



Health benefits of banana (Musa)- A review study

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Abstract

Banana is a very delicious and nutritious fruit, economically more affordable in all over the world for all age groups from the Musaceae family. It belongs to the genus Musa. Banana is easily digestible, have low fat, sufficient amount of minerals and vitamins therefore used in special diets as for babies, patient having stomach disorders, arthritis. Every part of banana plant has specific health benefits, used to treat and prevent different diseases like cancer, ulcer, Alzheimer's disease, infection, diarrhea, hemorrhoids, diabetes, and hypertension due to its antifungal, antibiotic, antimicrobial, antidiabetic, antioxidant, and anti-inflammatory properties. The unripe banana cooked form called plantains used as vegetable in some countries, useful for ulcer and digestive disorder. The leaves of banana plant are used for skin allergies, skin burns and flower of banana for bronchitis, diabetes, insect's bites. The peel and pulp have dopamine, norepinephrine, serotonin which is effective for the smoothness of muscles of intestine and vitamin c of banana peel helps to get rid from free radical and protect the body from disease attack. The purpose of writing this review article to study the benefits of nutrients present in banana like phenols, flavonoids, phytochemicals, potassium, vitamins, fiber on human health.

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Introduction

Plants are the natural source of drugs and food products used in all over the world, plants itself and its derivatives are safer in use and have no harmful effects (Calberto *et al.*, 2015). That's the reason the plants and its derivatives are used as or in the production of medicine globally (Serafino *et al.*, 2008). Medicine based research helps to know the value of the plants and the amount of active ingredients present in it (Williamson, Liu, & Izzo, 2020). The daily consumption of Fruits can lower the risk of some diseases like diabetes, hypertension, cancer, gastric problems etc. ulcers that's the reason of the addition of fruits as important ingredient in a healthy diet (Rakotoniaina, 2018).

Banana is mostly consumed by the people globally due to its low price and affordable for everyone (Amri, Hossain, & Sciences, 2018; Rodriguez-Amaya & Analysis, 2010). It is cultivated in all over the world about almost 130 countries, mostly in the tropical and subtropical regions and Asia is the center of origin from South-East. Cost-effectively, banana is the fifth agricultural food cultivated in world trade, after cereals, cacao, coffee and sugar and it is an essential fruit crop in the world other than grapes, apples and citrus fruits (Aurore, Parfait, Fahrasmane, & Technology, 2009). Only 20% of banana yield is exported to other countries while the rest are consumed by countries where they are grown. The major countries which are exporters of banana is Ecuador and USA in the world (Tubiello *et al.*, 2013)

Banana fruit consist of two parts: pulp and peel. Peel is about 40% of total weight of the banana and main by-product of fruit. In past before the researches have begun banana peel is dumped into waste, contributing as massive amount of organic material considering it has no useful benefits. Later on the composition of banana peel is studied and found that it has many beneficial activities and used in many applications (Agama-Acevedo *et al.*, 2009). Banana pulp is the edible portion of the fruit and has a large amount of nutrition composition. Researchers has studied the vast variety of biologically active components found in banana pulp that can be extracted or isolated for the

enrichment of food for health purposes such as different types of starch and cellulose (Khoozani, Birch, Bekhit, & technology, 2019)

The main reason to study health benefits of banana to elaborate the need of consumption of banana in daily dietary practices, as it contains many bioactive substances like phytosterols, phenolics, biogenic amines, carotenoids which are highly required in daily diet as they have many beneficial and healthy effects on human well-being. Most of these substances have antioxidant properties and are required for protecting the body against various free radical stress. (Singh, Singh, Kaur, & Singh, 2016)

Nutritional value of banana

Bananas are good source of potassium as well as also an excellent source of vitamins

A, B6, C, and D. Banana is also known as supplementary staple food because 100 grams of fully ripe banana provides approx. 116 Kcal energy. Banana contains about 20% sugar (K. S. Kumar, Bhowmik, Duraivel, Umadevi, & Phytochemistry, 2012).

Table 1. Nutritional composition of 100 gram of banana (Pereira & Maraschin, 2015).

