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An overview of *Musa paradisiaca* Linn.

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ABSTRACT

As the people are becoming aware of the potency and side effect of synthetic drugs, there is an increasing interest in the natural product remedies with a basic approach towards the nature all over the world. Many infectious diseases have been treated with herbals throughout the history of mankind. Medicinal plants play a vital role for the development of new drugs. It is estimated that about eighty percent of the world's population residing in the vast rural areas of the developing and under developed countries, still rely mainly on medicinal plants. Medicinal plants are the only affordable and accessible source of primary health care for them, especially in the absence of access to modern medical facilities. In this review literature on of *Musa paradisiaca* Linn. pharmacological activities as well as the chemical constituents have been summarised.

KEYWORDS

Musa paradisiacal; Musaceae,chemical constituents and biological activities.

INTRODUCTION

Musa paradisiaca L. (Family:Musaceae), commonly known as "plantain" is a perennial tree-like herb widely distributed in the tropics. *M. paradisiaca* is still largely unexplored source for the development of new drugs. Globally, about 85% of all medications for different diseases are derived from plants. Hence, the aim of the present review on *M. paradisiaca* is to collect all the work done on this important plant in one place, to facilitate the researchers to explore further on this plant.

It is a tall, robust herb, and the plant portion above the ground is a false stem (pseudostem) consisting of concentrically formed leaves, from the centre of which develops the inflorescence stalk. The rhizome or true stem is underground. Near the tip of the flower stalk are several groups of sterile male flowers subtended by brilliant purple bracts. The lower female flower clusters on the same stalk and give rise to the fruit.

The whole plant as well as specific parts (Flowers, banana bracts, ripe, unripe fruits, leaves and

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stems) of plant extract and its active constituents have been used for the treatment of large number of human ailments. Traditionally the plant has been used for different purposes such as abscess, alopecia, burns, cancer, cataplasm, diabetes, diarrhea, dog bites, snake bite, dysentery, dyspepsia, fracture, gangrene, hematuria,emiplegia, hemoptysis, hemorrhage, hypertension, lizard bites, marasmus, migrain, ringworm, shingles, smallpox, syphilis, tuberculosis, tumor, uremia, otalgia, psoriasis, urticaria, warts and wounds[1]. Similarly, the pulp has antiulcer, wound healing, hair growth promoting, analgesic, antioxidant property and hepatoprotective activities[2].

Despite these medicinal importance of *M. paradisiaca*, it is usually cultivated for food. It is consumed as an energy yielding food and desert. Fruits are an important contribution to the diets of many peoples. India is the largest producer of banana. The states of Maharashtra and Gujarat in Western India, Karnataka in Southern India and Assam in the northeast are large banana growers.

CHEMICAL CONSTIUTENTS

The whole plant as well as specific parts (Flowers, banana bracts, ripe, unripe fruits, leaves and stems) of plant extract and its active constituents have been used for the treatment of large number of human ailments. Flower consists of tannins, saponins, reducing and non reducing sugars, sterols and triterpenes. The structure of new tetracyclic triterpine isolated from the flowers of *M. Paradisiaca* Linn was determined as (24R)-4α-14α, 24-trimethyl-5-cholesta-8, 25-dien-3β-ol[3]. The anthocyanins reported are 3-rutinoside derivatives of dephinidin, pelargonidin, peonidine and malvidin[4]. Fruit consists of carbohydrates, amino acids, sugar and starch. The skin of the fruit is rich in cellulose (10%), hemicelluloses (7%). The pulp protein was rich in arginine, aspartic acid, glutamic acid,methionine and tryptophan[5]. A new bicyclic diarylheptanoid,8-hydroxy-3-(4-hydroxyphenyl)-9-methoxy-4a,5,6,10b-tetrahydro-3H naphthopyran as well as four known compounds 1,2 dihydro 1,2,3 trihydroxy-9-(4-methoxy phenyl) phenalene 2-hydroxy anigorufone, 2-(4-hydroxy phenyl) naphthalic anhydride and 1,7 bis(4-hydroxy phenyl) hepta-4,6-diene-3-one were isolated from ethyl acetate soluble fraction of the methanolic extract of fruits[6]. Peeled fruits consist of two new acyl steryl glycosides Sitoindoside-III and Sitosterol myo-inositylbeta-D-glucoside[7]. Fruit pulp consists of three forms of α-glucan phosphorylase[8]. Leaves having two forms of starch phosphorylase were found in the mature banana leaf[9].

PHARMACOLOGICAL ACTIVITIES

The various effects of *M. paradisiaca* are documented in traditional as well as scientific literature. The main pharmacologial effects of this plant are - diuretic, analgesic, antiulcer, wound healing, antioxidant, hypoglycemic activities mutagenic effects in which few are reported.

Antiulcerogenic activity

In a study conducted to evaluate the effect of orally administered banana pulp powder (0.5 mg/kg orally twice aily for 3 days) in ulcers induced by aspirin,indomethacin, phenylbutazone, prednisolone and cysteamine in albino rats and histamine in guinea pigs suggest that banana powder treatment not only strengthens mucosal resistance against the ulcerogens but also promotes healing by cellular proliferation[10]. In another study, albino rats fed with banana pulp 0.5 gm/kg orally twice daily for 3 days showed significant increase in total carbohydrate content of gastric mucosa, significant decrease in gastric juice and protein and a significant increase in the total carbohydrate and carbohydrate protein ratio of gastric juice[11]. The active ingredient of banana responsible for antiulcerogenic effect, identified to be leucocyanidin, a flavonoid. The leucocyanidin at 5 mg/kg orally demonstrated a significant ($p < 0.05$) protective effect against aspirin induced erosions[12].

