A REVIEW ON THE NUTRACEUTICAL POTENTIAL OF MANGO (*MANGIFERA INDICA* L.) WITH SPECIAL REFERENCE TO TRADITIONAL MANGO VARIETIES OF WEST BENGAL

Mitu De[1*] and Santi Ranjan Dey[2]

[1*]Associate Professor, Department of Botany, Gurudas College, Kolkata 700054

[2]Assistant Professor, Department of Zoology, Rammohan College, Kolkata 700009

*Correspondence E-mail: mitu.botany@gurudas.education

Abstract

Mango (*Mangifera indica* L.), popularly known as the "King of Fruits," is one of the most economically and culturally significant tropical fruits of South Asia. Beyond its nutritional importance, mango possesses immense nutraceutical potential owing to the presence of diverse bioactive compounds such as polyphenols, carotenoids, flavonoids, mangiferin, dietary fiber, vitamins, and volatile compounds. Different parts of the mango plant viz. pulp, peel, kernel, leaves, barkand flowershave been reported to exhibit antioxidant, antidiabetic, anticancer, anti-inflammatory, antimicrobial, hepatoprotectiveand cardioprotective activities. West Bengal, especially the districts of Malda and Murshidabad, represents a rich repository of traditional mango germplasm. These heirloom cultivars possess unique phytochemical profiles and organoleptic characteristics that contribute significantly to their nutraceutical value. The present review discusses the nutritional composition, phytochemical constituents, health-promoting propertiesand therapeutic applications of mango with special emphasis on traditional mango varieties of West Bengal.

Keywords: Mango, Nutraceuticals, Traditional mango varieties, West Bengal, Mangiferin, Antioxidants, Functional foods

Introduction

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae and is one of the oldest cultivated tropical fruit crops in the world. India is recognized as the centre of origin and diversity of mango and contributes significantly to global mango production. Mango has immense socio-cultural, economic, nutritionaland medicinal importance in South Asia. The fruit is widely appreciated for its unique flavour, aroma, attractive colourand nutritional richness. In addition to being consumed fresh, mango is processed into juices, jams, pickles, chutneys, dehydrated productsand beverages.

In recent decades, mango has attracted considerable scientific attention because of its nutraceutical properties. Nutraceuticals are food-derived bioactive compounds that provide health benefits beyond basic nutrition and may help prevent or manage chronic diseases. Mango contains an abundance of bioactive molecules including polyphenols, carotenoids,

flavonoids, phenolic acids, vitamins and the xanthone mangiferin, which collectively contribute to its therapeutic potential [1, 2].

West Bengal possesses a remarkable diversity of indigenous mango cultivars, particularly in the districts of Malda and Murshidabad. These traditional varieties have evolved over generations under local agro-climatic conditions and are known for their distinct biochemical composition, aroma, sweetness, textureand medicinal value. However, modernization of agriculture and preference for commercial hybrids threaten the conservation of many traditional/heirloom cultivars. Scientific documentation of their nutraceutical significance is therefore essential for biodiversity conservation and sustainable utilization.

Nutritional Composition of Mango

Mango is a nutrient-rich fruit containing carbohydrates, vitamins, minerals, organic acids, amino acids, and dietary fiber. The fruit pulp is particularly rich in vitamin C, provitamin A carotenoids, folates, and phenolic compounds.

Major nutritional components of mango include:

Nutritional Component	Biological Importance
Carbohydrates	Energy source
Dietary fibre	Digestive health
Vitamin C	Antioxidant and immune support
Vitamin A precursors	Eye health
Potassium	Electrolyte balance
Polyphenols	Antioxidant activity
Carotenoids	Anti-inflammatory and antioxidant roles

The biochemical composition of mango changes during fruit ripening. Ripening leads to increased sugar accumulation, carotenoid synthesis, and flavour development. Different cultivars exhibit significant variation in vitamin and phytochemical content.

Nutraceutical Properties of Mango

Antioxidant Activity

Oxidative stress is associated with aging, diabetes, cardiovascular diseases, neurodegenerative disorders, and cancer. Mango phytochemicals exhibit significant free radical scavenging activity. Polyphenols and carotenoids help reduce oxidative cellular damage [3].

Antidiabetic Potential

Mangiferin and phenolic compounds have demonstrated hypoglycemic activity by improving insulin sensitivity and glucose metabolism. Mango leaves are traditionally used in herbal medicine for managing diabetes.

