WWW.IJRPR.COM

International Journal of Research Publication and Reviews

Journal homepage: www.ijrpr.com ISSN 2582-7421

Bioactive Substance in Banana and its Antioxidant Property

[1]Metha Jaganathan, [2]Sharmila G, [3]Sri Dhivya M

[1,2,3]Department of Biotechnology, V. S. B Engineering College, Karur.

ABSTRACT

In many countries, bananas are a regular staple food and are a very well-liked fruit on the international market. It has been separated into dessert or sweet bananas and cooking bananas or plantains. Because of their positive effects on human health and wellness, a variety of bioactive chemicals present in bananas, such as phenolics, carotenoids, biogenic amines, and phytosterols, are highly desired for the diet. The majority of these compounds have antioxidant capabilities and are effective at protecting the body from various oxidative stresses. Bananas have historically been used to treat a variety of conditions, including reducing the risk of numerous chronic degenerative diseases. This paper looks at the historical background, classification of cultivars, health-promoting phytochemicals, antioxidant activity, and benefits of bananas.

KEYWORDS: Banana cultivars, Dietary composition, Phytochemicals, Flavonoids, Antioxidant

INTRODUCTION

Bananas are the important commercial crop which belongs to the family Musaceae. It is grown by farmers across the tropics and subtropics, including the Americas, the Islands of South East Asia, Melanesia and the Pacific [3]. About 87% of banana production is consumed as local food. Bananas are consumed as both dessert and food [3]. The dessert bananas are suitable for consumption only when ripe. The bananas are boiled and fried before consumption. In 2004, the banana had a production of 106.34 million tonnes from 9.52 million hectares across the world [1]. The genus classification of Musa was found by Sagot in 1887[1]. In 1893, Baker made the initial classification. The comprehensive classification of Musaceae was done by Cheesman (1947-1950) [1]. He delimited its two genera, *Ensete* and *Musa*. He listed 21 species in Musa and 25 species in *Ensete* [5]. Banana is consumed in the form of fresh and manufactured products in Indonesia [2]. Banana is commercially required by all countries to seek profit. According to the Food and Agriculture Organization (FAO), there are about 15.9 million tonnes are exported all over the countries [4]. Banana are a nutritious fruit which is found in almost all countries [5]. It undergoes easy digestion upon consumption [4,5]. Following the production of rice, maize, and wheat, bananas rose to fourth position. The importance of bananas in commercial status has paved the way for the tissue culture of bananas. The science of cultivating isolated plant cells, tissues, or organs in artificial media is known as plant tissue culture. It offers various practical goals as well as methodologies and approaches suitable for several botanical disciplines of research. In vitro, ordered and unstructured growth are both feasible [6,7]. Banana disorganized tissue in vitro cultivation is nearly entirely associated with the development of embryonic cell cultures. Embryonic cell suspensions can be produced when an embryonic callus that has been generated on solid media with high auxin concentrations is transferred to liquid medium [6].

1. BANANA CULTIVARS CLASSIFICATION

According to Rieger (2006) and Nakasone & Paull (1999), the main subgroups and cultivars of bananas are as follows

Table 1 Classification of Musa [8,10]

Sucrier (AA)	Thin skinned, small and sweet fruits
Cavendish (AAA)	Dessert type
Lujugira (AAA)	Beer Production Eg. Intuntu and mujuba
Lacatan (AAA)	Aromatic fruits Eg. Pisang Cultivars

Robusta (AAA)	Large bunchy fruits such as Valery cultivars
Goldfinger (AAAB)	Dessert Banana in America and Australia
Saba Bluggoe (ABB)	Cooking banana type in Philippines
Figue Pomme (AAB)	Acidic dessert such as Maca and Silk
Plantain (AAB)	Cooking banana in Africa and South America
Saba (BBB)	Used for cooking in Malaysia and Indonesia

2. DIETARY COMPOSITION OF BANANA

The banana contains various nutrients such as water, energy, carbohydrates, sugars, folate, vitamin A, vitamin C, Potassium which are listed in the table shown below.

