

# NUTRACEUTICAL VALUE AND THERAPEUTIC APPLICATIONS OF INDIAN HERITAGE FRUITS: A REVIEW

## Abstract

This review delves into the nutraceutical value and therapeutic uses of bael, woodapple, aonla, ber, and karonda fruits, revered for their medicinal properties across traditional medicine systems. Enriched with essential nutrients and bioactive compounds like phenolics, flavonoids, and alkaloids, they offer diverse health benefits, including immune support and digestive health enhancement. Through a meticulous analysis of scientific literature, the review underscores their potential in preventive and holistic healthcare. By acknowledging and leveraging their nutraceutical and therapeutic potentials, individuals and communities can endeavor towards improved health and well-being.

**Keywords:** Fruits, nutritional profile, bioactive compounds, therapeutic values, health benefits

## 1. Introduction

The increased demand for natural products and plant-based medicine highlights the importance of nutraceuticals that offer health benefits beyond basic nutrition. Among these, underutilized fruits play a vital role due to their abundance of essential nutrients and bioactive compounds. India, with its rich biodiversity, has a wide range of heritage fruits that have been used in traditional medicine and dietary practices.

Underutilized fruits provide vital food, vitamins, and minerals, alongside contributing to livelihoods due to their medicinal properties (Das, 2021). Despite being used in local medicine, many of these fruits lack domestication and human selection efforts, restricting their cultivation mainly to the wild. Underutilized crops, although less explored in terms of promotion and research, thrive in diverse and challenging conditions. Their importance varies across different crops and regions but can be significantly enhanced through increased awareness. With a rich history of usage, underutilized wild edible plants are increasingly recognized for their high nutritional value, as evidenced by ongoing global research efforts (Kour et al., 2018).

India is the origin of several underutilized fruits, many of which possess remarkable medicinal and therapeutic properties. This review delves into a selection of these indigenous fruits, examining their nutritional profiles, bioactive compounds, and diverse health benefits. By highlighting the medicinal and therapeutic potential of these fruits, this review underscores their significance in both traditional and modern healthcare practices.

Bael, renowned for its efficacy in treating digestive disorders, is abundant in vitamins and phenolic compounds, offering a broad spectrum of health benefits (Venthodika et al., 2021). Wood apple, distinguished by its unique flavor and nutritional composition, has traditionally been used to manage diabetes and support liver health (Sharma et al., 2024). Aonla, also known as Indian Gooseberry, is acclaimed for its high vitamin C content and strong antioxidant properties, making it exceptionally effective in enhancing immunity and preventing chronic diseases (Sharma, 2022). Ber, or Indian Jujube, is rich in vitamins and minerals and is esteemed for its anti-inflammatory and hepatoprotective properties (Sharma et al., 2019). Finally, Karonda is acknowledged for its antimicrobial and cardioprotective benefits, which are attributed to its diverse phytochemical profile (Maurya and Kumar., 2023).

This review aims to consolidate the current knowledge on the nutritional and bioactive composition of these fruits, their traditional and modern therapeutic applications, and the underlying mechanisms of their health benefits. By doing so, it seeks to underscore the potential of these heritage fruits as nutraceuticals and their role in promoting health and wellness in contemporary society.

## **2. Nutraceutical Potential of Indigenous Fruits**

### **2.1 Bael**

The bael tree, deeply rooted in Indian history and mythology, has long been recognized for its therapeutic value in traditional medicine. Modern research confirms its effectiveness, attributing to its antioxidant, and antimicrobial properties. Bael addresses various health concerns including gastrointestinal, and cardiac issues, while also exhibiting hepatoprotective, radioprotective, anti-diabetic, and wound-healing properties (Singh *et al.*, 2020).

The subtropical fruit *Aegle marmelos* L., commonly referred to as Bael is a member of the Rutaceae family. The sacred Tripatra tree's leaves are vital in offerings to Lord Shiva. Its root, bark, leaf, flower, and fruit find diverse uses. While wild fruits are smaller and less commercial, cultivars like Kagzi Gonda, Gonda no 1, Gonda no 2, Kagzi Etawah, Mirzapuri, and Baghel are cultivated. (Sharma et al. 2007). Research on bael fruit indicates its rich nutritional composition, encompassing a diverse array of phytochemicals such as phenolic acids, flavonoids, alkaloids, tannins, and coumarins. Additionally, bael contains amino acids, fatty acids, various organic acids, minerals, carbohydrates, vitamins, and fibers, rendering it a highly nutritious fruit with significant health advantages (Bhardwaj,2014). Table 1 indicates the medicinal properties of bael.

