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Review Article

Ethanopharmacological Profile of *Musa Acuminata*

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ABSTRACT

Banana is the common name for herbaceous plants of the genus *Musa* and for the fruit they produce. Banana plant is a pseudo stem, palm like aspect having large leaves overlapping bases of each other to form a false trunk. It is grown in the tropical and Sub tropical countries and are widely used for its nutritional values. The plant has been used as a fodder, ailments of different disorders and it is having various activities like cholesterol reducing activity, antioxidant activity, hepatoprotective potential, anti-ulcer activity, anti-cancer activity, inhibitory activity, Immunomodulatory activity wound healing activity, antibacterial activity antidiabetic activity, anti-leishmanial activity. The Plant has many nutrients and biological active compounds. The present objective of this review is to highlight the various chemical constituents and different pharmacological activities of the plant.

Keywords: *Musa acuminata*, hepatoprotective, anti diabetic, anti – ulcer, anti-oxidant

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1. Introduction

Botanicals have been very important for medicine and health throughout evolution. Plant extracts, infusion, powders and biological active elements have been used traditionally to treat a variety of illnesses, according to ethnobotanical literature(1). Ethnobotanists says that the plants and plant products are the gold mines of

pharmaceutical industries. Many of these herbs have been used purely on the basis of a traditional belief, but researchers are now showing that they are effective. According to the World Health Organization (WHO) (2), traditional medicine is used by a large portion of the population in developing nation for basic health care.

However, the majority of them are still taken from natural sources without scientific control, putting many species in jeopardy. *Musa acuminata* is an herbaceous plant with a robust tree like pseudo stem, a large elongated crown and wide leaves with a prominent mid-rib. Each plant produces a single large drooping spike inflorescence with large opening bracts. Fruits are oblong, fleshy, 5-7 cm long in wild form and longer in the cultivated varieties(3). Banana is a familiar tropical and subtropical fruit. It is cultivated all over the world. It was reported to be possibly the world's oldest cultivated crop. It is herb, colloquially called as a banana tree

Banana has two wild species. 1 *Musa acuminata*

2 *Musa balbinosa*

Musa acuminata is an herbaceous plant with a robust tree like pseudo stem, a crown of large elongated oval deep - green leaves with a prominent midrib, each plant produces a single inflorescence like drooping spike, and large bracts opening in succession, ovate, 15-20 cm long, concave, dark red in color and somewhat fleshy. Fruits are oblong, fleshy, 5-7cm long in wild form and longer in the cultivated varieties(4).

Due to its long and wide of leaves, a wide range of applications. They are flexible, large, water proof and decorative. *Musa acuminata* is a *Musaceae* genus, found in southeast Asia's hot, tropical areas and also broad range of distribution. *Musa balbinosa* is also a *Musaceae* genus, native to Burma. The genus name *Musa* was chosen to commemorate Antonius Musa, Roman physician and botanist (63 B.C. to 14AD), while the species name *acuminata* refers to the pointed apex of fruit. Both *Musa acuminata* and *Musa balbinosa* undergoes natural hybridization in the Indo-Burman region. It leads to the formation of triploid AAA banana cultivator(5).

Scientific classification

Taxonomy (6)

- Kingdom: Plantae
- Subkingdom: Viridiplantae
- Infrakingdom: Streptophyta
- Superkingdom: Embryophyta
- Division: Tracheophyte
- Subdivision: Spermatophyte
- Class: Magnoliopsida
- Superorder: Liliana
- Order: Zingiberales
- Family: Musaceae
- Genus: *Musa*
- Species: *acuminata*

Distribution:

M. acuminata having the number of species. The following are the most commonly accepted species are *M. chinensis* Sweet, *M. cavendishii* Lamb, *M. nana* Lour, *M. corniculata* Kurz, *M. rumphiana* Kurz, *M. sapientum* var. *suaveolens* Blanco Malag, *M. sinensis* Sagot ex Bake, *M. simiarum* Journal of Pharmaceutical and Biological Research

Kurz, etc. *IM. acuminata* exhibits considerable variation and has been split up into eight subspecies namely *M. acuminata* subsp. *burmannica*, *M. acuminata* subsp. *acuminata*, *M. acuminata* subsp. *halabanensis*, *M. acuminata* subsp. *errans*, *M. acuminata* subsp. *microcarpa*, *M. acuminata* subsp. *malaccensis*, *M. acuminata* subsp. *truncate*, *M. acuminata* subsp. *siamea*, and three varieties namely *M. acuminata* var. *sumatrana*, *M. acuminata* var. *tomentosa*, and *M. acuminata* var. *chinensis*(6,7).



Figure 1



Figure 2

Musa acuminata plant having the inflorescence in Picture A and *Musa acuminata* Plant in Picture B

Nutritional classification

- Protein
- Glucose
- Fat
- Micro elements
- Carbohydrates(8)

Medicinal use

Banana plant continues to be a significant source of biological active compounds, new chemical entities, and developing novel chemical compounds requires a multidisciplinary approach integrating ethnobotanical, ethnopharmacological, phytochemical and biological methods (9,10).