Musa acuminata Colla composition per 100Gfw [8,16]

Nutrient	composition
Water (g)	74.9
Energy(kcal)	89
Carbohydrates(g)	22.84
Total sugars	12.23
Folate, DFE(µg)	20
Vitamin A (IU)	64
Vitamin A (RAE) (µg)	3
Vitamin C (mg)	8.7
Potassium (mg)	358

3. PHYTOCHEMICALS

A phytochemical is a naturally occurring bioactive substance that is present in plant-based foods and functions with nutrients and dietary fiber to fend off disease [8]. The following compounds were identified in various regions of bananas and plantains by Iman and Akter (2011) in their phytochemical and pharmacological review [10].

- Catecholamines are present in Musa species. Norepinephrine, serotonin, dopamine, tryptophan, indole chemicals, and pectin in the pulp are the examples of catecholamines.
- Plantain's unripe pulp contains flavonoids and associated substances such as leucocyanidin, quercetin and its 3-O-galactoside, 3-O-glucoside, and 3-O-rhamnosyl glucoside.
- The fruit pulp contains serotonin, norepinephrine, tryptophan, indole compounds, tannin, starch, iron, sugars, vitamin C, B vitamins, albuminoids, lipids, and mineral salts.

- From the fruit peel, cycloartane triterpenes as 3-epicycloeucalenol, 3-epicyclomusalenol, 24-methylene pollinastanone, 28-norcyclomusalenone, and 24-oxo-29-norcycloartanone have been identified.
- The fruit and peel contain cellulose, hemicelluloses, arginine, aspartic acid, glutamic acid, leucine, valine, phenylalanine, and threonine

4. ANTIOXIDANT PROPERTY

The secondary metabolism of plants produces bioactive chemicals that contribute to antioxidant activities, which have a clear medicinal potential [11]. The primary phytochemicals in fruits and vegetables that are associated with human health are phenolics and carotenoids [11,17,18]. One of the most significant foods high in antioxidants is the banana. An antioxidant is a substance which slows down, halt or prevents the oxidation of a substrate which leads to the formation of radicals that are stable [11,18]. The antioxidant property provides the defensive mechanisms in the body. Reactive oxygen species (ROS) damage proteins, lipids, nucleic acids during oxidation. Many individuals routinely eat bananas, and their bioactive constituents have powerful antioxidant properties that have been shown to be useful in defending the body against a variety of oxidative stressors [11,20]. Bananas include a variety of bioactive substances that have antioxidant and chelating activities [20,22,23]. In addition to the free phenolics, banana pulp includes a large number of cell wall-bound phenolics that are easily bio accessible in the human gut and may be appropriate sources of natural antioxidants [11,24]. The antioxidant activity of banana flavonoids (M. paradisiaca) investigated in rats given normal and high fat diets underlined that flavonoids found in bananas served as useful antioxidants [11,20]. Ascorbic acid, the most potent known water-soluble antioxidant, is present in edible banana pulp at the peak of ripeness in the range of 6.9 to 10 mg/100 g [11,25]. Numerous research have demonstrated that banana peel extracts have higher antioxidant activity than banana pulps [11,23,26].

5. PHYSIOLOGICAL BENEFITS

Because of the enormous nutritional and therapeutic benefits of bananas, they are one of the most readily available and reasonably priced fruits for human consumption that promotes good health. It has shown that banana pulp contains bioactive substances with significant antioxidant capacity and antitumor action, such as phenolic acids and flavonoids [27]. Consuming bananas increases the body's potassium levels, which is good for the muscles [11]. When compared to potatoes, plantains have a higher nutritional value and a lower carbohydrate content, making them an excellent food for those with diabetes [28]. Bananas' antihyperglycemic effects in numerous animal studies have demonstrated their value in the treatment of diabetes [11,29]. Banana Fruits' antioxidant contents lessen the risk of neurological disorders, slow down ageing, and aid to prevent degenerative illnesses like heart disease, arteriosclerosis, inflammation, arthritis, cancer, and brain malfunction [11,17,18]. Bananas include norepinephrine, dopamine, and serotonin, which increase blood pressure and restrict gastric output via stimulating the smooth muscle of the intestines, respectively [11,30]. The amounts of cholesterol, phospholipids, free fatty acids, and triglycerides in male rat blood, liver, kidney, and brain have decreased as a result of flavonoids derived from unripe banana fruits was given [31]. The powerful anti-cancer properties of bananas were due to their phenolic components. phytosterols added to food reduce serum LDL cholesterol levels by preventing the absorption of cholesterol from the small intestine [32]. Colon, breast and prostate cancer can be prevented [32].

