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A Review on Nutritional Benefits of Banana (*Musa balbisiana*) Waste

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ABSTRACT

The agricultural waste has drawn attention of scientists in recent years and the waste generated has become an attraction to study and gain benefits from them. *Musa balbisiana* is a tall robust plant that is rich in medicinal and traditional values. Over the past few years, the nutritional properties of *Musa balbisiana* have received much importance. *M. balbisiana* possesses antidiabetic, anticancer, antibacterial and hepatoprotective properties. Various parts of the plant including fruits, stems, peel, roots, flowers and leaves are used as traditional medicine to treat many diseases. The present review paper highlights the nutritional benefits of different parts of *Musa balbisiana* waste and its utilization in the food industry to create health-based foods. The phytochemical and antioxidant properties of *M. balbisiana* can help treat different diseases and aid in the pharmacological industry. Hence,the banana residue has a huge scope that will create new avenues and research areas for the future.

Key Words : *Musa balbisiana, Bhimkol, Elavazhai,* Banana peel, Banana stem

INTRODUCTION

Banana is an edible fruit that ranks as the second most important fruit crop in India (Post Harvest Profile of Banana, 2015). It is grown mostly for its fruit and other decorative and religious ritual purposes. Present-day parthenocarpic bananas are mostly derived from two wild species: *Musa acuminata* and *Musa balbisiana* (Narzary and Sharma, 2022). Depending on the genetic makeup, bananas are known by their scientific names *Musa balbisiana* and *Musa acuminata,* or hybrids of these two species (Wikipedia, 2024). Bananas are herbaceous, monocotyledonous plants that grow quickly (Borborah *et al.,* 2016). The cultivars differ substantially in terms of food quality, disease and pest resistance, plant and fruit size, and plant morphology (Swargiary *et al.,* 2021). When ripe, the majority of bananas have a sweet flavor, plantains and cooked bananas are the exceptions. Itsall-year availability, taste, nutritional content, variety, affordability, and medicinal worth make it everyone's favorite fruit (Post Harvest Profile of Banana, 2015).

Musa balbisiana is a robust herb growing up to7.5 m with several medicinal and religious values (Borborah *et al*., 2016). The banana belongs to the family *Musaceae* which belongs to the genome group BB and is both cultivated as well as available in the wild. *Musa balbisiana* is locally known as "*Bhimkol"* or "*Athiyakol"* in Assam and "*Elavazhai"*in South India (Swargiary *et al*., 2021). They are robust in growth, very hardy, resistant to pests, diseases and drought and high yielder. The fruits of *M. balbisiana* are seeded which makes it different from other varieties of banana (Narzary and Sharma, 2022). The banana is considered as a good natural source of baby food among the rural masses of Assam and other states.The local inhabitants of Assam and other Northeastern states consume the flower and pseudostem of *M. balbisiana* as vegetable. The fruits are also consumed as food since ancient times as dietary

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supplements and for nutrition (Borborah *et al.,* 2016).

Botanical Classification:

Kingdom	:	Plantae
Division	:	Angiospermae
Class	:	Scitaminae
Order	:	Zingiberales
Family	:	Musaceae
Genus	:	Musa
Species	:	*M. balbisiana colla*

Fig. 1 : *Musa balbisiana* fruit

Cultivation:

Bhimkol banana are mostly found in Southeast Asian countries including China, India, Indonesia, Malaysia, Nepal, Philippines, Thailand, Sri Lanka, and Myanmar. The northeastern region of India is rich in this banana type; the majority is found in Assam, with small distribution also occurring in nearby states like Arunachal Pradesh, Manipur, Nagaland, Meghalaya, Mizoram as well as in West Bengal. The banana type is also found in Andaman and Nicobar Islands and some parts of South India (Borborah *et al*., 2016).

Nutritional Properties:

M. balbisiana possesses phytochemical contents and secondary metabolites (Swargiary *et al.,* 2021). It is also reported as a source of high potassium, chloride, calcium and carbonate (Deka *et al*., 2019). The higher accumulation level of potassium and chloride caused high alkalinity in the plant which justified their medical uses (Mudoi *et al*., 2011). Seeds of *Musa balbisiana* colla contain ferulic acid, C16, C18 fatty acid and polyphenols (Ghosh *et al*., 2017). The inflorescence is used to treat jaundice. Young tender banana pseudo-stem is a very rich source of iron and fibers (Kalita *et al*., 2004). Fresh ripe pulp of the fruit possesses antiperoxidative and antioxidant properties which can prevent oxidative stress-related disease (Borborah *et al*., 2016). *Musa balbisiana* Colla contain flavonoids, polyphenols, tannins, monoterpenoid and sesquiterpenoids, quinones, and saponins (Kusuma *et al*., 2017). A significant level of bioactive substances such as apigenin, gallic acid, quercetin, epicatechin and rutin are present in different parts of the banana (Kumari *et al*., 2020). A flavanol compound, Apiforol has been found to have strong inhibitory capability against α-amylase and á-glucosidase which increases the absorption of glucose by cells isolated from *Musa balbisiana* seeds (Gopalan *et al*., 2014). Kalita *et al.* (2004) reported that *M. balbisiana's* root extract contains a calyx [4] arene class of compound that may possess antioxidant properties which is partially responsible for its antidiabetogenic and antilipidemic properties.

