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Banana Medicinal Uses

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Abstract

Banana (Genus *Musa*) cultivars are grown from long time throughout the world. All parts of banana have nutritional and traditional medicinal uses. Many *in vitro* studies , animal model studies and clinical studies suggest that various parts of banana act as food medicines for treatment of diseases like diabetes, hypertension, cancer, ulcers, diarrhoea, urolithiasis, Alzheimer's and infections. Other medicinal uses are in surgical dressing, pain relief, food and pharmaceuticals, nano medicine, pollution control, apoptosis and cell cycle.

Key words: Banana, Medicinal uses, Anti diabetic activity, Anticancer activity, Antimicrobial activity

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Introduction

For thousands of years products from natural sources have been used in caring for human health. Most of the drugs given even today are directly or indirectly from natural sources [1]. These medicines which are safe, free from side effects and eco-friendly are derived from a wide variety of plants and are in use in every part of the world [2]. Recently, interest in local plants' research has increased significantly for a variety of reasons including an inability of many rural people and some governments to afford western-based pharmaceutical care, renewed interest in native resources and "traditional" health systems along with a greater appreciation for local and indigenous knowledge, international concerns for the conservation of biodiversity and their income-generating potential [3].

Limitations of synthesized compounds in the treatment of chronic diseases and the potential of plant-based medicine as a more effective and cheaper alternative, was probably responsible for the fast growing industry of herbal medicine [4]. India is gifted with a rich wealth of medicinal plants. The Charak Samhita (1000 B.C.) gives details of about 340 medicinal plants of which only 85 are accepted by the Indian Pharmacopeia (1966). In the Ayurvedic and the traditional medicinal systems of India, almost all the parts of banana plant (*Musa x paradisiaca)* are used for the treatment of various diseases. Banana (*Musa x paradisiaca* L) is commonly a fruit but technically, a berry. The genus *Musa* of herbaceous plants produces this universally consumed fruit It is suitable for consumption by people of any age group and so, is one of the world's most important food produce.

The Musaceae family is made up of three genera, *Musa*, *Ensete* and *Musella*. *Musa* is the largest group, with about 35 species. *Musa* species are divided into different sections. According to recent DNA work, there are three sections: Musa (with 22 chromosomes), Callimusa (with 20 chromosomes) and Ingentimusa (with 14 chromosomes). There are about seven *Ensete* species and one *Musella* species.

Banana is an excellent source of nourishment and a well-balanced diet to people of all ages around the globe and contributes to income of individuals through crop production, processing and marketing. Banana is eaten in many ways and has plenty of nutritional and medicinal benefits (Table 1). Bananas and plantains are grown in India from Vedic times and mentioned in Tamil literature dating back to 120 BC.

India has a very rich genetic bio-diversity with respect to banana cultivation and the cultivars available (Table.2). There are more than 90 distinct clones,

depending on the contribution of *Musa acuminata* and *Musa balbisiana*. India is the largest producer and consumer with annual production of 11.7 million tones on 404,000 Ha, contributing to 27% of the world production and about 37% of the total fruit crop production in the country [5].

Carbohydrates	22.84 g
Sugars	12.23 g
Dietary fiber	2.6 g
Fat	0.33 g
Protein	1.09 g
Vitamin A equiv. 3 µg	0%
Thiamin (Vit. B1) 0.031 mg	2%
Riboflavin (Vit. B2) 0.073 mg	5%
Niacin (Vit. B3) 0.665 mg	4%
Pantothenic acid (B5) 0.334 mg	7%
Vitamin B6 0.367 mg	28%
Folate (Vit. B9) 20 µg	5%
Vitamin C 8.7 mg	15%
Calcium 5 mg	1%
Iron 0.26 mg	2%
Magnesium 27 mg	7%
Phosphorus 22 mg	3%
Potassium 358 mg	8%
Zinc 0.15 mg	1%

Table 1: Nutritional profile of banana

Domestic production of banana in India alone exceeds the entire world trade, with 21 per cent share of the total production of banana in the world (Fig 1).

