechuic acid, vanillic acid, epicatechin gallate and catechin gallate (Lee et al., 2012). These and other polyphenolic compounds have a potential role in prevention of oxidative stress damage by scavenging reactive oxygen species (ROS) (Fu et al., 2015; Zhou et al., 2016), prevention of lipid peroxidase (Toschi et al., 2000) and may be helpful in prevention of different skin pathological conditions. In another study different polyphenol have been separated from methanolic

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