CONCLUSION

One of the most significant and ancient food crops in human history is the banana [1]. The entire banana plant is valuable in a variety of industrial applications, including food, feed, medicine, packaging, and others [5]. In the current review, it was discovered when reading the literature that bananas contain a wide variety of highly valuable bioactive chemicals. A considerable amount of beneficial bioactive chemicals are present in bananas to promote health. Due to these molecules' therapeutic qualities, bananas have been effectively used in several studies to prevent disease and promote health by demonstrating and proving their antioxidant activity. It is important to identify, promote, and employ banana cultivars with high concentrations of these bioactive chemicals in breeding initiatives to create bio-fortified cultivars. These cultivars would make excellent tools for tackling several health-related problems. The natural antioxidants and dietary fiber found in banana peels need to be further investigated in order to be used for improving health. The banana peel, which can be used as a functional food source to fight many chronic diseases, has been found to contain higher amounts of significant bioactive chemicals than the banana pulp in numerous studies.

REFERENCE

1. Nm Nar 2

The Bananas: Botany, Origin, Dispersal

2

The Bananas: Botany, Origin, Dispersal

1. N.M.Nayar, Department of botany “The Bananas: Botany, Origin, Dispersal” 2010.
2. Siti Mardhikasari, Ahmad Yunus and Samanhudi “Modification of Media for Banana In Vitro Propagation with Foliar Fertilizer and Coconut Water in cv. Rajabulu” 2020.

