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Jackfruit: From Neglected Crop to Nutritious Superfood

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Jackfruit (*Artocarpus heterophyllus* Lam.), a native tree species of the Western Ghats, India, is globally recognized as the largest tree-borne fruit and has recently been spotlighted as a potential superfood. Once underutilized and overlooked due to its bulkiness and strong aroma, jackfruit is gaining international acclaim for its exceptional nutritional content, therapeutic benefits, culinary flexibility, and potential for addressing food security in the face of climate change. This review article presents an exhaustive exploration of jackfruit's botanical characteristics, nutrient profile, phytochemical composition, health-promoting properties, traditional and industrial applications, economic significance, ecological adaptability, and future prospects. Emphasis is also laid on its transformation from a neglected tropical fruit to a key player in the global health food market, highlighting both opportunities and existing challenges.

Introduction

The increasing prevalence of diet-related diseases and the urgency of climate adaptation have shifted global focus toward nutrient-dense, environmentally resilient crops. Among such candidates, jackfruit emerges as a promising solution. Cultivated widely across South and Southeast Asia, jackfruit has been a staple food source for millennia, yet lacked the market appeal and research investment seen in other tropical fruits like mango or banana. With the advent of plant-based food movements, jackfruit's fibrous texture and meat-like consistency in its unripe form have captured the imagination of food innovators and health enthusiasts alike. As consumers in Western countries look for sustainable and healthy alternatives to animal-based foods, jackfruit has begun to appear in mainstream supermarkets, vegan restaurants, and food technology research centers. This paradigm shift from cultural staple to global superfood has been facilitated by emerging scientific studies and governmental initiatives aimed at tapping the plant's potential. Moreover, jackfruit plays a critical role in local cultures and traditional practices. It features prominently in regional cuisines, rituals, and folklore. The fruit's ability to feed large families in food-scarce seasons has granted it the moniker "famine food" in many rural communities. However, with evolving dietary trends and urban migration, its consumption declined, relegating it to rural backyards. The current rediscovery of its nutritional and ecological significance opens avenues for both cultural revival and economic upliftment.

Botanical Overview

Taxonomy and Classification

- Kingdom: Plantae
- Order: Rosales

- **Family:** Moraceae
- **Genus:** *Artocarpus*
- **Species:** *Artocarpus heterophyllus* Lam.

Morphological Features Jackfruit trees are massive, perennial, and monoecious, bearing both male and female inflorescences. Flowers are borne on short, thick branches and trunks (a phenomenon known as cauliflory). Fruits develop from multiple ovaries and are technically composite syncarps.

Distribution and Cultivation Originating from India, jackfruit is now widely cultivated in Bangladesh, Thailand, Indonesia, the Philippines, Sri Lanka, Vietnam, and parts of East Africa and Brazil. It thrives in humid tropical lowlands, tolerates drought, and prefers well-drained sandy loam soils. Jackfruit trees are highly productive and resilient, often growing with minimal human intervention. Mature trees can yield up to 250 fruits annually, each weighing between 5 to 35 kilograms. Its adaptability to marginal lands and intercropping systems has positioned it as an ideal candidate for agroecological farming models.

Nutritional Profile and Phytochemistry

Macronutrients and Micronutrients Jackfruit pulp is rich in simple sugars like fructose and sucrose, dietary fiber, vitamins A, C, and B-complex, and essential minerals such as potassium, magnesium, and iron.

Nutrient	Content per 100 g
Energy	95 kcal
Carbohydrates	23.5 g
Protein	1.7 g
Fat	0.6 g
Fiber	2.0–3.6 g
Vitamin C	13.7 mg
Potassium	448 mg

Phytochemical Constituents

- Flavonoids
- Tannins
- Saponins
- Carotenoids (especially β -carotene)
- Phenolic acids
- Lignans

These compounds contribute to antioxidant, antimicrobial, anti-inflammatory, and anticancer properties.

Jackfruit Seeds The seeds are rich in starch, protein, and micronutrients. They have high amylose content, making them suitable for flour production. Seeds also exhibit antioxidant and antimicrobial properties.

Beyond direct consumption, jackfruit seed starch is used in pharmaceutical capsules, biodegradable films, and as a food thickener. Studies suggest that the seeds contain lectins and phenolics with potential roles in cancer prevention and immune modulation.

Health Benefits

Antioxidant and Anti-inflammatory Activities Phytochemicals in jackfruit neutralize free radicals and reduce systemic inflammation, thereby lowering the risk of chronic diseases such as cancer and cardiovascular disorders.

Gastrointestinal Health High dietary fiber supports digestion, improves bowel movement, and prevents constipation.

Cardiovascular Protection Low fat and sodium, along with high potassium, help regulate blood pressure and cholesterol levels.

Blood Sugar Control Jackfruit has a relatively low glycemic index. Jackfruit flour, in particular, is being explored for use in diabetic-friendly foods.