Health Benefits:

One of the most promising dietary options for preventing cardiac hypertrophy is powdered *Musa balbisiana* fruit pulp which helps in modulating inflammation and oxidation in hypertrophy heart (Kumari *et al*., 2020). The fruit bark is used to treat gout. The dried peels are used to heal gastritis and cough or are taken as health tonic (Borborah *et al*.,2016). *M. balbisiana* is also proven effective for kidney stone disease. The fresh peel of ripe banana is used to heal dysentery (Borborah *et al.,* 2016). Various parts of the plant are used either as food, in religious rites and also as medicine for the treatment of diseases like jaundice, dysentery, etc. (Bhattacharjya *et al*., 2015). Banana pseudostem have a low glycaemic index and high content of dietary fibre and antioxidant which is good for diabetes (Bhaskar *et al*., 2011). A study by Das *et al.* (2014) reported that the fresh or dried *M. balbisiana* seeds paste was used as a form of birth control in Tripura, India. The tablets were made from a 5 g paste of either fresh or dried seeds, and they were taken orally twice a day on an empty stomach for a duration of seven days. Numerous investigations have shown that parts of *M. balbisiana* have anticancer and anti-proliferative properties (Swargiary *et al*., 2014). Borborah *et al.* (2016) reported that exudates deposited from *M.*

balbisiana pseudostem are employed to treat infertility in women and remove intestinal worm infection. The rich antioxidant content of *M. balbisiana* provides beneficial health factors by the removal of free radicals thereby preventing chronic diseases such as cancer, diabetes, heart disease, etc. (Ara *et al*., 2019). *M. balbisiana* is a rich source of minerals, amino acids, energy and Vitamin C which makes it a wholesome and nourishing diet for babies (Barthakur *et al*., 1990).

Uses :

A study carried out reported that leaf extract of *M. balbisiana* can be a good ingredient for active packaging (Rahmadia *et al.,* 2019). *M. balbisiana* peels provide 100% conversion rate of leftover cooking oil to biodiesel (Gohain *et al*., 2017). The banana peel waste can be used as a substrate for the production of crude pectinase from Aspergillus Niger which proves to be an efficient source of carbon and possesses potential as a substrate for pectinase production due to its cost-effectiveness, renewability and abundance availability (Barman *et al*., 2014). Studies on the waste banana pseudostem biomass (WBPB) polymer composite which improved thermal stability and moisture resistance suggests that waste *Musa balbisiana* Colla fibre could be used as a reinforcing agent in PVC composites, finding applications in structural components like window, window profiles, table tops, partition walls, and so forth (Gogoi *et al*., 2014). The pseudostem of *M. balbisiana* is consumed as vegetable by majority of people. Besides that, the ash of the banana peel is widely used to prepare *Khar* which is one of the old and popular ingredients of many dishes in Assam (Borborah *et al*., 2016).

Conclusion:

The therapeutic foods have been a part of diet of the indigenous people since time immemorial which forms an integral part of the traditional healthcare system. The banana plant generates a tremendous amount of waste which includes peel, pulp, pseudostem, pith, flowers, and leaves. The banana plant residue after utilization of the fruit by the industries is often dumped in the environment without any treatment which causes environmental hazards and economic losses. The ripe bananas are mostly consumed unprocessed but significant industrial processing of banana chips, banana flour and other processed foods are produced resulting into a vast peel waste due to underutilization of the banana residue. Banana peels have attracted the attention of researchers for the last few years due to their bioactive chemical components. The bioactive compound found in plant extract can be applied naturally, safely and effectively which can prove beneficial in the pharmacological and nutraceutical industry. In addition to being used as a source of food, *Musa balbisiana* has numerous other uses for its leaves, seeds, peel, inflorescences and roots thereby creating opportunities to explore in the area of product development, food packaging, biowaste and health-based foods, etc. Hence, *M. balbisiana*is an emerging food with multiple nutritional and health benefits properties but more studies need to be carried out to study its efficiency and explore its potential further.

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