Banana Quantity	100g
Fat	0.33g
Protein	1.09g
Dietary fiber	2.6g
Sugar	12.23g
Energy	89kcal
Carbohydrates	22.8g
Phosphorus	22mg
Thiamin (Vit. B1)	0.031mg
Iron	0.26mg
Vitamin C	8.7 mg
Pantothenic acid (B5)	0.334mg
Vitamin B6	0.367mg
Zinc	0.15mg
Niacin (Vit. B3)	0.665mg
Calcium	5mg
Riboflavin (Vit. B2)	0.073mg
Magnesium	27mg
Vitamin A	3 µg
Potassium	358mg
Folate (Vit. B9)	20 µg

There are the caloric content of some banana according to their sizes are given below:

- Less than six inches (extra small), 81 grams gives 72 calories.

- 6–7 inches (small size), 101 grams gives 90 calories.
- 7–8 inches (medium size), 118 grams gives 105 calories.
- 8–9 inches (large size), 136 grams gives 121 calories.
- 9 inches or longer (extra-large), 152 grams gives 135 calories.
- 1 cup (sliced form), 150 grams gives 134 calories.
- 1cup (Mashed form), 225 grams gives 200 calories (Das, 2010).

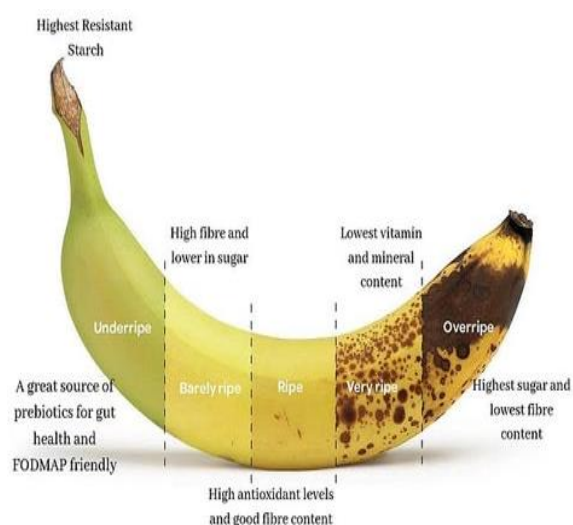




Fig. 1. Nutrients availability with stages of banana ripening.

Table 2. Comparison between consumption of green banana and yellow banana benefits.





Comparison between ripe and unripe banana	
Green Banana	Yellow Banana
	
More resistant starch	Higher GI
Helps to feel fuller for longer	Easier to digest
Lower antioxidant levels	Higher antioxidant levels
Lower sugar content	Much sweeter
Contain high amount of micronutrients	Some micronutrients loss

Nutritional benefits of Musa (Banana)

Every part of banana such as peel, leaves, banana seeds, pulp, inflorescence is utilized as food or nonfood serving compound having properties of nutraceuticals and natural fiber is source of micro and macro nutrients, biologically active ingredients, and

bio-fertilizers (Padam, Tin, Chye, Abdullah, & technology, 2014). Banana provides immediate energy and healthy nutrients (Pereira & Maraschin, 2015; Zafar, Saleha, Hoque, & Sohel, 2011) is considered as the natural source of antioxidant and functional food against the diseases etc. cancer and heart problems (Mosa & Khalil, 2015). It is a high caloric fruit and good is a rich source dietary fiber, micro-nutrients as vitamin B6, vitamin C and biotin, minerals as manganese, potassium and copper (Bhaskar, Salimath, Nandini, & Agriculture, 2011). Banana peel and leaves are used to cure the healing of burn wounds and helps to prevent the psychological illness as depression (Pereira & Maraschin, 2015). The antiallergic, antibacterial and antiulcerant properties of banana helps to improve the intestinal health against ulcer, and to treat dysentery and improve skin healing from allergy (Rao, Prasad, Jyothirmayi, & Sciences, 2012; Zafar *et al.*, 2011). It has high amount of sugar derivates , fatty acids, sterols, and esters and linoleic acid (Al-Mqbali & Hossain, 2019) which are the major substitutes of lipophilic compounds present in banana tissues contain diacylglycerols, sterylglucosides, long chain fatty alcohols, and aromatic compounds (Al-Busaidi & Forestry, 2013; Debandya, Sabyasachi, & Namrata, 2010; Oliveira, Freire, Silvestre, Cordeiro, & chemistry, 2008). To control biological function and activities some important biologically active chemical substances were found in the banana like vitamin B & C, triterpenes, oxalic acid, starch, tannin, glycosides, sulphate, phenolic derivatives, lanosterol, and α-amyrin (Aboul-Enein *et al.*, 2016; Adinarayana & Babu, 2011; Pitak, Rakshit, & technology, 2011; Tepal, 2016). The banana extracts have additive effect to reduce the risk of cancer (Al-Mqbali & Hossain, 2019; Rao *et al.*, 2012). The amount of phenolic compounds in banana peel is greater than the pulp of banana (Sulaiman *et al.*, 2011). The slow digestibility of carbohydrates present in banana made it the best choice in dietary routine (Mohapatra, Mishra, & Sutar, 2010). Potassium is the main element required to maintain the intracellular fluid of muscles and other cells. Presence of required amount of K is essential for the proper functioning of muscles, heart, blood vessels, liver, kidneys, brain cells and other organs (D'Elia, Barba, Cappuccio, & Strazzullo, 2011; He & MacGregor, 2008).