Anticancer Properties

Several studies indicate that mango extracts may inhibit proliferation of cancer cells due to the presence of mangiferin, quercetin, and gallic acid. These compounds induce apoptosis and reduce inflammatory pathways associated with carcinogenesis.

Cardioprotective Effects

Dietary fiber, potassium, and antioxidants in mango help reduce blood pressure, improve lipid profiles, and minimize oxidative stress-related cardiovascular damage.

Anti-inflammatory Activity

Mango phytochemicals inhibit inflammatory mediators and reduce chronic inflammation associated with arthritis, obesity, and metabolic syndrome.

Antimicrobial Activity

Extracts from mango leaves, bark, and kernels have demonstrated antibacterial and antifungal activities against several pathogenic microorganisms.

Gastroprotective and Hepatoprotective Effects

Traditional medicinal systems use mango plant parts for treating digestive disorders. Mango bioactive compounds may protect liver tissues and improve gastrointestinal health.

Nutraceutical Importance of Mango By-products

Mango processing industries generate large quantities of peel and seed waste. These by-products are rich in bioactive compounds and possess commercial nutraceutical value [4].

Mango Peel

Mango peel contains high concentrations of:

- Polyphenols
- Dietary fiber
- Carotenoids
- Flavonoids

Peel extracts are being explored for antioxidant supplements and functional foods.

Mango Kernel

The kernel contains healthy fats, starch, proteins, and phenolic compounds. It may be utilized in nutraceutical formulations and food fortification.

Mango Leaves

Mango leaves contain mangiferin, flavonoids, and tannins with medicinal applications in traditional healthcare systems [5, 6].

Phytochemical Constituents of Mango

Mango is considered a phytochemical-rich fruit. Different plant parts contain various secondary metabolites with medicinal importance.

Major Bioactive Compounds

Mangiferin

Mangiferin is one of the most important xanthone glycosides present in mango leaves, bark, peel, and pulp. It exhibits strong antioxidant, anti-inflammatory, antidiabetic, antiviral, and anticancer activities.

Polyphenols

Mango contains several polyphenolic compounds such as:

- Gallic acid
- Quercetin
- Catechins
- Kaempferol
- Tannins
- Chlorogenic acid

These compounds help neutralize free radicals and reduce oxidative stress.

Carotenoids

Carotenoids are responsible for the yellow-orange coloration of mango pulp. Important carotenoids include:

- Beta-carotene
- Lutein
- Alpha-carotene
- Violaxanthin

These compounds act as antioxidants and precursors of vitamin A.

Flavonoids

Flavonoids contribute to antioxidant and anti-inflammatory activities and may reduce risks of cardiovascular diseases and certain cancers.

Traditional Mango Varieties of West Bengal

West Bengal is renowned for its rich diversity of traditional mango cultivars. The districts of Malda and Murshidabad are considered important centres of mango germplasm diversity. Preliminary studies have been carried on by the authors to variation of pulp quality among the traditional mango varieties of these two districts [7]. Eugenol was found using the GC-MS Analysis of The Methanolic Extract of The Fruit Pulp of the traditional mango variety, Champa from Murshidabad district [8].

Role of Traditional Mangoes in Functional Foods

Traditional mango varieties of West Bengal can be utilized for developing:

- Functional beverages
- Mango-based nutraceutical supplements
- Antioxidant-rich powders
- Fermented probiotic products
- Herbal teas from mango leaves
- Polyphenol-rich extracts

The unique phytochemical diversity of traditional cultivars offers opportunities for region-specific nutraceutical branding and geographical indication-based value addition.

Conservation and Sustainable Utilization

Rapid urbanization, monoculture farming, and replacement of traditional varieties with commercial hybrids threaten indigenous mango biodiversity. Conservation strategies should include:

- Germplasm documentation
- Community seed and graft banks
- Farmer participatory conservation
- Molecular characterization
- Nutritional profiling
- Promotion of traditional cultivars in agro-tourism and functional food industries

Integration of traditional knowledge with modern phytochemical research can enhance sustainable utilization of these valuable genetic resources.