3. Edmond De Langhe, Luc Vrydaghs, Pierre de Maret, Xavier Perrier and Tim Denham “Why Bananas Matter: An introduction to the history of banana domestication”2009.
4. M.R.Hanumantharaya, M.G.Kerutagi, B.L.Patil, V.C.Kanamadi and Basavaraj Bankar “ Comparative economic analysis of tissue culture banana and sucker propagated banana production in Karnataka” 2008.
5. Debabandya Mohapatra, Sabyasachi Mishra and Namrata Sutar “Banana and its by-product utilization: an overview” 2010.
6. STROSSE, H., I. VAN DEN HOUWE, B. PANIS “BANANA CELL AND TISSUE CULTURE – REVIEW” 2015.
7. GEORGE, E.F, Plant tissue culture techniques. In: Plant propagation by tissue culture. Part 1: The technology, Exegetics Ltd., Edington, Wilts, England (1993) 3-36.
8. Sunil Pareek “Nutritional and Biochemical Composition of Banana (Musa spp.) Cultivars” 2016.
9. R. DORE SWAMY, N.K. ~RINPCASA RAO and ELIAS K. CHACKO ” TISSUE-CULTURE PROPAGATION OF BANANA” 1983.
10. Imam, M.Z., Akter, S., 2011. Musa paradisiaca L. and Musa sapientum L.: a phytochemical and pharmacological review. Journal of Applied Pharmaceutical Science 1, 14–20.
11. Singh, B., Singh, J.P., Kaur, A., Singh, N., Bioactive compounds in banana and their associated health benefits – a review, Food Chemistry (2016), doi: http://dx.doi.org/10.1016/j.foodchem. 2016.03.033
12. Akihisa, T., Shimizu, N., Tamura, T., & Matsumoto, T. (1986). (24S)-14α, 24-dimethyl-9β, 19-cyclo-5α-cholest-25-en-3β-ol: A new sterol and other sterols in Musa sapientum. Lipids, 21, 494-497.
13. Anyasi, T. A., Jideani, A. I., & Mchau, G. A. (2015). Morphological, physicochemical, and antioxidant profile of noncommercial banana cultivars. Food science & nutrition, 3, 221-232.
14. Arora, A., Choudhary, D., Agarwal, G., & Singh, V. P. (2008). Compositional variation in β-carotene content, carbohydrate and antioxidant enzymes in selected banana cultivars. International journal of food science & technology, 43, 1913-1921.
15. Beatrice, E., Deborah, N., & Guy, B. (2015). Provitamin A carotenoid content of unripe and ripe banana cultivars for potential adoption in eastern Africa. Journal of Food Composition and Analysis, 43, 1-6.
16. USDA, 2012. Nutrient Database. http://www.nal.usda.gov/fnic/foodcomp/Data/SR17/wtrank/sr17a306.pdf (accessed October 2013).
17. Singh, J. P., Kaur, A., Shevkani, K., & Singh, N. (2015). Influence of jambolan (Syzygium cumini) and xanthan gum incorporation on the physicochemical, antioxidant and sensory properties of gluten-free eggless rice muffins. International Journal of Food Science & Technology, 50, 1190-1197.
18. Singh, J. P., Kaur, A., Singh, N., Nim, L., Shevkani, K., Kaur, H., & Arora, D. S. (2016). In vitro antioxidant and antimicrobial properties of jambolan (Syzygium cumini) fruit polyphenols. LWT-Food Science and Technology, 65, 1025-1030
19. Someya, S., Yoshiki, Y., & Okubo, K. (2002). Antioxidant compounds from bananas (Musa Cavendish). Food Chemistry, 79, 351-354
20. Vijayakumar, S., Presannakumar, G., & Vijayalakshmi, N. R. (2008). Antioxidant activity of banana flavonoids. Fitoterapia, 79, 279-282.
21. Vijayakumar, S., Presannakumar, G., & Vijayalakshmi, N. R. (2009). Investigations on the effect of flavonoids from banana, Musa Paradisiaca L. on lipid metabolism in rats. Journal of dietary supplements, 6, 111-123.
22. Englberger, L., Aalbersberg, W., Ravi, P., Bonnin, E., Marks, G. C., Fitzgerald, M. H., & Elymore, J. (2003a). Further analyses on Micronesian banana, taro, breadfruit and other foods for provitamin A carotenoids and minerals. Journal of Food Composition and Analysis, 16, 219-236.
23. Someya, S., Yoshiki, Y., & Okubo, K. (2002). Antioxidant compounds from bananas (Musa Cavendish). Food Chemistry, 79, 351-354.
24. Bennett, R. N., Shiga, T. M., Hassimotto, N. M., Rosa, E. A., Lajolo, F. M., & Cordenunsi, B. R. (2010). Phenolics and antioxidant properties of fruit pulp and cell wall fractions of postharvest banana (Musa acuminata Juss.) cultivars. Journal of agricultural and food chemistry, 58, 7991-8003
25. Kanazawa, K., & Sakakibara, H. (2000). High content of dopamine, a strong antioxidant, in cavendish banana. Journal of agricultural and food chemistry, 48, 844-848.
26. Sulaiman, S. F., Yusoff, N. A. M., Eldeen, I. M., Seow, E. M., Sajak, A. A. B., & Ooi, K. L. (2011b). Correlation between total phenolic and mineral contents with antioxidant activity of eight Malaysian bananas (Musa sp.). Journal of Food Composition and Analysis, 24, 1-10.
27. Borges, C. V., de Oliveira Amorim, V. B., Ramlov, F., da Silva Ledo, C. A., Donato, M., Maraschin, M., & Amorim, E. P. (2014). Characterisation of metabolic profile of banana genotypes, aiming at biofortified Musa spp. cultivars. Food chemistry, 145, 496-504.
28. Lassoudière, A. (2007). Bananier et sa culture (le). Editions Quae,, Versailles CEDEX, France, 383 pp.

29. Alarcon-Aguilara, F. J., Roman-Ramos, R., Perez-Gutierrez, S., Aguilar-Contreras, A., Contreras-Weber, C. C., & Flores-Saenz, J. L. (1998). Study of the anti-hyperglycemic effect of plants used as antidiabetics. Journal of Ethnopharmacology, 61, 101-110.

30. Kumar, K. S., Bhowmik, D., Duraivel, S., & Umadevi, M. (2012). Traditional and medicinal uses of banana. Journal of Pharmacognosy and Phytochemistry, 1, 2278-4136.

31. Krishnan, K., & Vijayalakshmi, N. R. (2005). Alterations in lipids & lipid peroxidation in rats fed with flavonoid rich fraction of banana (Musa paradisiaca) from high background radiation area. Indian Journal of Medical Research, 122, 540.

32. Quilez, J., Garcia-Lorda, P., & Salas-Salvado, J. (2003). Potential uses and benefits of phytosterols in diet: present situation and future directions. Clinical Nutrition, 22, 343-351.