**Table 1:** Medicinal properties of bael (Chhetri., 2021)

| Parts of Bael  | Bioactive Compounds | Medicinal Properties and Therapeutic Properties     | Reference   |
|----------------|---------------------|---|---|
| Fruits         | Marmelosin          | Anthelmintic and antibacterial activity             | Badam <i>et al.</i> 2002, Rastogi and Mehrotra 1998; Ghosh and Playford 2003, Shoba and Thomas 2001 |
|                | Auraptin            | Treatment of hypertension                           | Rastogi and Mehrotra 1998   |
|                | Psoralean           | Antispasmodic                                       | Hansel <i>et al.</i> 1994   |
|                | Tannin              | Diarrhoea   | Shoba and Thomas 2001   |
| Roots and Bark | Fagarine            | Abortifacient property                              | Takase <i>et al.</i> 1994, Duke <i>et al.</i> 1992  |
|                | Marmin              | Antiulcer activity                                  | Takase <i>et al.</i> 1994   |
| Leaves         | Cuminaldehyde       | Antifungal, antibacterial and anticancer properties | Gurjar <i>et al.</i> , 2015; Rahman and Pravin., 2014<br>Maity <i>et al.</i> , 2009                 |

## 2.2 Wood apple (Thakur *et al.*, 2020)

The botanical name of the Wood apple is *Feronia limonia* Groff belongs to the Rutaceae family. The native of wood apple is India. The other names of wood apple are elephant apple; monkey fruit; curd fruit and kathbel. The tree is small to medium size, deciduous with thorny branches, hardy in nature and can withstand salt and drought (Troup., 1921). The fruit type is Amphisarca which is a hard shelled berry and fruit has sweet aromatic edible pulp (Meena *et al.*, 2022). The processed products of wood apple are powder, jam, RTS, pickle, candy, preserve, squash, toffee and wine (Vidhya and Narain., 2011). The medicinal uses of wood apple fruit includes several treatments such as cardiac tonic, Sore throat, peptic ulcer, tumors, hepatitis, asthma, diarrhoea, liver problems and blood purification. Wood apple leaves are used

to cure diarrhoea, dysentery, breast cancer, uterus cancer, respiratory disorders, Carminative and Hepatoprotective activity. The bark is used to cure venomous wounds, constipation, diarrhoea and Haemorrhage (Bagul et al., 2019; Dhakar et al., 2019; Parvez & Sarker, 2021). Table 2 and 3 indicates chemical composition and pharmacological activities of wood apple.

**Table 2:** Chemical composition of Wood Apple (Pal et al., 2019; Thakur et al., 2020)

| Characters        | Composition  |
|-------------------|--------------|
| Moisture (%)      | 72.00 ± 2.04 |
| Protein (%)       | 7.14 ± 0.24  |
| Fat (%)           | 1.45 ± 0.09  |
| Carbohydrates (%) | 7.24 ± 0.12  |
| Ash (%)           | 4.98 ± 0.02  |
| Calcium (%)       | 0.12 ± 0.07  |
| Phosphorus (%)    | 0.07 ± 0.002 |
| Iron (%)          | 1.0 ± 0.03   |

**Table 3:** Pharmacological activities of Wood Apple

| Part          | Pharmacological activities | Reference   |
|---------------|----------------------------|---|
| Fruit         | Anti-tumor activity        | Saima et al. (2000); (Haque et al., 2000)         |
| Fruit         | Anti-diabetic activity     | Gupta et al. (2009); Priya et al., 2012           |
| Fruit pulp    | Wound healing property     | Senthilkumar et al., 2010; Wakchoure et al., 2023 |
| Leaves        | Anti-microbial activity    | Bellah et al., 2015; Kumar et al. (2010)          |
| Seeds         | Anti-microbial activity    | Sonawane et al., 2013                             |
| Root and bark | Hepatoprotective activity  | Jain et al., 2012                                 |
| Fruit         | Antioxidant activity       | Phapale and Thakur, 2010                          |
|               | Neuroprotective activity   | Rakhunde et al. (2014)                            |

### 2.3 Aonla (Diwan et al., 2018)

Aonla, also known as Indian gooseberry (*Emblca officinalis* Gaertn.), is a member of the Euphorbiaceae family, revered for its medicinal properties since ancient times in India. This indigenous fruit of the Indian subcontinent is widely utilized in the Indian System of Medicine.

