



ISSN (E): 2277-7695

ISSN (P): 2349-8242

NAAS Rating: 5.23

TPI 2023; 12(7): 746-749

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www.thepharmajournal.com

Received: 25-04-2023

Accepted: 28-05-2023

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Prosopis cineraria: Utilization in enhancing health benefits: A review

Ritvika Rajpurohit**Abstract**

Khejri (*Prosopis cineraria*) is a drought-resistant tree native to India and other dry places across the world. The plant *Prosopis cineraria* (L.) Druce (family Leguminosae, subfamily Mimosoideae) has several traditional medical uses. People's lives are impacted in social, ethnotechnical, traditional, and therapeutic ways by *P. cineraria*. The tree produces numerous products, including firewood, charcoal, gum, and medicines. Its wood is exploited for architecture, furniture, and agricultural equipment, while its pods are consumed as animal feed. One of the remarkable properties of khejri beans is their ability to preserve their nutritional content even after processing. This makes them excellent additions to foods that require long-term preservation, such as canned or packaged foods. Moreover, khejri is recognised for its medicinal properties. Traditional medicine employs the tree to cure a number of maladies, including digestive issues, skin disorders, and respiratory illnesses. The present review has studied the physicochemical features and bioactive potential of *Prosopis cineraria*. It has highlighted the myriad industrial applications, including the manufacture of fermented, non-fermented, and syrup-based beverages. Khejri is also utilised in making bakery products, which help enhance the shelf life and nutritional status of the product. Additionally, they create an amber-colored, water-soluble gum that builds a coating over time. Camels, cattle, sheep, and goats readily consume the leaves and pods as animal feed because of their high palatability and nutritional content. However, as the leaves contain 8–10% tannins, there is more scope and potential for the khejri, yet constraints like lack of awareness and not enough exposure have been the major drawbacks that are required to be addressed.

Keywords: Shelf life, sustainability, nutraceuticals, industrial applications, bioactive compounds

1. Introduction

Prosopis cineraria, which is also described as Jand, Khejri, and Ghaf, is one of the wonder crops and a state tree of Rajasthan, where the annual rainfall is very low, which is accompanied by low water availability and land conditions. *Prosopis cineraria* is a leguminous crop that can grow as a hardy wood stem tree. With wonderful properties ranging from improving soil fertility to having a nutritional status in pods, this plant grows in arid climatic conditions (Girase *et al.*, 2016) ^[10]. In the world scenario, these are mostly found in the Asian subcontinent, especially in countries such as Iran, Bahrain, Yemen, and India. Due to its traditional medicinal properties, it's used to treat diseases such as leprosy, asthma, dysentery, etc. (Goyal & Sharma, 2009) ^[11]. It consists of a compact combination of alcohols, steroids, etc. (Vaza *et al.*, 2018) ^[19]. *P. cineraria* has a high mineral content and is an important source in bone-dry and semi-dry locales. It has the capability to tolerate dry, salty, and alkaline conditions, which are persistent in arid conditions. Seeds for this tree are enclosed in the pods, which are known as sangria. It has multiple uses, such as in the processing of flour, beverages, and gum; as feed for animals; and as a vegetable (Kumar *et al.*, 2023) ^[14]. The reproductive stage (i.e., flowering) occurs in the March to May months. As the tree is a leguminous plant, it helps in enhancing the soil fertility status as well as developing the soil's ecological balance (Afifi *et al.*, 2019) ^[18]. *Prosopis cineraria* belongs to the evergreen tree category, with slight foliage and spines of cone shape to cope with the high transpiration rate in arid regions. Bipinnate types of leaves are present, and the flowers are yellow. Pods are torulose with a coriaceous exocarp, and the pods are generally elongated with 10–15 seeds present in the seed capsules (pods), where the outer part of the seed, which is also called the testa, is rough with a brown, earthy colour (Girase *et al.*, 2016) ^[10]. *Prosopis cineraria* is a mix of flavonoids, alkaloids, diketones, phenolic contents, vitamins such as Vitamin A, B, C, and D, and lipids; all these mixtures jointly constitute the therapeutic properties of *Prosopis cineraria* (Vyas *et al.*, 2020) ^[21]. A mixture of flowers is used to avoid miscarriage during the

