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Medicinal benefits of *Musa paradisiaca* (Banana)

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Abstract
Banana is one of the earliest crops cultivated by man and still remains as the staple food crop for millions of people in tropical world. It constitutes an important component of the diet of rural and working class people, as the fourth important global commodity in terms of gross value of producer after rice, wheat and maize/milk products and an important source of high calorific energy. It is not only a rich source of easily digestible carbohydrate but also provides essential vitamin B, C and several minerals such as potassium, calcium and magnesium and several medicinal properties.

Keywords: *musa paradisiaca,* lignocelluloses, healing of wounds, cytostatic drugs

1. Introduction
Banana plant, often erroneously referred to as a tree, is the largest herbaceous flowering plant [1]. The parts of banana plant grow from a fleshy rhizome, usually called 'corm'. Plants are, generally, tall and fairly sturdy. Interestingly, what appears to be a stem is, actually, a pseudo-stem. It is a cylinder of leaf-petiole sheaths arising from a corm. The leaves of banana plants are composed of a stalk (petiole) and a blade (lamina). The base of the petiole widens to form a sheath; the tightly packed sheaths make up the pseudo-stem which is all that supports the plant. The edges of the sheath come together, when it is first produced, making it tubular. With growth taking place at the centre of the pseudo-stem, the edges get separated. Suckers spring up around the main plant forming a clump, the oldest sucker replacing the main plant when it dies.

Generally, they are around 5 m (16 ft) tall, ranging from 'Dwarf Cavendish' plants at around 3 m (10 ft) to 'Gros Michel' at 7 m (23 ft) or more [2]. Leaves are spiral and may grow 2.7 metres (8.9 ft) long and 60 cm (2.0 ft) wide. When a banana plant is mature, the corm stops producing new leaves and begins to form a flower spike or inflorescence. Stem grows up inside the pseudo-stem carrying the immature inflorescence to the top [3]. Each pseudo-stem, normally, produces a single inflorescence which is known as the *banana heart*. The inflorescence contains many bracts (sometimes, incorrectly, called petals) between rows of flowers. The female flowers (which can develop into fruit) appear in rows further up the stem (closer to the leaves) from the rows of male flowers. The ovary is at the bottom which means that the tiny petals and other parts appear at the tip of the ovary [4].

Banana, developed from the banana heart in a large hanging cluster, is made up of tiers (called 'hands') with up to 20 fruits in a tier. The hanging cluster [5], known as a bunch, comprising of 3–20 tiers is called 'banana stem' weighing between 30 and 50 kg [6]. The average weight of banana fruit (commonly known as a banana or 'finger') is 125 g. The fruit has been described as a 'leathery berry' [7]. There is a protective outer layer (a peel or skin) with numerous long, thin strings (the phloem bundles) which run lengthwise between skin and edible inner part [8].

2. Classification of Banana plant
Banana belongs to *plantae* kingdom. Carolus Linnaeus (1707-1778), a Swede, classified banana as follows.

Kingdom	:	*Plantae*
Division	:	*Angiosperms*
Order	:	*Zingiberales*
Family	:	*Musaceae*
Genus	:	*Musa*

Linnaeus, initially, classified banana into two species based on the pattern of consumption: *Musa sapientum* for dessert and *Musa paradisiaca* for plantains [9]. Subsequently, more species were added. However, this simplistic classification was inadequate to address the sheer number of cultivars existing in the primary centre of diversity of the genus, South East Asia [10]. The classification is based on chromosome numbers and morphological characters which is widely accepted by most of the taxonomists. Such a classification has resulted in *Musa* genus being split into four sections; *Australimusa*, *Callimusa*, *Eumusa*, and *Rhodochlamys*. Majority of species in the section *Callimusa* and *Rhodochlamys* are only ornamental plants.

3. Chemical composition of different morphological parts of banana plant
Banana is the second largest produced fruit after citrus, contributing to about 16% of the world's total fruit production. Peel is rich in vitamins, sugar, pectin, and lignin and can be used as cattle feed and base material for biogas and alcohol production and for protein extraction. Leaf is a good source of lignocellulose and has varieties of uses from feed to wrapping of food product and even as roofing material in banana growing places. Fibre obtained from pseudo-stem can be utilised as bio-degradable binding ropes. Pith can be used as colour absorber and food after properly processed. Apart from starch, juice too has nutraceutical properties and has potential use in pharmaceutical industry. The general chemical composition of different morphological parts of banana is presented in table 1. below.