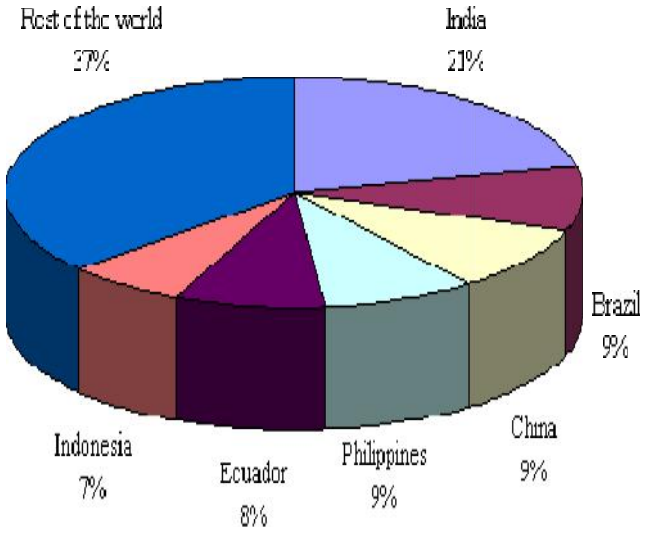

Figure 1: Distribution of the world banana production.

Traditional (cultural) Medicinal uses of bananas

Ranking of food items as per their consumption in the country puts banana in the fourth place after rice, wheat and milk.

- Bananas help in treating some emotional and bodily sicknesses. They contain tryptophan, which is an essential amino acid required in the production of serotonin, which helps a person relax, improve overall mood and feel happy. This indirectly shows that bananas help in increasing the synthesis of serotonin thereby, curing depression.
- Bananas contain high amounts of iron, which helps stimulate the production of hemoglobin in the blood. So, they can be used in cases of anemia, which is a condition caused due to lack of or low levels of iron in the body.
- Food and Drug Administration (FDA) has also confirmed the importance of bananas in reducing the risk of blood pressure and stroke due to its high potassium and low salt content.
- Bananas also contain Vitamin B_6 that helps alleviate symptoms of Pre – Menstrual Syndrome.
- Eating a banana between meals can help reduce morning sickness because it stabilizes sugar levels and provides the necessary vitamins required by the mother and the developing fetus.
- In folklore, the banana plant because of its continuous reproduction is regarded by Hindus as a symbol of fertility and prosperity, and the leaves and fruits are deposited on doorsteps of houses where marriages are taking place.
- A banana plant is often installed in the corner of a rice field as a protective charm.
- Malay women bathe with a decoction of banana leaves for 15 days after childbirth.
- Early Hawaiians used a young plant as a truce flag in wars.
- Studies have also verified that banana helps in fighting hangovers, constipation, heartburn, mosquito bites, stress, ulcers, and temperature control.
- In most of the Hindu temples and functions bananas are distributed to devotees and visitors respectively at end.

Anti Diabetic Activity of Bananas

A study by Kaimal S *et al* [6] showed that ethanol extract of mature green fruits of *Musa* AAA (Chenkadali) has antioxidant and hypolipidaemic properties and may be used for treating diabetes mellitus.L. Pari and J. Umamaheswari, [7] showed

that banana flower extract has anti-hyperglycaemic action. Ble-Castillo JL *et al* [8] studied the effects of native banana starch (NBS) and soy milk (control) on body weight and insulin sensitivity in obese type 2 diabetics by making the subjects undertake two phases of 4-week supplementation either with NBS or soy milk. It was observed that patients on NBS lost more body weight than when they were on control treatment. Also, plasma insulin and HOMA-I were reduced after NBS consumption. These results support the use of NBS as part of dietary fiber supplementation.