Antimicrobial and Antifungal Properties Extracts from leaves, latex, and seeds have shown activity against pathogens like *Staphylococcus aureus*, *Escherichia coli*, and *Candida albicans*.

Weight Management and Satiety Due to its high fiber and low fat, jackfruit contributes to satiety and reduced caloric intake, making it suitable for weight management diets.

Eye and Skin Health Vitamin A and carotenoids in ripe jackfruit support vision and skin regeneration. Antioxidants also prevent premature aging and photodamage.

Culinary Applications and Industrial Uses

Jackfruit's culinary versatility is unparalleled among tropical fruits. In its raw (unripe) form, it has a neutral taste and meaty texture, making it a popular meat substitute in vegetarian and vegan diets. Common preparations include curries, stir-fries, tacos, jackfruit biryani, and burgers. The ripe fruit, on the other hand, is sweet and aromatic, widely used in desserts, jams, smoothies, ice creams, and beverages.

Jackfruit seeds are roasted, boiled, or ground into flour to be incorporated into traditional dishes and bakery items. Flour from jackfruit pulp and seeds is gaining traction in gluten-free and diabetic-friendly products.

Industrial applications include:

- **Canned and vacuum-packed jackfruit** for international vegan markets.
- **Jackfruit leather and chips** as healthy snacks.
- **Seed flour** for biscuits, bread, and noodles.
- **Latex and leaves** for medicinal and packaging uses.

Socioeconomic Importance and Market Potential

Historically undervalued, jackfruit is now seeing a resurgence in both domestic and export markets. Countries like India, Sri Lanka, Vietnam, and Bangladesh are developing value-added jackfruit products and entering global trade.

Key points:

- Increased farmer income through jackfruit-based microenterprises.
- Employment generation in processing, packaging, and logistics.
- High demand in Western vegan markets due to meat-substitute properties.
- Potential for inclusion in midday meal schemes, school lunches, and food security programs.

Challenges include perishability, lack of storage and transport infrastructure, and underdeveloped supply chains.

Environmental and Agricultural Benefits

Jackfruit is highly resilient, making it suitable for climate-smart agriculture. It tolerates high temperatures, drought, and poor soils.

Environmental benefits:

- Carbon sequestration through long-lived trees.
- Soil stabilization in erosion-prone regions.
- Minimal agrochemical input requirement (low maintenance).

Agricultural benefits:

- Compatible with agroforestry and intercropping.
- High yield per hectare.
- Source of year-round food and fodder in rural communities.

Biotechnological Interventions and Breeding Prospects

Despite its potential, jackfruit remains genetically under-researched. Biotechnological advancements can aid in:

- Developing dwarf and high-yielding varieties.
- Enhancing shelf life and disease resistance.
- Genomic studies for trait selection.
- Tissue culture and micropropagation for large-scale plantation.

Bioprospecting for phytochemicals and nutraceuticals is also emerging as a research frontier.

Ethnobotanical and Cultural Significance

Jackfruit holds a sacred and symbolic value in many cultures. In South India and Southeast Asia, it is used in religious rituals, temple offerings, and traditional medicine.

Ethnobotanical uses include:

- Latex as a healing agent for wounds.
- Leaf ash for ulcers and boils.
- Bark decoctions for fever and skin disorders.

Such traditional knowledge supports integrative medicine and can complement modern pharmacology.

Comparative Analysis with Other Superfoods

Parameter	Jackfruit	Avocado	Banana	Soy
Fiber	High	Moderate	Moderate	Moderate
Protein	Moderate (in seeds)	Low	Low	High
Climate Resilience	High	Moderate	Moderate	Low
Versatility	Very High	Moderate	High	High
Market Value	Increasing	Established	Established	Established

This analysis shows jackfruit's strong potential to be promoted alongside traditional superfoods in nutrition programs and commercial products.

Constraints and Challenges

Despite its merits, jackfruit faces several obstacles:

- Lack of awareness among consumers and policymakers.
- Inadequate infrastructure for harvesting, processing, and storage.
- Short shelf-life of ripe fruit.
- Underinvestment in research and extension services.
- Market instability due to seasonal glut and absence of standard pricing.

Future Prospects and Recommendations

To realize jackfruit's full potential:

- Promote value-added product development and MSMEs.
- Strengthen farmer cooperatives and market linkages.
- Establish jackfruit germplasm banks and breeding programs.
- Integrate jackfruit in national food security missions.
- Conduct nutrition awareness campaigns and culinary education.
- Encourage public-private partnerships for international trade.

Conclusion

Jackfruit is a symbol of resilience, nutrition, and tradition. Its transformation from a neglected backyard fruit to an international superfood reflects changing dietary patterns and the urgent need for sustainable crops. With the right interventions—scientific, commercial, and policy-based—jackfruit can revolutionize food systems, contribute to economic development, and combat malnutrition. The fruit's future lies in innovation, collaboration, and rediscovery.