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Wood Apple as a Functional Food: Nutritional Significance and Therapeutic Potential

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Wood apple (*Aegle marmelos*), commonly known as bael, is a tropical fruit widely grown in India and other parts of South Asia. It belongs to the Rutaceae family and is well known for its hard outer shell and aromatic, nutritious pulp. The tree is highly drought-resistant and can grow in dry and harsh climatic conditions, making it suitable for regions like Maharashtra. Traditionally, wood apple has been used in Ayurvedic medicine for treating digestive disorders, especially problems like diarrhea, constipation, and indigestion. The fruit is rich in vitamins, minerals, dietary fiber, and bioactive compounds, which provide several health benefits. Despite its nutritional and medicinal importance, wood apple is still underutilized in modern food processing industries. With increasing awareness about healthy and functional foods, it has great potential for use in value-added products, nutraceuticals, and innovative food technologies. Therefore, wood apple is gaining attention as an important fruit for research and industrial applications.

Commercial varieties

Variety Name	Taste/Flavor	Pulp Content & Texture
Kagzi (Thin-skinned)	Sweet & aromatic	High pulp, less fibrous
Desi (Indian Local)	Slightly sour	Medium pulp, fibrous
Goma	Mildly sweet	Medium pulp, moderately fibrous
Pant Aparna	Sweet	High pulp, less fibrous
Bangalore Local	Sweet-sour	Medium pulp, fibrous

Medicinal uses and health benefits

Wood apple (*Aegle marmelos*) is a nutrient-rich fruit renowned for its wide range of medicinal uses and health benefits. It is especially valued for digestive health, as its pulp acts as a natural laxative, helping to relieve constipation, diarrhea, and indigestion. Packed with antioxidants, vitamins C and A, and essential minerals, wood apple plays a crucial role in boosting immunity and supporting liver function by aiding detoxification. It also contributes to blood sugar regulation, making it beneficial for diabetic patients, and its potassium content helps maintain healthy blood pressure, promoting cardiovascular health. Traditionally, it has been used to treat respiratory

issues like coughs, asthma, and common colds, while its anti-inflammatory properties help alleviate fever, body aches, and joint pain. The fruit's high dietary fiber content supports weight management by increasing satiety, and its antioxidant-rich composition helps maintain healthy, youthful skin. Wood apple can be consumed in various forms such as fresh pulp, juice, or powdered form, making it a versatile and powerful natural remedy in both traditional medicine and modern wellness practices.

Nutritional composition

Nutrient	Amount per 100 g
Energy	150 kcal
Carbohydrates	35 g
Dietary Fiber	5 g
Protein	1.8 g
Fat	0.6 g
Calcium	140 mg
Phosphorus	60 mg
Iron	2.5 mg
Vitamin C	60 mg
Vitamin A	15 µg
Thiamine (B1)	0.05 mg
Riboflavin (B2)	0.06 mg
Niacin (B3)	0.9 mg
Potassium	700 mg
Sodium	10 mg
Magnesium	30 mg

Functional properties

The fruit contains pectin, which is widely used as a gelling agent in food industries. Its fiber and pectin content make it suitable for developing low-calorie and digestive-friendly foods. It is rich in bioactive compounds that provide various health benefits. Marmelosin – exhibits antimicrobial and anti-inflammatory properties; Tannins – useful in treating diarrhea and dysentery; Flavonoids – act as antioxidants, reducing oxidative stress; Alkaloids and phenolic compounds – contribute to therapeutic effects. These assist in treatment of gastrointestinal disorders, Anti-diabetic and anti-inflammatory effects, Potential use in cancer prevention due to antioxidant activity. It is also used as a raw material for Medicinal and Nutraceutical Products like Herbal Teas – Leaves and dried pulp can be used to make immunity-boosting teas; Ayurvedic Formulations Traditional medicine uses wood apple for digestive, liver, and respiratory health. Powders and Capsules – Dried pulp can be processed into capsules for digestive health.

Value addition of Wood apple

The first step in value addition is processing the fruit into pulp by breaking the hard shell and extracting the edible portion. This pulp can then be used to prepare different products such as beverages (like ready-to-serve drinks, squash, and nectar), jams, jellies, chutneys, and syrups. These products are easier to consume, have better taste appeal, and extended shelf life. Further value-added products include dehydrated forms such as wood apple powder, candies, and fruit bars. Drying or dehydration reduces moisture content, which helps prevent spoilage.

The process of value addition involves cleaning, pulp extraction, preservation, and product formulation.

Conventional methods, while effective, often face challenges related to quality consistency, microbial contamination, and nutrient loss. This is where emerging technologies play a transformative role. Advanced food processing techniques such as high-pressure processing (HPP), pulsed electric fields (PEF), and freeze drying help retain the fruit's natural flavor, colour, and nutritional value while extending shelf life. Biotechnological approaches also offer promising avenues for value addition. Enzyme-assisted extraction techniques can improve pulp yield and processing efficiency, while fermentation technology can be used to develop novel probiotic beverages from wood apple. Such products not only diversify the market but also cater to the growing consumer demand for functional and health-promoting foods.

Conclusion

Wood apple stands out as a promising functional food due to its rich nutritional profile and diverse health benefits. Its antioxidant, antimicrobial, and digestive properties make it valuable in promoting overall well-being and preventing various lifestyle-related diseases. Despite being underutilized, increased awareness, scientific validation, and value-added product development can enhance its acceptance among consumers. By integrating traditional uses with modern food technologies, wood apple has the potential to play a significant role in the functional food sector while also supporting sustainable agriculture and rural livelihoods.