Aonla fruits are characterized by their round shape, ribbed texture, and pale green color. The fruit's surface is shiny, divided into six segments by pale liner grooves, and varies in size from small marble to large plum. Despite its nutritional value, the raw fruit's high acidity and astringent taste make it unpalatable to consumers (Singh et al., 2019). Aonla, also known as Amla, Adiphal, Amlaki, and Nelli in various languages, is commonly grown in arid zones and saline soils. It is a major component of traditional medicines like Chyawanprash. The fruit is rich in vitamin C (600 mg/100g) and possesses various medicinal properties. Fresh fruit is used to treat dysentery, fevers, indigestion, and eye inflammation. Dried fruit acts as an astringent, stomachic, and blood purifier, beneficial for diarrhea, dysentery, and anemia. A decoction of dried fruits is effective for gonorrhoea, and when combined with iron, it treats jaundice and dysentery. Aonla seeds are infused for fever, diabetes, and eye diseases, while the oil extracted from seeds treats dandruff and darkens hair. The smoke from burning seeds is inhaled to relieve asthma and bronchitis. Overall, aonla fruit and seeds offer diverse therapeutic benefits for various ailments (Kumar, 2011). Table 4 indicates the medicinal uses of aonla.

**Table 4:** Medicinal uses of aonla

| Part          | Medicinal uses                         | Reference   |
|---------------|--|---|
| Fruit extract | Cancer treatment                       | Alam and Gomes, 2003                                    |
|               | Diabetics treatment                    | Suryanarayan <i>et al.</i> , 2007                       |
|               | Immunomodulation                       | Sai, <i>et al.</i> , 2002                               |
|               | Memory enhancer                        | Vasudevan and Parle, 2007                               |
|               | Cholesterol and Dyslipidemia treatment | Kim <i>et al.</i> , 2005; Anila and Vijayalakshmi, 2002 |
|               | Snake venom neutralizer                | Alam and Gomes, 2003                                    |
|               | Antimicrobial activity                 | Srikumar <i>et al.</i> , 2007                           |
|               | Antigenotoxicity                       | Srikumar <i>et al.</i> , 2007                           |
|               | Antimutagenicity                       | Singh <i>et al.</i> , 2008                              |

## 2.4 Ber

The ber (*Zizyphus jujuba* Lam) tree, a thorny small tree native to India, has been cultivated since ancient times for its highly nutritious fruits, rich in vitamin C, A, and B12, with almost all parts possessing medicinal properties. The roots are bitter, cooling, and tonic, beneficial for cough, fever, wounds, and ulcers, while stem bark treats dysentery, diarrhea, and boils. Leaves are used for various ailments including stomatitis, wounds, asthma, and obesity,

and boiled leaves are applied to promote suppuration in boils and abscesses. Fruits are sour, sweet, and cooling, beneficial for digestive issues, constipation, and wounds. Seeds, acrid and soporific, are used for encephalopathy, cough, and insomnia, with kernels applied as a liniment for rheumatism (Kumar, 2011). Table 5 indicates the medicinal uses of ber.

**Table 5:** Medicinal uses of ber

| Part  | Medicinal and therapeutic properties | Reference                   |
|-------|--------------------------------------|-----------------------------|
| Fruit | Anticancer property                  | Lee <i>et al.</i> , 2003    |
|       | Antidiabetics property               | Jarald <i>et al.</i> , 2009 |
|       | Hepatoprotective                     | Dahiru <i>et al.</i> , 2010 |
|       | Antimicrobial Activity               | Tanvir <i>et al.</i> 2014   |
|       | Anti-inflammatory Effect             | Huang <i>et al.</i> , 1990  |
|       | Antispastic Effect                   | Huang <i>et al.</i> , 1990  |
|       | Antiallergic                         | Su <i>et al.</i> , 2000     |

