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Review Article

# A review on banana flower: Nutritional composition, processed products and health benefits

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ABSTRACT

India is the world's largest producer of banana with 13.90 million tons followed by Uganda (10.14 million tons). Banana blossom also known as a banana heart, is a fleshy purple - skinned flower shaped like tear, which grows at the end of banana fruit cluster. Now days researchers aimed to addressing dietary related diseases through promotion of food products enriched with high protein, vitamins, minerals and dietary fiber. Banana blossom is rich source of nutrients and antioxidants which have several health benefits. The juice from the male bud provides an apparent remedy for stomach problems in people of all ages. Banana blossom is a popular dish in Sri Lanka. It is consumed as a curry as well as a boiled or deep fried salad with rice and wheat bread. It is generally valued as a fiber-rich source. Dietary fiber has demonstrated its benefits in health and disease prevention in medical nutrition therapy. Consumption of dietary fiber is known to lower blood cholesterol level, normalize blood glucose and insulin level, promote normal laxation, avoid constipation, prevent diverticulosis and diverticukitis, lower the risk of colon cancer and breast cancer and prevent obesity. The flower has been used to treat bronchitis, constipation and peptic ulcer. The extract has anti-oxidant property that prevents free radicals and control cell and tissue damage. Based on the main components of banana flower extract and its anti-oxidant properties, we hypothesized that the banana flower extract may have anticancer activities against cancer cell lines.



## 1. Introduction

The banana (*Musa paradisiaca*) grows best in a humid tropical environment with an optimum temperature 27°C during the day and minimum temperature is not below 13°C. India is the world's largest procedure of banana with 14.20 million tons and it is grown almost in every state. among the states Tamilnadu ranks first in banana cultivation with a production area of 118.04 hectors in the crop year 2013-2014.the by-products of banana cultivation are estimated at about 220 tones of plant mass per hector. Flower of the banana plant (*Musa acuminate Colla*) is often consumed as a vegetable in many Asia countries such as Sri Lanka, Malaysia, Indonesia and the Philippinnes. Banana blossom is a popular dish in Sri Lanka. It is consumed as a curry as well as a boiled or deep fried salad with rice and wheat bread. It is generally valued as a fiber-rich source. The banana is rich in phytochemicals like vitamins, flavonoids, and protein. A, C and E. Banana flowers have tremendous nutritional valve. They are a good source of fiber and protein. The flowers contain a class of photochemical known as saponins. Saponins lower bad cholesterol, boost our immunity infection and are through to inhibit the growth of cancer cells. They also have antioxidant activity as so can reduce our risk of chronic disease such as cardiovascular disease. Banana flowers are also an excellent source of flavonoids. These found in many plant-based

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foods help prevent damage to DNA cells by neutralizing free radicals. They also help lower cholesterol, are anti –inflammatory, anticancer and anti-aging. Banana blossom is usually considered as a byproduct of banana cultivation. Banana blossom is a tremendous nutritional value and health effects. It is consumed as a vegetable either raw or cooked by some ethnics in the Asian region. Instead of being treated as an agriculture waste banana blossom can be utilized as an ingredient in food formulations. Although India is the leading country in banana cultivation the nutritional properties and health benefits of banana blossom are less focused by researchers. Banana blossom is considered as an indigenous food and its consumptions is limited due to the tedious preparations procedure. [1–8]

**Table 1:** Nutritional composition of banana flower

| Parameter | Composition |
|---|---|
| Energy (kcal) | 51 |
| Carbohydrate ( g/100g) | 9.9 |
| Protein ( g/100g) | 1.6 |
| Fat( g/100g) | 0.6 |
| Dietary fiber( g/100g) | 5.74 |
| Moisture(g/100g) | 88.75 |

