

A Review - Antimicrobial, Antioxidant and Anticancer properties of *Musa paradisiaca* L

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ABSTRACT: The Western Ghats of Karnataka is known as treasury of bioactive compounds because of diverse distribution medicinal plants. Many tribal's and traditional practitioners residing in the vicinity, capable of healing ailments like jaundice, herpes, psoriasis and complex diseases including cancers. *Musa paradisiaca*. (Musaceae) cv. 'Puttabale' (AB group) cultivated in the central part of Karnataka (Chitradurga, Davangere and Shimoga districts). In addition to the fruit, it provides health benefits. Traditionally the whole or parts of this plant are used to treat various disorders such as abscess, diarrhea, dog bites, dyspepsia, wound healing and insects bites. Many investigators revealed the success stories of pharmacological properties in banana plant parts such as fruits, stem juice, fruit peel and inflorescence. The preliminary investigations showed presence of polyphenols, flavonoids, terpenoids and saponins etc., in inflorescence. Based on the literature survey, In the present context, the *M. paradisiaca* cv. puttabale gain an attention for detail investigation of plant part and extract used for biological properties such as antimicrobial, antioxidant and anticancer. The finding benefits further studies.

KEYWORDS: *Musa paradisiaca*, Antimicrobial, Antioxidant and Anticancer activity.

I. INTRODUCTION

Natural bioactive constituents are the treasury of medicinal plants and have been in use for many centuries to prevent infectious diseases and cure ill-health. In recent times, researchers and scientists extensively involved around the world for the investigation of bioactive principles from medicinal plants and have developed the scientific methods for prevention and treatment of diseases. In developing countries, folklore medicinal system is well established and about 80% of population still practices in India. The folklore medicines have benefits in cost effectiveness, lesser side effects and clinically effective than allopathic medicine.^[1-3]

Natural phytoconstituents from medicinal plants as one of the most promising source of various bioactive activity. The secondary metabolites such as flavonoids, steroids, alkaloids, phenolic lignans and saponins are biosynthesized in plants and play a vital role in growth, reproduction, metabolic activity and plant protection. Phenolics compounds present in banana fruits are the major bioactive constituents which includes p-hydroxybenzoic, catechin, tannins, anthocyanins, ferulic, syringic, sinapic, gallic acid, salicylic, gallic, epicatechin, p-coumaric acids, gentisic, and vanillic etc.,^[4,5] and possess antiallergic, anticancer, antimicrobial, anti-inflammatory, antidiabetic and antioxidant properties which provides health benefits.^[6-8]

Medicinal plants are promising sources of new drugs because of their antimicrobial, antioxidant and health-related properties. They are ideals for developing pharmaceutical products, phytomedicines, and dietary supplements. Several medicinal plants are used as nutraceuticals because of their nutritional and medicinal properties.

Banana are monocotyledonous plants belongs to the family Musaceae and genus *Musa* originated from the Southern Asia. The different banana varieties and cultivars have cultivated in diverse ecosystem of 130 countries and second largest fruit produced. Bananas are the fifth largest agricultural commodity in world trade after cereals, sugar, coffee and cocoa. There are quite 1000 varieties of bananas produced and consumed around world. Total banana production in the world was 148.4 million tons during 2016. In developing countries, banana production nearly 122 million tons during last three decades (FAOSTAT, 2020). Banana production in china increases by 11 million tons in 2016–18 (FAOSTAT, 2020).

India's banana harvest over the last six decades reached 30 million t in 2016–2018 among 37 banana-producing countries (FAOSTAT, 2020). Assam produces 913270 tons banana from an area of 53080 ha area during 2017-18 (Annon, 2018)

with productivity of 17.21 tones/ha. Conventionally, banana plants parts such as pseudostem juice, flowers and fruits are used to treat illness in diarrhea and dysentery patients.^[9,10] In South Asian countries, still banana leaves are used as plates and for prevention of infections in wounds

and insect bites.^[11] The roots extracts from *Musa paradisiaca* are used for the treatment of sexually transmitted diseases.^[12] The different parts of banana plants have various bioactive properties are listed in Table 1.

Table 1: Bioactivity of *Musa paradisiaca*

Bioactivity	Plant parts used	References
Anti-diarrhoea (unripe), Anti-dysentery, Anti-diabetes	Stem and banana peel	13, 14
Antilithic	Stem juice	15, 16
Antiulcerogenic	Banana powder, Unripe plantain	17, 18, 19
Hypoglycemic	Inflorescence stalk	20
Hypolipidemic, Antioxidant	Fraction of banana	21
Inflammation, pain & snakebite	Stem juice	22
Antidiarrhoeal activity	-	23
Antiulcerative activity	Pseudostem, banana fruits	24, 25
Antimicrobial activity	Fruits peel, Unripe banana, Banana blossom	26, 27, 28, 29, 30, 31
Hypoglycemic activity	Green fruits, Roots,	32, 33, 34, 35
Hypocholesterolaemic activity	Banana flavonoids	36
Antioxidant activity	Banana fruits	37
Diuretic activity	Fruit peel	38
Wound healing activity	Plantain banana	39
Anti-allergic activity	-	40
Antimalarial activity	-	41
Anti-snake venom activity	Fruit Juice	42

Antimicrobial activity

Infectious diseases indicate an important cause of morbidity and mortality among the population, particularly in developing countries. Therefore, pharmaceutical companies have been motivated to develop new antimicrobial drugs. Due to the extensive use makes microorganisms more resistant to drugs. Moreover, the currently available antimicrobial drugs are known to be sensitive to humans & animals and became multi-resistant. Therefore, molecular strategies are adopted by

pharmaceutical companies to supply the market with new antimicrobial drugs which includes changing the molecular structure of the existing medicines in order to make them more efficient or recover the activity lost due to bacterial resistance mechanisms. Numbers of reports are available on antimicrobial activities of plantain *M. paradisiaca* against fungi and bacteria. Still need to investigate phytoconstituents with better antimicrobial properties (Table 2).