Table 1: Elemental composition of ashes from banana plant fractions (% of ash content)

Element	Petioles/ midrib	Leaf blades	Floral stalk	Leaf sheaths	Rachis
Si	7.0	24.9	7.8	2.7	1.2
Ca	32.3	8.0	0.6	5.5	0.6
K	9.4	11.6	23.1	21.4	28.0
P	0.7	0.7	0.7	0.9	1.7
Mg	2.9	1.1	0.5	1.9	0.3

4. Nutritional value of banana

Banana, a tropical fruit with high calorie, provides exceptional nutrition in different forms. Potassium, an important component of cell and body fluids, supports muscles and nerves. It controls heart beat and blood pressure. It also counters the bad effects of sodium. Further, it lowers triglyceride. It is triglyceride which causes the accumulation of harmful cholesterol. It is a very good source of antioxidants, vitamin C and vitamin B6 in addition to manganese [11] and other minerals. Magnesium is essential for strong bone and has a cardiac protective role. Manganese is used by body as a co-factor for anti-oxidant enzyme, superoxide dismutase. Copper is required in the production of red blood cells.

Depending upon cultivar and ripeness, the flesh can vary in taste from starchy to sweet, and in texture from firm to mushy. Both the skin and the inner parts are edible either raw or cooked. Banana contains prebiotics which supports useful bacteria inside our intestine. In spite of sweetness, banana is low on glycemic index. Consequently, it results in moderate impact on sugar level in blood. The nutritional value of banana is furnished below in table 2.

Table 2: The nutritional value of banana

Nutritive value per 100 g			
Principle		**Nutrient Value**	**Recommended Daily Allowance**
Energy		90 kcal	4.5%
Carbohydrates		22.84 g	18%
Protein		1.09g	2%
Total Fat		0.33 mg	1%
Cholesterol		0 mg	0%
Dietary Fiber		260 mg	7%
Vitamins	Folates	20 µg	5%
	Niacin	0.66 mg	4%
	Pantothenic acid	0.33 mg	7%
	Pyridoxine	0.36 mg	28%
	Riboflavin	0.07 mg	5%
	Thiamin	0.031 mg	2%
	Vitamin A	64 IU	2%
	Vitamin C	8.7 mg	15%
	Vitamin E	0.10 mg	1%
	Vitamin K	0.5 µg	1%
Electrolytes	Sodium	1 mg	0%
	Potassium	358 mg	8%
Minerals	Calcium	5 mg	0.5%
	Copper	0.07 mg	8%
	Iron	0.26 mg	2%
	Magnesium	27 mg	7%
	Manganese	0.27 mg	13%
	Phosphorus	22 mg	3%
	Selenium	1.0 µg	2%
	Zinc	0.15 mg	1%
Phyto-Nutrients	Carotene-α	25 µg	--
	Carotene-β	26 µg	--
	Lutein-zeaxanthin	22 µg	--

Banana plant | Bunch of banana with flower | Banana plant pseudo-stem | Banana fruit

Fig 1: Different parts of the Banana plant

- Banana is rich in fructose and sucrose. It replenishes energy and revitalises the body instantly. Therefore banana is most useful for athletes. It also supplements food in the treatment plan for underweight children. A good amount of soluble dietary fiber helps normal bowel movements (Fig.1).
- It is a moderate source of vitamin-C, health promoting flavonoid, and poly-phenolic antioxidants such as lutein and zeaxanthin. It contains β- and α-carotenes in small quantity. These compounds help acting as protective scavengers and neutralise oxygen-derived free radicals and reactive oxygen species (ROS). They play a decisive role in retarding ageing and various disease processes.
- It is also a very good source of vitamin-B6 (pyridoxine). Pyridoxine is an important B-complex vitamin. It plays a supportive role in the treatment of neuritis and anemia. Moreover, it helps to decrease homocystine (one of the causative factors in coronary artery disease (CHD) and stroke episodes) level inside body.

Apart from these advantages, banana acts as a brain tonic and helps to boost memory power. It helps to overcome morning sickness and heart burn. Ripe banana is an ideal food for infants. Face mask of mashed ripe banana helps to rejuvenate skin and prevent formation of wrinkles. It helps to provide

required vitamins and minerals to smokers who want to quit smoking. The craving for nicotine is reduced by its consumption.

Banana calms nervous system; reduces stress and depression. According to a recent survey undertaken by MINDS - an NGO that imparts educational programmes on mental health and medical treatment services in rural India - many people, suffering from depression, felt much better after eating banana. This happens because banana contains tryptophan, a type of protein which is converted by the body into serotonin, known to make us feel relaxed, improve mood and generally make us feel happier [12].