Table 3. Parts of banana plant and their health benefits.

Flower		Cooked flower of banana is useful to treat bronchitis, dysentery, ulcers and also good for diabetes patient.	(Sheng <i>et al.</i> , 2010)
Sap		The sap portion of banana treat the leprosy, fever, digestive disease, hemorrhoids, insects bites, hysteria, hemorrhage and epilepsy.	(Apostolopoulos, Antonipillai, Tangalakis, Ashton, & Stojanovska, 2017)
Seeds and roots		Used to treat the stomach ulcers, digestive disorders like heart burn, constipation, bloating, nausea and irritable bowel syndrome.	(K. S. Kumar <i>et al.</i> , 2012)
Pulp and peel		Have antioxidant, antimicrobial and antifungal properties	(Barros, 2020)

Banana peel and plantain have a high value of pectin rather than the other fruit peel (Vu, Scarlett, & Vuong, 2018). Isoamyl acetate (aromatic compound) is used to flavor the food banana taste extract from the banana peel (Ji & Srzednicki, 2013).

Health benefits of Banana

For the immediate pain relief make the paste of banana and spread it on burn wounds then cover it with bandage or banana leaf, it give cool effect to wound and boost the healing effect (Touwaide & Appetiti, 2013). The medical benefits of bananas helps to the pass stool with relief in constipation and diarrhea, in treatment of anemia and arthritis (Abe & Ohtani, 2013). Banana have large amount of soluble and non-soluble dietary fiber and phenolic compounds act as laxative during constipation (Anjum, Sundaram, & Kumar Rai, 2014). Banana has an active substance polysaccharide which is phytochemical participate beneficial role in human health (Yang *et al.*, 2019). It also have rich amount of dietary fiber which allow them to participate in a variety of nutraceutical and medicinal applications (Sundaram, Anjum, Dwivedi, Rai, & biotechnology, 2011).

Maintain kidney health

Bananas helps to maintain and build the new healthy tissues as it is abundant in calcium, nitrogen, and phosphorus, and have rich source of potassium intake (Pereira & Maraschin, 2015; Zafar *et al.*, 2011). Bananas are abundant in vital electrolytes as

magnesium and potassium which helps to promote the health of the kidney. If potassium consumes in a limited amount it can minimize the excretion of calcium which reduce of kidney stones (Shruthi, 2019).

Protect from cancer

The industry utilize the natural source of antioxidants trend made by the Consumers (Carocho, Morales, Ferreira, & Technology, 2018). Banana is a rich source of antioxidant have abundant amount of polyphenol (Septembre-Malaterre, Stanislas, Douraguia, & Gonthier, 2016; Sidhu, Zafar, & Safety, 2018). The Presence of naturally occurring antioxidants which are found in fruits and vegetables have pharmaceutical properties can delay the progress of many chronic diseases to defend the human body from free radicals and prevent the body from the lipid oxidative stress (Hernández-Ruiz *et al.*, 2019), antioxidant components present in bananas are tocopherol, ascorbic acid, dopamine, phenolic groups and beta carotene (Qusti, Abo-Khatwa, & Lahwa, 2010). Antioxidants are required to maintain the good health (Riaz, Abbasi, Shahzadi, Ajaib, & Khan, 2012). The damage off cell can be repair by the utilization of natural antioxidant with the help of reparative ability of body (Reinisalo *et al.*, 2015). Banana is used to treat many diseases as fever, cough, bronchitis, allergic infections, infections that transmit sexually, contain nutrients that have antioxidant, immunomodulatory, antidiabetic, hypolipidemic, anticancer, dysentery and antimicrobial properties