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conceiving process. The bark of the tree has medicinal properties that can boost immunity against the common cold, asthma, and dysentery. Ash from wood can be a good source of protein (Sobhy Amin Afifi & Abu Al-rub, 2019) [18]. *P. cineraria* can be used to enhance the nutritional status of soil, prevent soil wind erosion, and maintain ecological balance among soil microbes. Promote soil water holding capacity (Bhatta *et al.*, 2002) [3]. *P. cineraria* can be utilised as a vegetable, especially unripe pods for curry and pickle making (Liu *et al.*, 2012). The flour of pods can be used for curry and pickle making. The gum of the tree can be utilised as mesquite gum. Pods consist of protein content of around 7 to 22% as well as fibre content of 30%. Flour made from the pods can be utilised for baking treats (Sobhy Amin Afifi & Abu Al-rub, 2019) [18]. *P. cineraria* consists of tannins (gallic acids), flavones, and alkaloids, which can be utilised as antipyretics and pain-relieving, antioxidant, antitumor, it consists of anti-microbial properties as well as boots immunity, Has 16.5 to 18.5 % protein content which can be effectively utilized in elimination of malnutrition (Velmurugan & Ganesan, 2012).

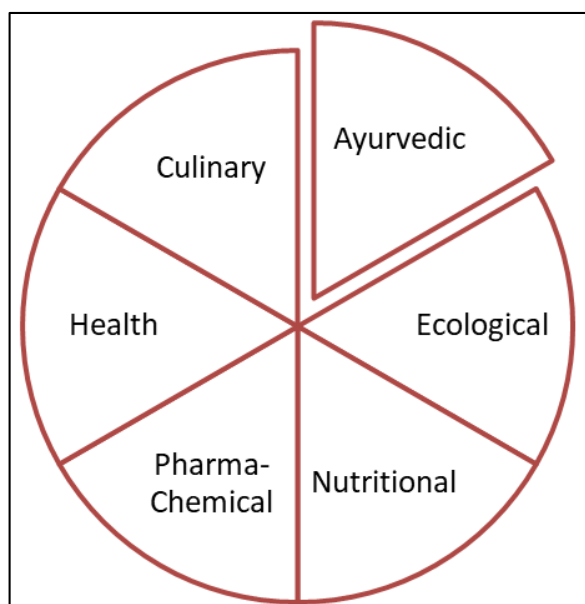
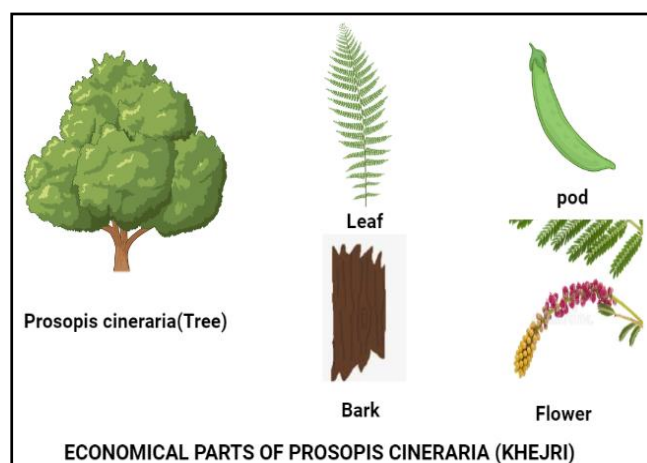


Fig 1: Various Perspectives of *Prosopis cineraria* in daily life.

