



# A Review on the Phytochemical Composition and Biological Activities of *Argania spinosa* L. Skeels

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*Argania spinosa* L. Skeels, endemic tree of Morocco and Algeria, proves to be crucial for its diverse environmental adaptation, playing an essential ecological role in soil preservation and contributing significantly to the economy through wood, grazing, and the highly valued cosmetic oil. Despite its versatile use, the argan tree remains underexploited in Algeria, emphasizing the need for an initial exploration of its phenolic compounds. Polyphenols, known for their antioxidant properties, encompass compounds such as simple phenols, phenolic acids, coumarins, and flavonoids, highlighting their crucial role as plant antioxidants with aromatic and color properties.

The argan tree, thanks to its remarkable resistance to arid conditions, holds undeniable ecological value. Its powerful root system allows it to release water stored in the soil during the driest periods, providing a crucial alternative water source in regions characterized by limited precipitation. Although it is not demanding in surface water, its extensive roots allow it to draw water from deep layers during periods of intense drought, while showing a marked sensitivity to atmospheric humidity. In case of water stress, the leaves exhibit an increase in relative water content due to the gradual closure of stomata.

Ecologically, the argan tree plays a crucial role at the regional level. It effectively protects the soil against heavy rains and erosion, thereby contributing to maintaining soil fertility in arid conditions. This characteristic makes it a key element in regional ecological balances, emphasizing its importance in preserving local ecosystems.

The argan tree is highly resistant to heat and aridity, withstanding temperatures up to 50°C. Through its powerful root system, it maintains soil, sustains fertility, and protects against water and wind erosion that threaten soil desertification, especially in the south.

In Algeria, the argan tree is located west

of the Sahara in the hamada of Tindouf in the heart of the north-western Algerian Sahara [1], between the Hamadian gorges of the Drâa and the cliffs of K'reb El-Hamada, and the northern depression of Tindouf [2]. The distribution of populations was determined on the map in three hydrogeographic units: these are the perimeters: Touaref Bou-âam, Merkala, Targant. In the context of valorizing little-known endemic species in Algeria, used in traditional phytotherapy, this study synthesizes research on the phytochemical compounds and biological properties of *Argania spinosa*. The benefits of this plant, rich in fatty acids, extend to the prevention of diseases such as neurodegenerative disorders, menopausal complications, inflammations, heart diseases, and bone fractures. Locally, it is used in alternative medicine to treat skin conditions and is suitable for the production of cosmetic products [3].

## Phytochemical screening

Phytochemical analysis of *Argania spinosa* pulp powder shows the presence of chemical groups which in turn have interesting biological activities. These include alkaloids, flavonoids (such as anthocyanins, saponins, coumarins, sterols and triterpenes), tannic acid (catechins and gallic acid) and reducing sugars [4-6]. Potentially active chemical groups, such as polyphenols (such as two forms of tannin) and anthocyanins, may support the use of this plant in traditional medicine mainly due to their pharmacological properties. Therefore, due to its interesting biological activity, this plant has become the material of choice for enriching conventional medicines [4,5]. Three methods were used separately to extract phenolic compounds from *Argania spinosa* fruit parts: Extraction with n-hexane (Soxhlet) [7], Exposing the samples to nitrogen gas [4], a fresh mixture of acetone/water/formic acid [5], Extraction with methanol/water in an ultrasonic bath [6]. The four fractions were analyzed by high performance chromatography coupled with a mass spectrometer. Analysis of the

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n-Hexane extract revealed epicatechin as the major compound (4792mg/kg), followed by 4,4'-Dihydroxy-3,3'-imino-dibenzoic acid (2071mg/kg), procyanidin B2 (1463mg/kg) and procyanidin C1 (1250mg/kg) [6]. In the extracts exposed to nitrogen gas revealed the presence of Flavonoids, Hesperidin, Rhoifolin, Catechin, Peltatoside, Myricetin 3-O-galactoside, Rutin, Isoquercetin, Quercetin, Avicularin, Procyanidin B2, Quercetin 3-sophoroside, Gossypine, Prodelphinidin B4, were identified as the main constituents [4]. In organic solvent extracts revealed Protocatechuic acid as major compound Protocatechuic acid (21.1%), Flavonoids-O-rhamnoglucosides Isorhoifolin (7.2%), Flavonoids-O-glycosides Naringenin-7-O-glucoside (minority compound, (15.3%), Other Naringenin Compounds (0.07%)(5) Extraction with methanol/water in an ultrasonic bath to reveal the presence of Total Polyphenol Content (mg/g) Pulp:  $3.43 \pm 0.72$  mg/g, Almond:  $1.34 \pm 0.03$  mg/g [4] and the Total Flavonoid Content (mg/g), Pulp:  $9 \pm 0.5$  mg/g, Almond:  $2.83 \pm 0.14$  mg/g [6]. The endocarps of fruits also present various compounds, with high levels of phenols, flavonoids, and proanthocyanidins. Phytochemical screening of *Argania spinosa* endocarps identified the presence of various compounds, showing differences between immature and mature endocarps. Immature endocarps displayed high levels of phenols, flavonoids, and proanthocyanidins compared to mature endocarps. Antioxidant tests demonstrated a strong antioxidant potential in the methanolic extract of the endocarps, suggesting interesting applications in the fields of health and nutrition..

### Bioactive activities

The biological properties of *Argania spinosa* extend to the prevention of diseases such as neurodegenerative, menopausal complications, inflammation, heart disease and bone fractures. Locally, it is used in alternative medicine to treat skin conditions, and it is suitable for the production of products, recent studies suggest that dietary argan oil from the fruits could protect against atherosclerosis and improve lipid profiles plasma levels, paraoxonase activities and LDL peroxidation in healthy Moroccan men [13,8]. Studies in animal models have indicated the beneficial effect of argan oil in the treatment of hyperlipidemia and hypercholesterolemia [14,9]. Despite suggestive in vitro and animal evidence, the potential cardioprotective properties of argan oil have been the subject of very limited studies in humans [9,14]. Additionally, the In Vivo effects of argan oil have been demonstrated to improve surrogate markers of cardiovascular disease and regulate blood pressure, insulin resistance, and oxidative stress in laboratory animals [10,11]

In conclusion, this study highlights recent advances in

exploring the medicinal properties of *Argania spinosa*, emphasizing its potential as a therapeutic agent. Its abundance in polyphenols suggests that it could be a valuable source for the development of new drugs. However, further research is needed for a thorough characterization of active compounds and a detailed evaluation of their biological activities.

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