Banana flower was tremendous nutritional value, health benefits and can be consumed as food additive in many Asian countries such as Sri lanka, Indonesia, Thailand and Myanmar. Banana flower can also be made into various products such as dehydrated vegetable, pickle and canned food (*Nyunt et al., 2012*). Banana flowers are also an excellent source of flavonoids. These found in many plant-based foods help prevent damage to DNA cells by neutralizing free radicals. They also help lower cholesterol, are anti –inflammatory, anticancer and anti-aging. (*Debabandya et al., 2010*). Banana peels are properly exploited and process, they could be a high-quality and cheap source of carbohydrates and minerals for livestock (*Anhwange 2008*). More Bananapseudostem is a byproduct of banana cultivation and is known to health beneficial effect (*Jamuna et al., 2012*). Energy is released from carbohydrate, protein and fat and are the main source of energy. AOAC method was used to estimate the nutritional facts of banana blossom. The energy present in banana blossom was reported as 51 kcal/100g (*Shilpi et al.,2017*). [9–15] The carbohydrate content in banana blossom is 9.9g/100g (*Sharmila et al.,2017*). Protein was, determined by Kjeldhal method and therafter a conversion factor of 6.25 was used to calculate the total nitrogen to crude protein. 12.5% of protein was reported /100g of banana flower (*Sheng et al.,2010*). 0.6g of crude fat content was determined by soxhlet fat extraction method per 100g of banana flower. (*Elaveniya et al.,2014*). The mineral content of banana flower is Magnesium 34.13mg, Potassium 571.33mg, Calcium 33.27mg, Phosphorus 53.27mg, Iron 43.44mg, Sulphur 27.03mg, Mercury 0.03mg and Arsenic 0.20mg (*Sheng et al.,2010*). Crude fiber was estimated by acid alkali digestion method shows 5.7g of dietary fiber in 100g of banana flower (Elaveniya et al.,2014). 5.74g total dietary fiber (TDF) was determined according to the AOAC enzymatic gravimetric method (*Sheng et al.,2010*). The nutritive composition of Poovan flower, moisture content 90.1g, protein - 1.99g, fat-0.43g, Ash-3.21g, crude fiber - 12.82g, carbohydrates - 95.23g. And the nutritive value of Monthan flower was moisture - 90.23g, protein - 1.49g, fat - 0.54g, Ash - 2.42g, crude fiber - 12.23g, carbohydrate - 95.61g this shows a similar nutritional composition of both variety. [16–19] (*Krishna et al.,2016*). The flavonoids have gained considerable interest as they are confirmed to be very effective in reducing the risk of cardiovascular disease by lowering the oxidation of LDL. total flavonoids in Baxijiao banana and paradiiaca flower is 5.90mg and 5.27mg. (*Gey et al.,1992*).

**Table 2:** Mineral composition of banana blossom

| Minerals | Composition (mg/100g) |
|---|---|
| Calcium | 56 |
| Phosphorus | 73.3 |
| Iron | 56.4 |
| Copper | 13 |
| Potassium | 553.3 |
| Magnesium. | 48.7 |
| Sulphur | 27.03 |

The banana blossoms are good sources of minerals. The samples were digested in HNO3/HClO4 for mineral determination. The mineral content (calcium, potassium, magnesium, iron, copper, lead, arsenic, mercury and sulphur) of each sample was determined by using a Varian Spectra atomic absorption spectrophotometer (model 220, Varian, US), and phosphorus was measured by spectrophotometric methods of AOAC (1995), the instrument was calibrated with known standards and samples analyzed at corresponding wavelengths. (Sheng et al., 2010). Calcium 56mg, iron 56.4mg, copper 13mg, potassium 553.3mg, magnesium 48.7mg and vitamin E 1.07mg (*Shilpa et al.,2017*). [20–30]

The minerals content of banana flower of two cultivars Musa paradisiaca and Musa chiliocarpa.The minerals content in banana flowers were determined by using SPECTROXEPOSEDXRF spectrometer at department of physics, niversity of Mandalay. The mineral content of Musa paradisiaca, Aluminum 0.1307%, silicon 0.1120%, phosphorus 0.3569% ,sulfur 0.6860%, chlorine 0.9821%, potassium 5.138%, calcium 0.5667%, magnesium 0.0106%, iron 0.p1547%. And the minerals content of Musa chiliocarpa is aluminum 0.1183%, silicon,0. 1658%,

phosphorus 0.2256%, sulfur 0.0555%, chlorine 1. 485%, potassium 5.390%, calcium 0.4667%, magnesium 0.0107%, iron 0.0202%. (*Khin et al.,2012*).