Full ripe banana with yellow skin and dark spots on it is eight times more effective in enhancing production and efficacy of white blood cells than the green skin version and its level of antioxidants also increases along with ripeness. These antioxidants protect the body against cancer and heart diseases. According to research conducted by a team of Japanese scientists, the above mentioned variety produces a substance called Tumour Necrosis Factor -α (TNF-α. This is a multifunctional cytokine, playing a key role in apoptosis and cell survival as well as in inflammation and immunity acting synergistically with cytostatic drugs. It has the ability to combat abnormal cells. The research further revealed that the effect of banana was comparable to that of lentinan, an immune-stimulant which is intravenously administered as an anti-cancer agent. Rich level of dopamine, an anti-oxidant as well, significantly reduces gastric ulcers. Dried unripe plantain is anti-ulcerogenic and works against aspirin- induced ulceration in rat and were equally effective as a prophylactic treatment and in curing ulcers already induced by aspirin [13]. Banana fruit is an ideal food for weaning mothers and infants. Along with dietary fibres, proteins and unsaturated fatty acids, banana flowers are also rich in vitamin E and flavonoids. The following are the therapeutic benefits of banana flower.

5. Infections

Ethanol-based extracts of banana flower retards the growth of pathogenic bacteria such as *bacillus subtalis*, *bacillus cereus*, and *escherichia coli*. Thereby it accelerates the process of healing of wounds and also prevents infection. Ethyl acetate extracts of banana flower may also inhibit the growth of the malarial parasite *plasmodiumfalciparum in vitro*.

6. Diabetes

Banana is widely used in Indian system of medicine for the treatment of diabetes mellitus. The antihyperglycemic activity of banana was proved when oral administration of the chloroform extract of the *Musa sapientum* flowers of 0.15, 0.20 and 0.25 g/kg body weight for a duration of thirty days resulted in significant reduction in blood glucose and glycosylated haemoglobin and an increase in total haemoglobin [14].

7. Antioxidant activity

Methanol extracts of banana flowers possess antioxidant properties. Hence they neutralise free radicals which were formed as a result of various metabolic processes in the body. If free radicals are not neutralised, then their unstable electrons react with DNA and proteins of human cells and alter their properties. This can also lead to serious problems like cancer, heart disease, etc.

8. Menstrual bleeding

Consumption of one cooked banana flower with one cup of curd or yogurt is the most effective treatment for excessive bleeding during menstruation. This combination increases the level of progesterone in the body and thereby reduces bleeding associated with menorrhagia.

9. Banana leaves

The flower, stem and the juice of green banana leaves are equally useful. Banana plant and banana leaves are not only food for elephant and other animals but also are of incredible medicinal value for human being. Banana leaves, at their tender stage, can be used to make poultice for treating burns and astringent ashes of unripe peel and leaves are effective for preventing the growth of malignant ulcers and are suitable to treat diarrhoea and dysentery. The juice of banana leaf is useful in case of cough, cold, breathing problem, dropsy constipation, dysentery, acidity, high BP, blood disorder or poisoning and also for liver problem. The consumption of half cup of the juice of green leaf every morning, without use of sweetener or salt, will prevent various diseases (i.e. Bronchitis, Nephritis, T.B, pleurisy). It purifies blood and is used as topical for chest pains. The chlorophyll in banana leaves protect us from intestinal ulcer, leukaemia and skin diseases.

10. Pseudo-stem

The inner part of tender pseudo-stem is edible and has many medicinal properties as well. Pseudo-stem is fibrous and is highly beneficial for those who are on a weight-loss programme. It is also a rich source of potassium and vitamin B6 which helps in the production of insulin and haemoglobin. If it is consumed once in a week, it keeps high blood pressure under control. It also maintains fluid balance within the body. It is a diuretic and helps to detoxify the body. The core of the pseudo-stem is believed to be useful for stomach disorder and diabetes. The extract of the same is considered to be useful in dissolving the stones in kidney and urinary bladder. The inflorescence mixed with coconut oil and spices is used for flushing the urinary blocks.

11. Banana peel

Banana peel has been credited with various medicinal uses. It is anti-inflammatory, anti-pruritic and antimicrobial. It will, apparently, relieve pain and swelling due to insect bites and plant stings.

12. Banana corm

The juice of the corms is used as antituberculars. The sap is vulnerary and it is used in the treatment of gonorrhoea. The juice from the corm is used to treat and also to help reduce the effects of jaundice [15].

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