## 2.5 Karonda

Karonda (*Carissa carandas L*) is an underutilized fruit belongs to Apocyanaceae (Wiert, 2006) which is commonly known as Christ thorn and it is an evergreen spiny shrub. The native of karonda is Indo-Malaysia. It is suitable for tropical and subtropical climate. *Carissa carandas*; *Carissa grandiflora*; *Carissa ovata*; *Carissa grandiflora*; *Carissa edulis*; *Carissa macrophylla*; *Carissa spinarum*; *Carissa bispinosa*; *Carissa diffusa* are the cultivated species of Karonda (Pareek and Sharma, 1993; Singh and Arora, 1978). Flowers are white in colour and the fruit type is berry. Flowering takes place in March-April and fruiting occurs in October-November. Unripe fruits are white in colour and ripe fruits are purplish in colour (Muhammad., 2016). Karonda is rich source of Iron (39.1%) and used to cure anaemia (Kumar et al., 2007; Saha et al., 2010). It is also used to cure malaria, head ache, cold, cough, leprosy, nervous disorders and myopatic spasms (Hasmah., 2013). Karonda is sexually propagated by seeds and asexual propagation through cuttings, air layering and inarching. The value-added products prepared from karonda are curries, condiments, jam, syrup and squash. Fruits contain high amount of pectin and is suitable for jelly making (Kumar et al., 2007). The varieties of karonda include Pant Manohar, Pant Suvarna and Pant Sudarshan released by **GBPUA&T (Govind Ballabh Pant University of Agriculture and Technology), Pantnagar; Thar Komal released by CIAH, Ghodhra (Central Institute for Arid Horticulture) (Singh *et al.*, 2013); Maru**

Gaurav released by ICAR-CAZRI (Central Arid Zone Research Institute), Jodhpur (Singh & Nigam., 2022). Table 6 & 7 indicates the medicinal properties of karonda and extraction methods.

**Table 6:** Bioactive compounds and medicinal properties of Karanda

| Parts of Karonda | Bioactive compounds            | Medicinal properties and therapeutic properties                | Reference   |
|------------------|--------------------------------|--|---|
| Root             | Carrissone and caridone        | Antibacterial property   | Lindsay et al., 2000<br><i>Panda et al., 2014</i>   |
|                  | Urosolic acid and methyl ester | Anticancer activity and cardioprotective compound              | Liobikas et al., 2011;<br>Pathak et al., 2007;<br>Shishodia et al., 2003<br><i>Panda et al., 2014</i> |
| Leaf             | Oleanolic acid                 | Anti-inflammatory and antihyperlipidemic properties            | Liu, 1995, <i>Panda et al., 2014</i>  |
| Wood and bark    | Carindone                      | Antibacterial activity   | Lindsay et al., 2000  |
| Fruit            | Linalool                       | Antimicrobial effect   | Park et al., 2012   |
|                  | Coumarin                       | Anti-HIC, Anti-tumor, Anti-hypertension, and Anti-inflammatory | Pino et al., 2004; Singh and Rastogi, 1972; Reisch et al., 1990, Liu, 2011, Pal et al., 1975;         |

**Table 7:** Medicinal properties of Karanda (Muhammad Arif *et al.*, 2016)

| Part used                         | Bioactive compounds<br>extraction method | Medicinal property                                       | Reference                                     |
|-----------------------------------|--|--|---|
| Karonda<br>leaves                 | Methanolic extraction                    | Anti- inflammatory and anti-<br>pyretic                  | Hati et al., 2014;<br>Anupama et al.,<br>2014 |
| Fruit                             | Chloroform, n- hexane<br>and methanol    | Anti- cancer property                                    | Sulaiman., 2014                               |
| Fruit                             | Solvent petroleum ether<br>extract       | Anthelmintic activity                                    | Mishra., 2012                                 |
| Fruits                            | Ethanolic extract                        | Antiviral activity and<br>antimicrobial activity         | Taylor., 1996                                 |
| Leaves                            | Aqueous extract                          | Anti-diabetic property                                   | Jigna et al., 2005                            |
| Roots                             | Ethanolic extract                        | Hepatoprotective activity and<br>cardiovascular activity | Hedge and Joshi.,<br>2009                     |
| Leaf, stem,<br>bark and<br>fruits | Methanolic and aqueous<br>extract        | Anti-malarial activity                                   | Bapna et al., 2013                            |

### 3. Conclusion

In essence, bael, woodapple, aonla, ber, and karonda represent a reservoir of natural resources, offering a diverse spectrum of nutraceutical benefits and therapeutic applications. Their extensive nutritional profiles and bioactive constituents, such as phenolics, flavonoids, and alkaloids, underscore their profound significance in preventive and holistic healthcare. As ongoing scientific investigations delve deeper into their latent potentials, incorporating these fruits into dietary and wellness regimens holds promise for cultivating robust health and vitality. Embracing and harnessing the nutraceutical and therapeutic attributes of these fruits can substantially contribute to the advancement of comprehensive health and well-being, both at the individual and societal levels.

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