Flower's:

Used to treat dysentery, ulcers, bronchitis. Cooked flowers are considered a good for diabetics(11).

Sap: Chemically banana sap has astringent qualities. It is also used in various ailments like leprosy, hysteria, fever, digestive disorder, hemorrhage, epilepsy, insect bites(12)

Peel and pulp: scientifically shown to have both anti fungal and antibiotics components.

Roots and seeds: Treat digestive disorder.

Instead of having many benefits, banana is reported to produce some side effects like:

- Consumption of banana may have allergic reactions in few people.
- Migraine head ache may be aggravated by consumption of banana and alcohol. Hence consumption of banana is not advisable with alcohol.
- High carbohydrate presence combined with tryptophan content in the fruit affect user's state of awareness influencing brain activity and bring sleepiness.

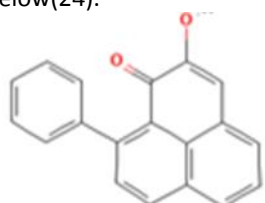
2. Phytochemical profile

Phyto is the Greek word for plant. There are many families of phytochemicals and they help the human body in a variety of ways. Phytochemicals may protect human from a host of diseases. Phytochemicals are non-nutritive plant chemicals that have protective effects and disease properties. Plants continue to be a significant source of biological active compounds and the new chemical entities and developing novel chemical compounds requires a multidisciplinary approach integrating ethnobotanical, ethnopharmacological, phytochemical and biological methods(13,14,15).

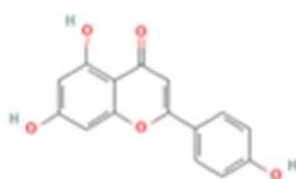
Medicinal properties of banana:

(traditional medicine) 1) Fruit has mild laxative, constipation property. 2) Banana plant is believed to be helpful in curing diarrhea, dysentery. 3) Fruit is used to treat intestinal lesions. 4) The core of stem is believed to be useful in stomach upset and diabetics. 5) Extract of core of stem is useful in dissolving the kidney stones and urinary bladder (16,17,18,19,20,21).

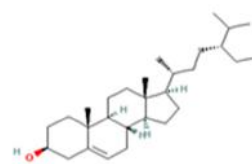
Chemical composition: *Musa acuminata* powder of leaf, shoot, root, peel, pseudo stem, rhizomes. contains the variety of phytochemicals such as saponins, terpenoids, steroids, anthocyanins, fatty acids, tannins, phenols, alkaloids, flavonoids have been discovered(22). The amount of phytochemicals found varies depending on the extraction technique and the use of solvent during extraction (23). Some of the bioactive compounds in *Musa acuminata* are Apigenin-7-glucoside, Myricetin-3-galactoside, Myricetin-3-O-rutinoside, naringenin-7-O-glucoside, kaempferol-3-O-rutinoside, Dopamine, M-acetyl serotonin, rutin, pectin and the structures drawn below(24).



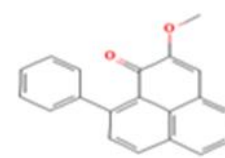
Anegorufone



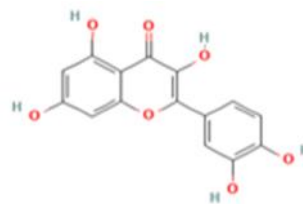
Apigenin



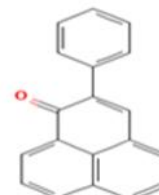
Beta sosterol



Methoxy angeofurane



Quercetin



Phenyl pheninone

3. Pharmacological Activities

1) Anti-oxidant activity:

Reactive oxygen species are oxygen free radicals with unpaired free electrons involved in both physiological and pathological conditions(25). Antioxidants on the other hand, prevent free radical damage by scavenging the radicals(26). Banana contains various compounds that exerts anti-oxidant activity. The highest chemical compound is 2,2-azido-bis(3-ethylbenzothiazoline-6-sulphonic acid) ABTS and DPPH free radical scavenging activities, indicative of strong relationship between the phenolic content and radical scavenging power of the flowers(27,28).

2) Anti ulcer activity:

Ulcer is a lesion caused by different factors some of them are caused by intestinal bacteria *Helicobacter pylori* and excess acidity. M ethanol extract of banana peel shows anti-ulcer activity against indomethacin plus pylorusligation-induced ulcer(29). The ulcer activity is measured by ulcer index, gastric wall mucus, gastric juice pH, and volume of ulcer induced animals. The study revealed that the methanol extract of banana peel extracts was able to prevent the induced ulcer by strengthening the gastric mucosa and decreasing the acidity of gastric juice. The volume of ulcer index compared to the standard ulcer drug ranitidine. The reason behind for anti ulcer activity of banana is to the presence of Leucocyanin. The results showed the preventive effect of peel extracts against indomethacin plus pylorus ligation-induced ulcer by 68.80 ± 20.53 and $43.22 \pm 14.82\%$.(30)

3) Cytotoxic effects:

Banana extracts suppress the growth of breast cancer on cell line (MCF-7) and human colorectal carcinoma (HCT-116) tumor cell line along with the human umbilical vein endothelial cells (HUVEC cell). Hexane extract of banana peel and pulp showed maximum toxicity against HCT - 116 and MCF - 7 cell lines with range of 62.04 and 61.21 respectively. But all the texted extracts show virtually no cytotoxic effect against the normal cell lines.(31)

4) Snake venom activity:

Borges et al. reported the *in vitro* neutralizing capacity of *Bothrops jararacussus* and *Bothrops neuwiedi* snake venom by the stem juice of *Musa paradisiaca* (32). The phospholipase A2kPLA2 and hemorrhagic activities induced by the venom was inhibited by the extract as it forms unspecific complex. However *in vivo* activity of the extract in mice was not significant to protect against the venom.

5) Anti-hypertensive activity:

Anti hypertensive activity of *Musa paradisiaca* in albino rats estimated by a mean arterial blood pressure lowering in rats with elevated blood pressure induced by the compound deoxycorticosterone acetate(DOCA),(33) the antihypertensive effect of ripe banana pulp in DOCA. Perfumi et al. (1994) reported that the antihypertensive effect of ripe banana pulp in deoxycorticosterone enantate-induced hypertensive rats, due to high tryptophan and carbohydrate content of banana that increases serotonin levels and gives serotonin-mediated natriotic effect.(34)

6) Hypoglycemic activity:

Due to the presence of high content of potassium (K) and sodium (Na) has been correlated with the glycemic effect,(35) fiber content present in fruit enhances glycogenesis in the liver and also lowered fasting blood glucose.(36) Researchers found that the hydro methanolic extract of *Musa paradisiaca* root and *Musa sapientum*, controls the lipid peroxidation in diabetics. Isolated pectin from the juice of the inflorescence stalk of *Musa sapientum* increases the glycogen synthesis, decreases glycogenolysis and gluconeogenesis.(37)

7)Anti-Leishmanial activity Phytoalexins from the *Musa acuminata* were discovered to have leishmanicidal action. The mitochondria of *Leishmania donovani* promastigotes and *L. infantum* amastigotes were targeted by anti-fungal phenyl-phenalenone phytoalexin REF20 and anigorufone compounds from the rhizome of *Musa acuminata*. The REF20 showed a somewhat stronger inhibitory impact on *L. donovani* and *L. infantum* proliferation, with LC 50S of 10.3µg/ml and 10.5 µg/ml, respectively than the anglophone, which had LC50S of 12.0µg/ml and 13.3µg/ml.(38)

8) Effect on atherosclerosis:

Arlinda SP, Kartika PR, Eria NP, Dyah PA, found that the *Musa paradisiaca* peel extract was used as an effective anti-atherosclerotic agent by the inhibition of NF-KB(nuclear factor kappa;beta) and increasing e-NOS (endothelial nitric oxide synthase) expression in atherogenic rats using immunohistochemical method. The extract can lower NF-Kβ activity by 82.1% and increase e-NOS expression by about 95.2%.(39)

9) Banana in pharmaceutical industries:

Ethnobotanists says that the plants are the gold mines of pharmaceutical industries. They produce raw materials, New Chemical Entities (NCE), Biological new compounds. Various formulations were prepared by direct compression method using super disintegrants(40) like banana, sodium

starch glycolate and cross carmellose sodium. Banana powder shows better disintegrating property over synthetic superdisintegrants such as SSG(sodium starch glycolate) and CCS (cross caramel sodium). Today, Nanotechnology is an emerging sector in the field of pharmaceutical industry. Nanoparticles are used to increase the surface-to-volume ratio of pharmaceutical agents. These particles pass through the biological barriers and are made from a wide array of biocompatible materials. Acetylated banana starch was used as nanovehicles for curcumin encapsulation and release. Acetylation proved to be a powerful chemical alteration for encapsulation of hydrogen bond donor molecule like curcumin(41). The formed nanoparticle shows strong hydrogen bond accepting sites. The encapsulation of Acetylated banana starch powder does not effects properties such as particle size and polydispersity index. The result showed that the ABSNp (acetylated banana starch nanoparticle) allowed more controlled release of curcumin in gastric medium.(42)

4. Conclusion

All the above information of banana was collected from electronic search using Pubmed, Scopus, Web of science, Science direct for published articles. This review presents phytochemicals and pharmacological information of *Musa acuminata*. The review starts that the traditional use and also pharmacological usage discovered by the researchers. The leaves and peels are regarded as agriculture waste but have high protein, fiber, carbohydrate as well as mineral and considered as cheap nutritive food. Phytochemicals present in the includes phenols, carotenoids, amine, secondary metabolites like tannins, terpenoids, glycosides, alkaloids. Pharmacological activities include atherosclerotic agent, wound healing agent, antimicrobial agent, antidiabetic agent, anti-ulcer agent, cytotoxic effect on cancer cells. Further bio active constituents need to be isolated and should be considered for further *in vivo* studies to confirm the claims and to explore the potential for the development of New Chemical Entities (NCE) and also Biological active compound in the novel drug development.

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