S. No	Cultivar	Names in different states
1.	Giant Cavendish (Robusta)	A.P. – Pedda Pacha Arati; T.N. – Robusta; W.B. – Bengali Jahaji; Mah – Harichal;
2.	Dwarf Cavendish	A.P. – Vamanakeli; T.N. – Pacha Vazhai; Mah – Basrai; W.B. – Kabuli;
3.	Poovan	A.P. – Karpura Chakkarakeli; T.N. – Poovan; Kar- Mysore; Kerala – Palayankodan; W.B., Bihar – Champa; Mah – Lal Velchi;
4.	Chakkarakeli	A.P. – Chakkarakeli; kar – Raja Bale; T.N. – Then Kadali; Kerala – Chakkara Kadali
5.	Rasthali	A.P. – Amruthapani; Kar – Rasa Bale; T.N. – Rasthali; W.B. – Martaman; Mah – Mutheli;
6.	Nendran	Kerala – Nendran; Mah – Rajeli
7.	Bontha	A.P. – Bontha; Kar – Madhuranga Bale; W.B. – Kanch Kela; Mah – Khasli, Basket
8.	Kunnan	Kar – Jirige Bale; Kerala – Kunnan; Orissa – Patti Mokiri

Table 2: Edible Banana cultivars in India

Ojewole JA and Adewunmi CO [9] evaluated the hypoglycemic effect of methanolic extract of mature, green fruits of *Musa paradisiaca* in normal (normoglycemic) and streptozotocin-treated, diabetic (hyperglycemic) mice. The findings of this experimental study indicated that the *Musa* extract possesses hypoglycemic activity, and thus lends credence to the suggested folkloric use of the plant in the management and/or control of adult-onset, type-2 diabetes mellitus. Salau *et al* [10] investigated the effect of methanolic extract of *Musa sapientum* Linn. sucker on fasting blood glucose, body weight and pancreas histology of alloxan induced hyper-glyceamic rats. It was observed that the extract at all tested doses significantly lowered fasting blood glucose level in the treated rats, it was efficient in reducing blood glucose level, improving body weight and rejuvenating the damaged pancreas of alloxan induced diabetic rats. Thus the potential use of the methanolic extract of *Musa sapientum* sucker in ethnomedical practice for diabetic management and possibly the curative properties at a dose of 10 mg kg-1 body weight per day was confirmed.

Antihypertensive, Antilipemic and Antioxidant activity of Bananas

Sarkar C *et al [11]* tested the effect of banana on cold stress induced hypertension, peak expiratory flow rate and plasma ACE activity in healthy human volunteers. The property of banana of decreasing blood pressure during cold stress may be utilized in clinical situations, and banana may be used with benefit as an adjuvant in hypertension therapy. Jo S and Megawati R [12] reported that consumption of one pisang ambon banana per day for a week lowered blood pressure in women with cold stress induced hypertension. Rao N.M *et al [13]* investigated ripened and unripened 'Nendran', 'Rasthali', 'Poovan', 'Robusta', 'Bontha' and 'Safed Velchi' bananas for inhibition against angiotensin converting enzyme (ACE). The result was that inhibition of ACE by different ripened banana cultivars was much more than that of unripened banana cultivars.

Parmar HS and Kar A [14] investigated the effects of *Musa paradisiaca* peel extracts on tissue lipid peroxidation (LPO) and on the concentration of thyroid hormones, insulin, and glucose in male rats. . The findings of this study revealed the hitherto unknown potential of the tested peel extracts in the regulation of thyroid function and glucose metabolism.

Yin X *et al [15]* studied the effects of a single banana meal on plasma lipids and lipoprotein profile, plasma oxidative stress and susceptibility of LDL to oxidation and concluded that the consumption of banana reduced the plasma oxidative

stress and enhanced the resistance to oxidative modification of LDL.