Table 2: Antimicrobial activity of *Musa paradisiaca*.

Extract	Plant part	References
Ethanollic, methanolic	Peel and fruit	43
Aqueous	Peel powder	44
Ethanollic and mixed ethanollic and aqueous (1:1)	Flowers	45
Aqueous	Banana Peel	46
Alcoholic	Banana Peel	47
Hexane, ethyl acetate and methanolic	Leaf	48
Dichloromethane and methanol (1:1)	Banana Peel	49
Methanolic and ethanollic	Banana Peel and stalk	50

Methanolic and ethanolic	Pseudostem exudates	51
Methanolic, hexane/chloroform (50:50), ethylacetate/methanol (50:50), ethylacetate/methanol (90:10)	Leaf	52
Ethanolic	Banana Peel, corm	53, 54

Antioxidant properties

The reactive oxygen species (ROS) such as superoxide ions, hydroxyl radicals, oxide radicals, nitric singlet oxygen and hydrogen peroxide are reported to cause many disorders like arthritis, arteriosclerosis, diabetes, age-related macular degeneration, inflammation, certain types of cancer and Alzheimer disease. Aziahet al. reported that the higher content of total dietary fibre, polyphenols, insoluble dietary fibre, flavonoids, lignocellulose, antioxidant capacity, hemicellulose, and free-radical scavenging capacity in the banana pseudo-stem flour (NBPF) than tender core of pseudo-stem flour (TCBPF).^[55] Singh et al. has reported that many bioactive substances in bananas, such as phenolics, carotenoids, flavonoids, vitamin C, amines, and vitamin E, have antioxidant properties and give numerous health benefits to humans.^[56]

The various plant parts of *M. paradisiaca* are reported antioxidants properties and isolated numerous of phytochemicals such as dopamine, gallic acid, catechin, and ferulic, from pseudostem.^[57] Saravanan and Aradhya reported the phytochemicals such as cinnamic, protocatechuic, caffeic acids, gentisic acid, catechin, and ferulic, from pseudostem.^[58] Arun et al. reported the inflorescence contains syringic, gallic, catechol ferulic acids, and p -coumaric.^[59] The oil extracted from fruits contains important phytochemicals such as α -terpinene, 1,2-benzenedicarboxylic acid, α -copaene, α -terpinene, hexadecanoic acid, 1-nonadecene etc. and possess bioactivity against certain cancers.^[60] Recently, Oyeyinka and Afolayan reported the crude plantain peels extracts showed dose depended antioxidant activity in acetone and aqueous extraction.^[61] Shodehinde et al. evaluated the antioxidant activity of aqueous extracts of unripe plantain (*Musa paradisiaca*). They found that raw flour had the highest Fe^{2+} chelating capacity, sodium nitroprusside inhibitory impact, and vitamin C content, while boiling flour had the highest DPPH and OH radical scavenging ability.^[62] Laeliocattleya et al. reported that the antioxidant activity (IC50) of ethanol extract and ethyl acetate were 3374.13 ± 123.46 ppm and 40318.19 ± 1014.90 ppm. They concluded that type

of solvents (ethanol and ethyl acetate) affected the content of bioactive compounds and antioxidant activity of candi banana.^[63]

Ahmad et al. reported the IC₅₀ value of the tepal methanol extract was found to be 22.5 μ g/ml for radical scavenging activity. The highest total phenolic contents (expressed as microgram of Gallic acid equivalent per gram of the extracts) were found in tepal methanol extract (8000 μ g/g) and the least in flesh methanol extract (2150 μ g/g).^[64] Agoreyo et al., (2017) determined the levels of antioxidants such as glutathione, carotenoids and vitamin E of two cultivars of *Musa paradisiaca* and three cultivars of *Musa sapientum* revealed an increase in these antioxidants from the unripe to the overripe stage during ripening. The result showed the methanolic extracts of the plantain and banana cultivars showed higher antioxidant activity than that of aqueous extracts.^[65]

Anticancer properties

Cancer is the second largest cause of death to the world population after cardiovascular diseases reported by World health organization (2019). The plant derived phytochemicals such as vincristine, vinblastine, camptothecin, and taxol clinically reported and approved by FDA as anticancer drugs against cell lines.^[66] Due to high demand for anticancer drugs with enhanced specific functional properties needs to investigate. This has prompted a search for novel drugs against cancer which has become major mortality burden globally. Several cancers cause life threatening disorders such as colorectal, liver, lung, prostate, stomach cancer, breast cancer, cervix cancer, colorectal cancer, lung cancer and thyroid cancer in human beings. It is estimated that 9.9 million deaths in 2020 around world. Among them, about 7.85 lakh deaths in India.^[67-68] The in vitro cytotoxic effects on colon cancer (HT29) caused in human from plantain inflorescence was reported.^[69] Another report showed the extracts of plantain inflorescence have cytotoxic effect on cervical cancer cells.^[70-71] Abd Ghafar et al. reported the plantain inflorescence extract effects on oral squamous cell carcinoma (OSCC) cell lines (HSC-

4).^[72] Harsha Raj et al. reported in vitro and in vivo cytotoxic activity against breast cancer cell lines (MCF-7 and MDAMB-231) from plantain roots extracted with ethyl acetate.^[73]

II. CONCLUSION

M. paradisiaca plant part are used to study the bioactive activity. The solvent used for extract of metabolite plays crucial role for various biological properties. Further, various biological properties also depends on climatic condition.

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