(Mathew & Negi, 2017). Not only banana pulp but the pseudo stem and fruit peel also are rich in antioxidants, higher amount of polyphenols, flavonoids, insoluble dietary fiber, total dietary fiber, lignin, hemicellulose, cellulose, antioxidant capacity, and free-radical scavenging substances (Pan, Recht, Charnvanichborikarn, Williams, & Aziz, 2011). It provides many health benefits due to the high amount of biologically active substances as carotenoids, flavonoids, phenolics, amines, vitamin C, and vitamin E which are the most beneficial antioxidant. The phenolic compounds are present in abundant amount in banana peel provide protection from free radical (Tsamo *et al.*, 2015) responsible for the increased activity of antioxidants to prevent the body from the inflammation or any kind of disease (Rebello *et al.*, 2014). The banana peel is rich in dopamine, L-dopa, and catecholamines are antioxidant (González-Montelongo, Lobo, & González, 2010). Unripe banana is used for the treatment of wounds healing and cancer (Angulo, Suaza, Romero, Sampablo, & Huila)

Effect on Hyperglycemia

Banana known as *Musa* is effective for the hyperglycemia, it maintain the insulin resistance (Navghare & Dhawale, 2017). Unripe banana has low caloric starch which helps to improves the bowel movement, the other sub types of this starch act as prebiotics (Adamson & Ganiyu, 2012; Odenigbo, Inya-Osuu, & Metabolism, 2012), which helps to improve the insulin sensitivity (type 2 diabetes) and stimulates the immunity to protect against inflammation (Horie *et al.*, 2020). It helps to decrease weight loss for weight management, inhibit glucose changes and lipid metabolism by improving the quality of diet in patients with diabetes (Costa *et al.*, 2019). Banana has low glycemic index if it take during the main meals as snacks it helps to lower the instant blood glucose level in the body (Al-Orf, 2010).

Helps to lower the Cholesterol and B.P.

Banana has low amount of salt which help to control the blood pressure and prevent from stroke (Jyothirmayi, Rao, & technology, 2015). The blood cholesterol level is reduced due to the structural similarities of phytosterol with cholesterol, it replace

the cholesterol in gut during the absorption (Marangoni & Poli, 2010). The extract of ripe banana pulp is a rich source of long-chain aliphatic alcohols, ω -3 and ω -6 fatty acids, phytosterols, and α -tocopherol helps to maintain the health (Vilela *et al.*, 2014). As the banana inflorescence is economically consumed as food and medicine, it can easily broke into biologically active substance called functional foods (Lau *et al.*, 2020).

Prevention from ulcer

Bananas are the fruits that can be recommended to the ulcer patients because it can reduce the acidity of gastric juices by covering the lining of the stomach (Izar *et al.*, 2018). Banana juice can reduce the pain of ulceration and other gastro-intestinal diseases and can help in the healing of wounds and burns (K. S. Kumar *et al.*, 2012). It has ability to fight against gastro-intestinal illness has properties like antibacterial antioxidant (Liao *et al.*, 2011).

Benefits for depression

Bananas is very helpful in the treatment of some emotional and mental stress disorders because they contain an important amino acid known as tryptophan, which is needed for the synthesis of serotonin, which is helpful to make the person relax and improve mood (Jyothirmayi *et al.*, 2015). Bananas are recommended to depressed patients (B. Kumar, 2012). It helps to get rid of or reduce a number of mental health disorders as depression containing the amino acid tryptophan converts into serotonin in the body made mood relaxed (Tavakkoli-Kakhki *et al.*, 2014).

Benefits of Phenolic compounds in Banana

Banana peel has highest amount of phenolic substances instead compare to other fruit peels as melon, pineapple, avocado, papaya, water melon so has increase rate of scavenging ability of free radicals (Mordi *et al.*, 2016). Green Banana flour contain phenolic compounds obtained from the pulp when it allow to reacted with ascorbic, citric, and lactic acids Applying pressure at 70°C before letting dry (Anyasi, Jideani, & Mchau, 2018; Menezes *et al.*, 2011). Banana rhizome contain a large amount of phenols used as food and for medicinal purpose (Kale *et al.*; Ogunlade *et al.*, 2019).

Phenols have antioxidants and antimicrobial qualities that found within banana peels helps to maintain the health (23).