Antimicrobial activity of ripened and unripened Bananas

Scott *et al*, [16] presented the partial antibiotic spectrum of extracts obtained from the pulp and skins of green, naturally ripened, and ethylene-ripened bananas, and from banana leaves and petioles by means of solvent extracts (aqueous, methanol and petroleum-ether). Antifungal activity was exhibited by all extracts. Very little, if any, measurable antibacterial activity in either the pulp or skins of green bananas was detected, but there was appreciable antibacterial activity in the pulp and skins of ripe bananas. Mokbel *et al* [17] evaluated the fresh green and yellow banana peel of (*Musa*, cv. Cavendish) (chloroform and ethyl acetate) extracts. The ethyl acetate and water soluble fractions of green peel displayed high antimicrobial and antioxidant activity, respectively. The investigation was undertaken to evaluate the antioxidant and antibacterial power of banana fruit peel. Ethyl acetate extract of green banana peel recorded significant antimicrobial activities, while yellow peel extracts recorded low activity and no activity was recorded to chloroform and water extracts as measured by paper disk methods

CS Alisi *et al [1*8] prepared aqueous extract from the unripe fruit peels (called the bark) and leaves of *Musa paradisiaca* var sapientum and tested it for inhibition of dehydrogenase activity in pathogenic bacteria like *Staphylococcus* and *Pseudomonas* species. The bark and leaves of *M. paradisiaca* could be an available source of raw material for the production of chemotherapeutic agents against pathogenic bacteria

Fagbemi *et al*' [19] investigation on the potency of unripe banana (*Musa sapientum* L.), was carried out against pathogens. The antimicrobial activity of these plants was examined using different solvents (ethanol and water) and efficacy was compared. All ethanolic extracts of unripe banana had antimicrobial activity. Under the conditions employed, all the test samples had potent inhibitory effects on the group of bacteria tested. Unripe banana (ethanolic extract) showed a high antimicrobial activity against all test organisms. For the aqueous extracts, only unripe banana had good antimicrobial activity against five organisms. In this study, it was observed that the potency of unripe banana was enhanced by the type of solvent used, indicating that some of the active materials in these medicinal plants dissolve well in ethanol than in water. Unripe banana had more antibacterial activity when used with the two different solvents (ethanol and water)

Jyothirmayi *et al* [20-23] studied the antibacterial activity of aqueous, ethanolic, methanolic and hexane extracts of fruit pulp of local varieties of unripened and ripened Amruthapani, Bontha and Chakkarakeli bananas. Minimum Inhibitory Concentration (MIC) values of the extracts and bioactive phytochemicals by qualitative tests and GC-MS method were determined. The antibacterial activities of aqueous and solvent extracts of ripened and unripened bananas were evaluated using the Kirby-Bauer method against *Bacillus cereus, Escherichia coli, Micrococcus flavus* and *Pseudomonas aeruginosa.* The extracts exhibited significant antimicrobial activity. Of the different extracts from the cultivars tested, ethanolic extracts showed maximum activity (in terms of zone of inhibition) against all the test organisms followed by methanolic, hexane and aqueous extracts. Low MIC values of ethanolic extracts of ripened bananas indicate that ripened bananas are more potent against the test organisms.

Phytochemical screening of these extracts by qualitative tests revealed the presence of flavonoids, terpenoids and alkaloids, phenols and esters. Furthermore, analysis of these extracts by GC-MS method indicated presence of phenols, aldehydes, ketones, alkaloids, terpenes, alkanes, esters, furans, sugars, sulfur-containing organic compounds, nitrosamines and pyrimidines. Since alkaloids, aldehydes, ketones, alkaloids, terpenes and phenols have antibacterial effects, antimicrobial activity of unripened and ripened Amruthapani, Bontha and Chakkarakeli bananas (Musa plants) may be due to the presence of these compounds.

Antiviral and Antifungal Activities of Bananas

Swanson MD *et al* [24] isolated BanLec, a jacalin-related lectin from the fruit of bananas, *Musa acuminata*. This lectin has the property of binding to high mannose carbohydrate structures including, those found on viruses. The tests carried out indicated that BanLec is a potential component for an anti-viral microbicide that could be used to prevent the sexual transmission of HIV-1.

Ho VS and Ng TB [25] isolated two proteins with N-terminal sequence homology to chitinases from fruits of the emperor banana and showed that both the proteins exhibited inhibition of mycelial growth. i.e, antifungal activity.

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Martins, F. O *et al [*26] evaluated the antiviral (simple human herpesvirus type 1 and simple human herpesvirus type 2) activity of extracts and fractions of *Musa acuminata* Colla. The results indicated that the tested extracts of *M. acuminata* could be potential target for use in antiviral therapy.