The comparision of mineral composition of Baxijiao banana and paradisiaca banana flower.mineral content of Baxijiao banana flower. 34.13mg of magnesium, 571.33mg of potassium, 33.27mgbof calcium, 53.27mg of phosphorus, 43.44mg of iron, 13.60mg of copper, 27.03mg of sulphur, 0.03mg of Mercury, 0.20mg of arsenic and 0.35mg of plumbum. The mineral content of paradisiaca banana flower, magnesium 48.73mg, potassium 553.3mg, calcium 56mg, phosphorus 73.33mg,iron 56.4mg, copper 13mg, sulphur 37mg,Mercury 0.03mg and plumbum 0.34mg. (*Shung et al.,2010*)

## 2. Products of Banana Flower

### *2.1. Banana blossom as dehydrated vegetable*

Freshly harvested banana blossom were washed under running water after removing 3 to 4 outermost fibrous bracts, and fresh weight of each banana blossom was recovered in order to determine the final yield of the processed product after dehydration. The blossom were then sliced to a thickness of 3mm using a vegetable slicer and immersed 250-260g of banana blossom slices in 1 litres of 0.2% citric acid solution. After 30 minutes slices placed in plastic trays allowed to drain out excess liquid. Slices were kept at 50°c in a dehydrator for 6 hours in Cross Flow of hot air at a flow rate of 0.305 m/s. The water activity of dehydrated banana blossom was 0.58g, moisture 5.18g, crude protein 20.54g, crude fat 5.70g, total Ash 8.53g, calcium 2.82mg, iron 0.01mg. (*kanchana et al.,2005*)

### *2.2. Banana blossom tea*

From the earliest time herbal plants have been used to treat and heal or comfort the sick. fortuitous discovery that banana flowers are produced in countries that can least afford to waste this natural resource.[31–45] The banana flower tea is produced by a process of first obtaining fresh banana flowers and Trimming, cleaning, and washing same. This is followed by roasting. Roasting of the banana flowers takes place in a roaster at 400-450F. For 5-7 minutes. The Roasted flowers may then be milled, blended with desired flavour and aroma materials, and packaged in tea bags and boxes for subsequent brewing to form a banana flower tea beverage. (*Ashikawa et al.,2001*)

### *2.3. Banana flower powder*

The blossoms were cut into a thickness of 5mm, directly into 0.5% citric acid solution in order to reduce enzymatic browning. The slices were immersed in the citric acid solution for 30 minutes. After that the water was drained and the banana blossom slices were spread over the trays. Banana blossom slices were dried at 600C for 12 hrs, ground in a mixer grinder into a particle size of 40 mesh, packed on polyethylene bags and then stored at 50C. (*Arya et al.,2016*). The blossom immersed in the rinsed rice water showed good appearance and fragrance. After pre treatment, the sliced blossom are drained and loaded in to an electric dryer and dried for 50°C.(*Elaveniya et al.,2014*)

### *2.4. Banana blossom incorporated dark chocolate*

The Banana blossom were used for the incorporation of banana blossom dark chocolate. The banana blossom were cleaned, peeled, discarded and dried for two or three days in hygienic manner. The banana blossom was grinded in to powder form. Then banana blossom flour was incorporated into dark chocolate. The treatment for preparation of banana blossom flour incorporated in dark chocolate were cocoa powder (control),cocoa powder+10% banana blossom, cocoa powder+20% banana blossom powder, cocoa powder+30% banana blossom powder. The overall acceptability and rating scale score was high for the 20% level of incorporation of banana blossom flour. (*Sharmila et al.,2013*)

### *2.5. Banana blossom powder ladu*

Ghee was melted in a kadai pan, measured amount of bengal gram and green gram flour was added and stirred continuously Add banana blossom powder (35%) sugar and stir well until a pasty texture is obtainedMixture was allowed to cool after switching off the flame Shaped into tight, hard laddu, roll the laddu in powdered rice flakes Laddu was allowed to cool completely, packed and stored. (*Fathima et al., 2018*).

## 3. Health Benefits of Banana Blossom

Banana flower is a good source of carbohydrate, protein, and micronutrients. They are used in the treatment of Diabetics, breast cancer, Inhibits AGEs formation, Helps in maintaining menstrual cycle, Helpful in infection treatment, wound healing and inflammatory bowel diseases. prevent diverticulosis and diverticukitis, lower the risk of colon cancer and breast cancer and prevent obesity (*Kanchana et al.,2005*).