Help in menstrual relief

The juice of banana from helps to reduce the abdominal pain, and cramps. The nutrients present in banana juice is very useful to give the relief of chest pain, lungs, bladder and it also help to soften the stomach tissue. When cooked banana mixed with the

curd it increases the progesterone hormone in the body which help to prevent the bleeding during the menorrhagia, it is also beneficial during the menstrual problems as they made the blood flow slow (Bagavan, Rahuman, Kaushik, & Sahal, 2011; Bhaskar, Chilkunda, Salimath, & chemistry, 2012; Hettiaratchi, Ekanayake, Welihinda, & nutrition, 2011; Jahan, Warsi, & Khaton, 2010; Loganayaki, Rajendrakumaran, Manian, & Biotechnology, 2010; Swanson, Winter, Goldstein, & Markovitz, 2010).

Table 4. Uses of bioactive compound in banana and their health benefits.

Bioactive compound	Health benefits	References
Tannic acid	Useful agent in the application for the treatment of burns	(Sidhu <i>et al.</i> , 2018)
Catechin	Lower LDL by increasing fat oxidation and brachial artery dilation	(Fahrasmane, Parfait, & Aurore, 2009)
Ferulic acid	Banana contain ferulic acid which help to treat cancers (especially lung cancer and stomach cancer), skin allergies, inflammation, microbial diseases, viral infections. It also useful for vadodilatory actions and play important role in the enzyme activity.	(N. Kumar & Pruthi, 2014)
p-Coumaric acid	It is essential to minimize the risk of stomach cancer due to its antioxidant property.	(Fahrasmane <i>et al.</i> , 2009)
Campesterol and stigmasterol	It decrease the cholesterol absorption and reduce the level of LDL in the human body, which help to maintain the heart health and reduces the risk of cardiac disorders.	(P Choudhary & S Tran, 2011)
Dopamine	Reduce the plasma oxidative stress and enhance the resistance to oxidative modification of LDL	(Yin, Quan, & Kanazawa, 2008)
Cryptoxanthin	It can minimize the risk of stomach cancer due to its antioxidant property.	(Fahrasmane <i>et al.</i> , 2009)
Quercetin	Help to maintain cardiovascular health by improving blood flow	(Perez-Vizcaino & Duarte, 2010)

Banana Home Remedies

- Eat a banana at night before to bed to get relief from constipation.
- Take a banana and mash it properly, add 2- 3 table spoon of yogurt and mix it well. Eat the mixture will increase gut ability and reduce the abdominal pain, cramps and treat the diarrhea. Or eat two unripe bananas at any time in a day it will also give relief from diarrhea.
- Mash a banana and mix it with 1-2 teaspoons of honey or milk. Apply it on face wait till the dryness of paste will reduce the redness of face and skin allergies as it stabilizes the blood flow, it will act as face mask.
- Apply mash banana of face directly, leave it for 20-30 minutes then rinse it with little warm water. Let it dry for some time then splash some cold water on skin it will work as anti-wrinkle treatment.
- Tape the inside of banana peel on warts till it turns into black color, repeat it for several weeks it will remove the warts.

- To reduce the leg cramps in pregnancy, eat banana daily before going to bed. In case of nausea and vomiting mash banana and apple, mix it well and consume it slowly.
- To gain the weight and body mass drink the banana milkshake daily 2-3 glasses.
- Eat 3 banana once in a day educes ulcer pain and improve the stomach ability.
- Tap banana peel on the bruises and leave it for overnight it will reduce the bruises. Cut pieces of banana and keep it on eyes for at least 30 minutes it will reduce the dark circle if repeated daily at night.
- Apply mashed banana on cracked heel for weeks it will heal them.
- In case of dry cough eat a banana with a teaspoon of honey and two pinches of black pepper daily.

Conclusion

Banana is very beneficial for human health. It is also economically affordable for every one and every age group, diseased person, the person who wants to

maintain their weight, helpful to reduce the pain during menstrual cycle, chest pain, burn wounds, bronchitis. Its daily consumption maintains the weight, reduce obesity, reduce the risk of the disease like cancer, hypertension, ulcer and many other diseases. All parts of banana plants can be used because every part have medicinal effect due to the presence of the phenolic compound, vitamins, antioxidants and micro and macro nutrients, minerals and trace elements in sufficient amount. It also has low calories and glycemic load best for the diabetes patient. It is used in both cooked and uncooked form, to maintain the human health by reducing the risk of inflammation due to the presence of phenolic groups, vitamin c, maintain blood pressure and prevent from heart problems. It acts as stress reducer, reduce the risk of stroke by maintaining the sodium level in the blood due to the presence of potassium.

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