Anti ulcer and Anti Diarrhoreal activity of Bananas

Lewis DA *et al [27]* dried and extracted the active anti-ulcerogenic ingredient from unripe plantain banana by solvent fractionation and identified it as leucocyanidin which has a protective effect against aspirin-induced erosions. Agarwal PK *et al [*28] undertook the present work with plantain banana (*M. sapientum* var. paradisiaca, MS) with the premise that the drug promoting ulcer healing could have effect on wound healing. Both aqueous and methanolic extracts when studied for incision and dead space wounds parameters showed good safety profile. Plantain banana thus, favored wound healing which could be due to its antioxidant effect and on various wound healing biochemical parameters.

Rao NM [29] found that the proteolysis of casein by trypsin, chymotrypsin and papain was inhibited by ripened and unripened bontha, poovan, nendran, cavendish and rasthali bananas. The probable role of unripened banana papain inhibitors in curing stomach ulcers was discussed.

Goel *et al* [30] explored the ulcer protective and healing effects of unripe plantain banana (dried plantain banana pulp powder). It was reported from their study that dried plantain banana pulp powder is a potent herbal drug for the treatment of peptic ulcer disease Rabbani GH *et al* [31] studied the effectiveness of green banana in the home management of acute or prolonged diarrhea at the community level and reported that a green banana-supplemented diet hastened recovery of acute and prolonged childhood diarrhea.

Rabbani GH *et al [32]* studied therapeutic effects of mature Green Banana in childhood shigellosis by determining colonic fatty acid production in a double-blind, randomized, controlled, clinical trial. Mature green banana (GB) fruit is rich in amylase-resistant starch that stimulates colonic production of short-chain fatty acids and is useful in treating diarrheal diseases. The conclusion was that green banana diet improved clinical severity in childhood shigellosis and could be a simple and useful adjunct for dietary management of this illness.

Agarwal *et al* [28] observation confirms the potential use of the methanolic extract of *Musa sapientum* sucker in ethnomedical practice for diabetic management and possibly the curative properties at a dose of 10 mg kg-1 body weight per day. The results of this study indicated an important healing effect of both aqueous and methanolic extracts of dried pulp powder of mature unripe fruit of *Musa sapientum* var *paradisiaca* and their effects were comparable to Vitamin E on various physical and biochemical parameters of wound healing.

Anticancer activity of bananas

Hugo, D –P *et al* [33] studied the effect of vegetables and fruits on colorectal cancer. This study indicated that banana intake influences colorectal cancer risk. Banana consumption reduced risk for colorectal cancer. Sun J *et al* [34] study was designed to investigate the profiles of total phenolics, including both soluble free and bound forms in common fruits like Cranberry, apple, red grape, strawberry, pineapple, banana, peach, lemon, orange, pear, and grapefruit, by applying solvent extraction, base digestion, and solid-phase extraction methods along with measurement of Total antioxidant activity using the TOSC assay and anti-proliferation activities *in vitro* using HepG(2) human liver-cancer cells. This study confirmed the presence of phenols, antioxidants and anti-proliferative action of banana.

Kazi A *et al [*35] hypothesized that Cell Quest, a patented formula which contains high level of tannic acid (TA) obtained from a Musaceae (plantain) plant extract, inhibited the tumor cell proteasome activity. The present study suggested that CellQuest targets and inhibits the proteasome selectively in tumor cells, which may contribute to the claimed anticancer activity. Rashidkhani,B P and Lindblad A W [36] reported that consumption of banana was associated with low risk of renal cell carcinoma which represents majority of all cancers of kidney.

A methanol extract of banana peel (BPEx) was shown by Akamine K *et al [37]* to significantly suppress the re-growth of ventral prostates and seminal vesicles induced by testosterone in castrated mice. Further studies in the human prostate cancer cell line showed that BPEx inhibited testosterone-induced cell growth. These results indicated that methanol extract of banana peel can inhibit 5alpha-reductase and might be useful in the treatment of benign prostate hyperplasia.