P. cineraria is a good source of anti-microbial capabilities because of the presence of phytochemicals such as saponins, glycosides, and phenolic compounds (Cattaneo *et al.*, 2016) [5]. The dark substance that is extracted from *P. cineraria* has the capability to lower sugar levels by 27.3% and has also proven to significantly decrease body weight in mice (Bhatta *et al.*, 2002) [3]. Around seventy percent of the hydroalcoholic bark dose has reduced around 88% of cholesterol, which is assisted by around 95% of triglycerides and 60% of ischemic indices (Malik *et al.*, 2013) [16]. Due to the presence of flavonoids and tannins, hydroalcoholic extracts of leaves and bark were found to be effective against the control of Ehrlich's ascites carcinoma tumour mode (Asati *et al.*, 2021) [2]. The presence of piperidine alkaloids makes it toxic, which shows adverse symptoms when consumed in high amounts. However, 50% hydroalcoholic extracts did not show any effect on breathing, behavior, or sensory nerves in mice (Dashora *et al.*, 2011) [7]. Alkaloids aid in being a good anaesthetic as well as having spasmolytic activity. Boosting

immunity is achieved by the presence of saponin, and anthelmintic activity is produced by tannins. Additionally, the presence of magnesium, iron, calcium, and phosphorous can contribute to overall health benefits. (Joshi *et al.*, 2023) [13]. Pods are used as a vegetable; tender pods are eaten raw and also dried and utilised for flour purposes; the sweet pulp surrounded by the seed is utilised for flour and to make cakes; mature pods are also utilised in cookies and local dish preparations. The bark of the tree is utilised for the purpose of cooking for normal consumption as well as for the purpose of baking bread cookies (Garg & Mittal, 2013) [9].



2. Discussion

2.1 Nutritional properties

As *Prosopis cineraria* is one of the tree which is infused with various essential nutritions ranging from carbohydrates which are the building blocks of cellulose, protein, assisting in the chemical reactions, to foam DNA, Triglycerides termed as fats useful for storage of energy, fibre which is a cellulose substance. These are the few important nutritional properties possessed by khejri pod.

2.1.1. Carbohydrates

Generally, carbohydrate means sugar or the substance that is rich in complex carbohydrate starch, which is the majority of rich starch substances (Asati *et al.*, 2022) [1]. There are various types of carbohydrates depending on the degree of polymerization, i.e., monosaccharides, oligosaccharides, and polysaccharides (Meena *et al.*, 2022) [17]. Carbohydrates are the essential part of cellulose, which is an important component of the cell wall of plants and animals. In animals, they are in the foam of glycogen, and they are also one of the main constituents of ribose, a component of RNA. In the context of Khejri, leaves are one of the major sources of green fodder for cattle, goats, etc., giving the essential nutrients, including pods, Where pods produced by this tree are around 2 to 5 kg annually, galactose and mannose are the major foams of carbohydrates, while glucose and arabinose types of carbohydrates are present in the minor foams. Whereas in seed endosperm, galactomannan is the chief polysaccharide (85% w/w of galactose in addition to mannose) (Zhong *et al.*, 2022) [23]. Khejri gum, which is the secondary constituent and secondary metabolite of *Prosopis* tree, is a complex substance that contains a combined foam of carbohydrates such as D-galactose, L-arabinose, D-glucuronate, D-mannose, etc. But its lack of L-rhamnose makes it inferior to Arabic gum. However, khejri has a huge potential role among the

nutritional grounds (Janbaz *et al.*, 2012) [12].