### *3.1. Inhibits AGEs formation*

It is reported that the banana blossom and pseudostem of Musa sp. Var. Elakkibale were efficient in ameliorating diabetes and inhibit the formation of AGEs in streptozotocin induced diabetic. Though aminoguanidine is a potent AGEs inhibitor. Hence it can be concluded that natural products in the form of diet or nutraceuticals are safe for the treatment of diabetes and AGEs complications. Hence, banana blossom and pseudostem can be used as

supplements in the diet of diabetic patients in order to reduce diabetes related complications like renal failure AGEs accumulation. (*Jamuna et al., 2011*)

### *3.2. Prevents diabetes*

The study shows that Apart from its food uses, banana flower are also believed to possess some medicinal properties. In this study the researcher grouped the rats based their diabetic condition one group control rats and other diabetic rats. The result shows that the rats fed banana flower as part of their diet fared much better than the rats in the control group that did not receive the banana flower. The findings showed that the banana flower has anti-diabetic properties. In China for instance, banana flower is traditionally used for certain illness such as heart pain, diarrhea, asthma and stomach cramps. (*Kumar et al., 2012*) it can be used for the treatment of bronchitis, dysentery, ulcers etc. Bhaskar et al., (2011) for instance, the consumption of cooked banana flower is believed to be beneficial to diabetic patients. (*Marikkar et al., 2016*). Anti-diabetic effect by inhibition of alpha-glucosidases from the intestine, in turn suppressing the carbohydrate absorption into the bloodstream. (*Ramith et al., 2014*)

### *3.3. Helps in maintaining menstrual cycle*

The study shows that the banana blossom caters lot of health benefits. Consumption of banana blossom regularly for about a month reduces the blood sugar level and raise the hemoglobin level in the body as it is rich in fiber and iron which assist in the production of red blood cells. It helpful to lowers menstrual bleeding menstruation brings pain in many women. Some suffer from sever PMS symptoms, while others bleed excessively. a cup of cooked banana flowers can help to reduce this problem. It reduces muscle cramps and regulate the progesterone hormone that can in turn reduces the painful bleeding. Increase the milk production in lactating mothers. Banana blossom being a good source of both soluble and insoluble dietary fiber help in maintaining good gastrointestinal health. It helpful in ulcer management as it neutralise the gastric juice and reduce ulcer formation. (*Shilpa et al., 2017*)

### *3.4. Helpful in infection treatment*

Banana blossom extract has been found to be very useful for treating the infection in natural way. During a research on antimicrobial activity of banana blossom extract, it was suggested that certain bioactive compounds extracted from banana blossoms exhibited antibacterial activity against bacteria bacillus. The bioactive compound malic acid found in blossom exhibited a stronger antibacterial activity against Bacillus subtilis, Bacillus cereus and Escherichia coli, along with that the flower extract is also usefull in healing wounds especially in children and preventing the malarial parasite, Plasmodium falciparum from growing and developing in the body. Besides fighting against infections, the juice of banana blossom is very helpful in healing the wound and burn faster (*Mokbel et al., 2005*).

### *3.5. Increase the milk production in lactating mothers*

Intake of banana blossom boost the milk Production in lactating mothers. Therefore, it can be a blessing for nursing mothers who face problem nursing their new-borns. (*Shilpi et al., 2017*).

### *3.6. Prevention of gastrointestinal disorders*

it shows that banana blossom as significant antibacterial and antioxidant properties. Since the banana blossom rich in phytochemicals like vitamins flavonoids and protein. The blossom can be used for the treatment of bronchitis, constipation and peptic ulcer. The antioxidant property of extract scavenges the free radical and control cell and tissue damage. (*Bhaskar et al., 2012*)

## 4. Conclusion

Banana flower is also called known as banana blossom or banana heart. Banana blossom is highly nutritious edible flower, Banana blossom rich in phytochemicals like vitamins, flavonoids, and proteins and antioxidants properties which are helps to enhance the human resistant in various diseases. To increase a shelf life of the banana blossoms, they are usually dehydrated. Instead of being treated as an agricultural waste banana blossom can be utilized as an ingredient in food. Banana blossom contains abundant dietary fiber (5.74g/100g) which helps to maintain our body health, to reduce the cholesterol level and protects our body from obesity. So many products are prepared using this banana blossoms are blossom coffee, blossom dehydrated vegetable, blossom incorporated chocolate, and in the preparation of curry, salad. They help in maintaining and functioning of body tissues.

## 5. Source of Funding

None.

## 6. Conflict of Interest

None.

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