Andrade CU *et al [*38] carried out a study of the mutagenic potential of the *Musa paradisiaca* fruit peel extract was assessed by the single-cell gel electrophoresis (SCGE) and micronucleus assays. The data obtained from the study indicated that fruit peel extract from *M. paradisiaca* showed mutagenic effect in the peripheral blood cells of Swiss albino

mice. Zhang C X et al [39] studied the influence of banana fruit intake on breast cancer risk. The onclusion was that greater intake of banana was associated with reduced risk of breast cancer in women.

Cheung AH *et al [4*0] isolated a homodimeric, fructose-binding lectin from Del Monte bananas by using a protocol that involved ion-exchange chromatography and gel filtration. The lectin showed hemagglutinating activity which was stable up to 80 degrees C and also stable in the range pH 1-13. The lectin was capable of fructose-binding activity and cytokine-inducing activity. It was concluded that it could be possible for developing the banana lectin into a useful anti-HIV, immunopotentiating and antitumor agent in view of its trypsin stability and thermostability.

Banana in neurological diseases

Heo H J *et al* [41] studied the effect of banana fruit extracts in protecting neuronal cells from oxidative stress induced neurotoxicity. Results of this study suggest banana reduces risk of oxidative stress induced neurodegenerative disease like Alzheimers disease.

Banana use in urolithiasis

Poonguzali P K and Cheju H [42] found that banana stem extract was useful in the treatment of urolithiasis and kidney stones. In hyperoxaluric induced rats banana stem extract reduced excretion of urinary oxalates.

Banana in apoptosis

Cell quest a patented banana product showed induction of apoptosis in tumor cells which resulted in tumor cell growth arrest. Apoptoic changes observed in tumor cells treated with cell quest were PARP cleavage and increased caspase -3 activity[35] .Banana flower extract induced apoptic death of ovarian cancer He LA cells [43] . Activation of apoptic enzyme caspase -9 by banana flower extract fraction caused apoptic death of He La cells.

Banana in cell cycle

Timsina B and Nadumane V K [43] studied the effect of banana flower extract on cell cycle kinetics of He La cells *in vitro*. In presence of banana flower extract there were few He La cells in S and G2/M phase due to inhibition of cell cycle.

Bananas in surgical dressing and anaesthesia

Wanitphakdeedecha R *et al [44]* studied the usage of banana as a surgery training model to refine blade control for Mohs layer removal and skin incisions. Gerstle RK [45] made a study of the usage of Bananas and beans as simulation models for training in trigger point injection i.e. a technique used in pain management that involves placing a needle into the trigger point and subsequent injection into the trigger point of a local anaesthetic, a corticosteroid or saline.

Gore MA and Akolekar D [46] in their search for new dressing material for partial thickness burn wounds developed the banana leaf dressing (BLD) and compared its results with that of boiled potato peel bandage (BPPB). After analysis of the results, the use of banana leaf dressing for all partial thickness burn wounds in our environment was strongly recommended.

Gore MA and Akolekar D. [47] conducted a trial to compare efficacy of BLD with vaseline gauze (VG) dressing used by majority of burns centers for dressing skin graft donor areas. The study clearly indicated that BLD is a completely non-adherent and painless dressing and it was recommended that BLD be used for all skin graft donor areas.

Suvarna *et al* [48] studied the analgesic activity of aqueous and ethanolic extract of stem of *Musa sapientum* Linn. using hot plate method and tail immersion method and concluded that aqueous and ethanol extract of stem of *Musa sapientum* Linn. Possess potential analgesic activity which can be explored further.

Bananas in Food and Pharmaceuticals

Rao NM [49] found inhibitors of Cysteine proteases in ripened and unripened banana (*Musa paradisiaca)* extracts.Ripe and unripe banana extracts showed papain, bromelein and subtilisin caseinolytic inhibition.

Karthikeyan A and Sivakumar N [50] showed that peels of banana (*Musa acuminata*) could be used as alternative, novel and economical substrates for the production of citric acid using *Aspergillus niger*.