Conclusion

Mango is not merely a delicious tropical fruit but also an important source of nutraceutical compounds with wide-ranging health benefits [7]. Its pulp, peel, leaves, kernel, bark, and flowers contain bioactive molecules including mangiferin, polyphenols, carotenoids, flavonoids, and vitamins that exhibit antioxidant, antidiabetic, anticancer, cardioprotective, antimicrobial, and anti-inflammatory properties. The emerging field of functional foods and nutraceuticals provides significant opportunities for promoting traditional mango biodiversity while supporting rural livelihoods.

Traditional mango varieties of West Bengal represent valuable reservoirs of unique phytochemical diversity and possess immense potential for functional food development and nutraceutical innovation. Some preliminary work started by the authors [10]. Conservation and scientific exploration of these heirloom cultivars are essential for safeguarding agro-biodiversity, promoting sustainable agriculture, and advancing future nutraceutical research.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding this publication.

Acknowledgment: The authors thank the Principal, Gurudas College, Kolkata and Principal, Rammohan College, Kolkata, India for providing encouragement to carry on this work.

Reference

1. Berardini, N., Fezer, R., Conrad, J., Beifuss, U., Carle, R., & Schieber, A. (2005). Screening of mango (*Mangifera indica* L.) cultivars for their contents of flavonol O- and xanthone C-glycosides, anthocyanins, and pectin. *Journal of Agricultural and Food Chemistry, 53*(5), 1563–1570.
2. Masibo, M., & He, Q. (2009). Mango bioactive compounds and related nutraceutical properties—A review. *Food Reviews International, 25*(4), 346–370. https://doi.org/10.1080/87559120903153524
3. Kim, H., Moon, J. Y., Kim, H., Lee, D. S., Cho, M., Choi, H. K., Kim, Y. S., &Mosaddik, A. (2010). Antioxidant and antiproliferative activities of mango (*Mangifera indica* L.) flesh and peel. *Food Chemistry, 121*(2), 429–436.
4. Jahurul, M.H.A. I.S.M. Zaidul, Kashif Ghafoor, Fahad Y. Al-Juhaimi, Kar-Lin Nyam, N.A.N. Norulaini, F. Sahena, A.K. Mohd Omar. (2015). Mango (*Mangifera indica* L.) by-products and their valuable components: A review. Food Chemistry, Volume 183, Pages 173-180, ISSN 0308-8146, https://doi.org/10.1016/j.foodchem.2015.03.046.
5. Kumar, M., Saurabh, V., Tomar, M., Hasan, M., Changan, S., Sasi, M., Maheshwari, C., Prajapati, U., Singh, S., &Mekhemar, M. (2021). Mango (*Mangifera indica* L.) leaves: Nutritional composition, phytochemical profile, and health-promoting bioactivities. *Antioxidants, 10*(2), 299.
6. Mehmood, H., Mehmood, J., & Zulfiqar, N. (2023). Exploring the phytochemistry and pharmacology of *Mangifera indica* L. leaves: A review. *International Journal of Plant Based Pharmaceuticals, 3*(1), 1–12.
7. De, Mitu and Dey, Santi Ranjan. 2021.Variation in the pulp quality of some rare indigenous mango (*Mangifera indica* L.) varieties of West Bengal. *International Journal of Experimental Research and Review***(ISSN- 2455-4855),**Vol. 26: December issue, pp. 70 -78 pp. DOI: https://doi.org/10.52756/ijerr.2021.v26.005
8. De, M., Ray, S., Dutta, S. and Dey, S. (2021). "Eugenol Found by GC-MS Analysis of The Methanolic Extract of The Fruit Pulp of Indigenous Mango (Mangifera indica L.) Variety, Champa from Murshidabad District of West Bengal, India", *International Journal of Advancement in Life Sciences Research*, 4(1), pp. 22-30. doi: https://doi.org/10.31632/ijalsr.20.v04i01.004.
9. Maldonado-Celis ME, Yahia EM, Bedoya R, Landázuri P, Loango N, Aguillón J, Restrepo B and Guerrero Ospina JC (2019). Chemical Composition of Mango (Mangifera indica L.) Fruit: Nutritional and Phytochemical Compounds. Front. Plant Sci. 10:1073. doi: 10.3389/fpls.2019.01073
10. De, Mitu and Dey, Santi Ranjan. 2021.Identification of volatile chemical constituents of fruit pulp by GC-MS analysis of some traditional mango varieties of Malda and Murshidabad district for increased consumer acceptability and subsequent conservation. International Journal of Integrated Research and Development (ISSN: 2278-8670), Vol I, Issue 19, June 2021, 225-237.