2.1.2. Protein

They are biomolecules, which are generally macromolecules containing a series of amino acids. Proteins are the primary structural components of all cells, play a crucial role in gene expression and immunological regulation, and catalyse all chemical events that occur in the body. In Khjeri, protein is one of the important nutrition elements, with around 9–15% of protein in the pod. *Prosopis cineraria* pods are known to avoid protein and mineral deficiency in Punjab (Yadav *et al.*, 2018) [22]. Khjeri as a vegetable contains 16.5 to 18.5% of protein content, which is a higher amount when compared to the well-known healthy source of protein, i.e., cereals with 10–15% (Sobhy Amin Afifi & Abu Al-rub, 2019) [18]. Apart from the protein, the pods also provide a slight amount of hydration to the dry zone animals in the months of high temperatures, especially April to May. Yet, being a potential source of protein, the khjeri is the most underutilised protein source that is easily available (Chandra & Mali, 2014) [6].

2.1.3. Fat

Fat can be described as the ester of fatty acids; generally, triglycerides are considered the fatty acids (Asati *et al.*, 2022) [1]. Fats are one of the primary constituents that are necessary for the sake of normal well-being because, during the digestion process, especially in animals, the fats are disintegrated into glycerol and fatty acids, which are then further metabolised by the lipase enzyme. As already discussed, the pod of the khejri tree (sangria) aids in weight loss. Sangri pods are an ideal aid for an overweight diet plan from a nutritional perspective. The pods of Khjeri contain a low amount of fat (0.328 to 2.30%), and nutritional analysis for fat content can be carried out using petroleum ether as solvent (Gangal *et al.*, 2009) [8]. Generally, the Soxhlet extraction method is the most preferred method of crude fat extraction. In a similar way, seeds are rich in essential fatty acids such as linoleic and oleic acids. In *P. cineraria* seed oil, 10.6 percent is composed of fatty esters, 28.6 percent is composed of fatty esters, 68.3 percent is composed of unsaturated fatty esters, and 3.1% is composed of methyl hydroxy fatty esters (Zhong *et al.*, 2022) [23]. In addition to linoleic acid, the seed oil is also high in oleic acid (31.3%). (32.1%). There is no indication of trans-unsaturation or the existence of keto, cyclopropenoid, or epoxy fatty acids in the oil or seeds of *Prosopis cineraria*. In a study (Sobhy Amin Afifi & Abu Al-rub, 2019) [18],

2.1.4. Fiber

Fiber in sangria is simply the arrangement of cellulose, often comprised of lignin, especially in Khejri. Fiber is one of the major components, as it's a woody, medium-trunk plant that contributes to wood fiber, and in normal terms, this wood can be used as a source of firewood (Goyal & Sharma, 2009) [11]. In nutrition's prospective Sangri contain dietary fiber, which accounts for 30% of the pods, pulp, and its water insoluble components. Neutral polysaccharides are a major component of this fibre (Bigne *et al.*, 2016) [4]. Dietary fibre from this tree has proved useful for the indigestibility issue concerned with the small intestine. Crude fibre in sangri pods ranges from 2.5 to 5%. More innovative uses and analyses are yet to be carried out on sangria content (Yadav *et al.*, 2018) [22].

Table 1: Nutritional properties of prosopis pod (sangria) flour (Cattaneo *et al.*, 2016) [5].

Compounds (kcal/100g)	Sangria flour
Carbohydrates	69.2
Total free sugar	13
Fat	2.12
Fiber	47
Protein	16.2
Energy	361

3. Conclusion

Khejri is a multipurpose tree species that is essential for the sustained development of dry environments. Because of its ecological, economic, and cultural value, its preservation and sustainable management are essential. This necessitates the implementation of suitable regulations and management measures, as well as the participation of local communities in conservation and restoration efforts. Despite its considerable ecological and economic advantages, khejri is threatened by overgrazing, deforestation, and soil degradation. In addition, the rising demand for khejri goods is resulting in the species' overexploitation, which is reason for worry. In conclusion, khejri is a very nutritious and adaptable tree that has been used for millennia for both culinary and medicinal purposes. It is a suitable component for use in a broad variety of goods due to its extensive root system and ability to keep its nutritional content after processing.

4. Acknowledgement

We acknowledge all the efforts the authors and Lovely Professional University faculty, in guiding throughout the process and helpful in completion of this review paper.

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