Ramli S *et al [51]* made a study that described the utilization of banana--Cavendish (*Musa acuminata* L., cv cavendshii) and Dream (*Musa acuminata* colla. AAA, cv 'Berangan')--pulp and peel flours as functional ingredients in yellow alkaline noodles. The conclusion was that banana pulp and peel flour could be useful for controlling starch hydrolysis of yellow noodles.

Carvalho GB *et al [52]* concluded that banana, being rich in carbohydrates and minerals and providing low acidity, may well be used as an adjunct in brewing methods, helping in the development of new products as well as in obtaining concentrated worts.

Juarez-Garcia E *et al [53]* obtained Banana flour (BF) from unripe banana (*Musa paradisiaca*

L.). Experimental bread was formulated with BF flour and the product was studied regarding chemical composition, available starch (AS), resistant starch (RS) and rate of starch digestion *in vitro*. BF bread had higher protein and total starch content than control bread. Results revealed BF as a potential ingredient for bakery products containing slowly digestible carbohydrates.

Bello-Perez LA *et al [54]* isolated maltodextrin from banana starch and saccharified it to obtain glucose syrup. Chemical characteristics of this banana glucose syrup were compared with those of commercial syrup obtaining similar results. Thus, it was concluded that banana starch may be used to obtain maltodextrins and glucose syrups with similar chemical characteristics of those obtained from maize starch, with special emphasis on the color of banana maltodextrin which is adequate for its use in food products.

Gebre-Mariam T and Nikolayev AS [55] evaluated the binding and disintegrant properties of starch obtained from *Ensete ventricosum* Musaceae. The effect of the starch was compared with tablets prepared with potato starch. The results showed that *Ensete* starch can be used both as a tablet binder and disintegrant and the indication is that *Ensete* starch has a better binding ability and less disintegrating power than potato starch.

Banana in Nanomedicine

Bankar A *et al* [56] synthesized Gold nano-particles by using banana peel extract (BPE) as a simple, non-toxic, eco-friendly 'green material'. Further studies carried out indicated efficient antimicrobial activity by the BPE mediated nano-particles towards most of the tested fungal and bacterial cultures like *Candida albicans* BX, *C. albicans* BH, *Shigella* sp., *Enterobacter aerogenes*, *Klebsiella* sp. and *Pseudomonas aeruginosa*.

Ibrahim M M H [57] synthesized silver nanoparticles using banana peel extract which showed anti microbial activity against pathogenic B.*Subtilis*, S. *Aureus*, P.*Aeruginosa*, C.*Albicanus* and E.*Coli*.organisms.

Bananas in Pollution Control

Salman JM and Hameed BH [58] prepared activated carbon from banana stalks (BSAC) waste and used it to remove the insecticide carbofuran from aqueous solutions. The results of this study indicated that the BSAC has good regeneration and reusability characteristics and could be used as alternative to present commercial activated carbon.

The study of Memon JR *et al [5*9] described the use of banana peel, a commonly produced fruit waste, for the removal of Cr (VI) from industrial wastewater.

Achak M *et al [6*0] determined the potential of application of banana peel as a biosorbent for removing phenolic compounds from olive mill wastewaters. The results showed that the increase in the banana peel dosage and the pH to above neutrality increased the phenolic compounds adsorption rates and capacity and the opposite (Desorption) happened at low pH value. These results indicated clearly the efficiency of banana peel as a low-cost solution for olive mill wastewaters treatment and gave some preliminary elements for the comprehension of the interactions between banana peel as a bio-adsorbent and the very polluting compounds from the olive oil industry.

Sonawane GH and Shrivastava VS [61] showed that an adsorbent prepared from *Musa paradisica* leaves--a low cost bioadsorbent, could be successfully used to remove methylene blue from an aqueous solution in batch study.

Conclusion

Globally banana plant and its various parts are consumed as part of food and used in traditional medicine for treatment of several diseases. Several finding suggest that various parts of banana can cure many diseases and useful in other areas also. Further studies are required to characterize effective molecules which serve as novel food medicines in future.

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