Antidiarrhoeal activity

A clinical trial was conducted to evaluate the efficacy of a solution of 50 gm/L of plantain flour and 3.5 gm/L of sodium chloride for rehydration of children with acute diarrhoeal disease. The plantain flour based solution proved effective for the treatment of dehydration due to acute diarrhoeal dis-

eases[13].

Antimicrobial activity

In a study conducted to evaluate the in–vitro antimicrobial activity of the root extracts of plantain banana, it was found that the benzene extract showed significant bactericidal and fungicidal effect. The hexane extract showed significant activity against gram negative bacteria[14]. In one study banana showed activity against *E. coli* and *S. aureus*[15].

Wound healing activity

The wound healing activity of both methanolic and aqueous extract of plantain banana in rats was studied and both extracts were found to increase hydroxyproline,hexuronic acid, hexosamine and superoxide dismutase as well the wound breaking strength and reduced glutathione level. They also decreased the wound area, scar area and lipid peroxidation. The effects were attributed to the antioxidant property of the plantain[16].

Hepatoprotective activity

The hepatoprotective activity of stem of *M. paradisiaca* in CCl4 model showed significant biochemical and histological deteriorations in the liver of experimental animals. Pretreatment with alcoholic extract (500mg/kg) more significantly and to a lesser extent the alcoholic extract (250 mg/kg) and aqueous extract (500 mg/kg), reduced the elevated levels of the serum enzymes like serum glutamic-oxaloacetictransaminase (SGOT), Serum glutamic pyruvic transaminase (SGPT), Alkaline phosphatase (ALP) and bilirubin levels, Also the alcoholic and aqueous extracts reversed the hepatic damage towards the normal, which gives the evidence of hepatoprotective activity of stem of *M. paradisiacal*[17].

Mutagenic effect

Mutagenic effect of the *M. paradisiaca* fruit peel extract was assessed by the single-cell gel electrophoresis (SCGE) and micronucleus assays. Peripheral blood cells of Swiss mice were collected 24 h after treatment for the SCGE assay and 48 and 72 h for the micronucleus test after feeding the extract in three different concentrations (1000, 1500 and 2000 mg/kg Body Weight). It was concluded that the two higher doses of the extract of *M. paradisiaca* induced significant increases in the average numbers of DNA damage in peripheral blood leukocytes for the two higher doses and a significant increase in the mean of micronucleated polychromatic Erythrocytes in the three doses tested[17].

Vasodilatory activity

The effect of aqueous extract of plantain on the contractile response of rats' aorta and portal veins was studied. It was observed that the extract produced relaxation of the contracted aorticrings, induced by noradrenaline and potassium chloride and completely abolished the spontaneous contraction of the portal veins[18].

Hypoglycaemic activity

Following a study on rabbits, it was reported that *M.sapientum* fruit showed significant antihyperglycaemic activity. The results showed significant decrease in the hyperglycaemic peak and/or the area under the glucose tolerance curve[19].

Hypolipidemic activity

A study of the effect of dietary fiber from unripe plantain banana on cholesterol metabolism revealed that, albino rats fed natural detergent fiber (NDF) from unripe plantain banana showed significantly lower levels of cholesterol and triglyceride in serum and tissues in both cholesterol diet and cholesterol free diet groups, when compared to control rats fed fiber free diet. Concentration of bile acids was high in rats fed NDF in both groups. Absorption of glucose and cholesterol in rabbits was significantly lowered in presence of NDF from unripe banana[20].

Analgesic activity

The analgesic activity of aqueous extract of the plant was evaluated using the hot plate method and writhing test in mice. The hot plate method is useful in detecting centrally acting analgesics whereas acetic acid induced writhing method is useful to detect peripheral analgesic effects. Acetic acid, which is used as an inducer for writhing syndrome, causes analgesia by liberation of endogenous substances, which then excite the pain nerve endings. The fact

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that aqueous extract of *M. paradisiaca* showed analgesic activity in both the models studied, indicate that this effect could be due to the presence of two components; one acting centrally and the other via peripheral route from the above results, it can be deduced that aqueous extract has shown dose dependent activity. As the phytochemical screening has shown the presence of carbohydrates, sterols, proteins, flavonoids,alkaloids in aqueous extract of *M. paradisiaca* leaves, its potent activity may be attributed to the presence of these phytoconstituents[21].

Antioxidant property

The antioxidant behavior of the extracts was evaluated by using the thiocyanate method, ß-carotene bleaching method and 1, 1-diphenyl-2-picrylhydrazyl (DPPH) free radical elimination. Antioxidant activity of water extracts was comparable to those of synthetic antioxidants such as butylated hydroxyanisole and butylated hydroxytoluene and it shows a significantantioxidant property. The antioxidant effects of crude extracts from green banana and yellow peel were investigated and the results indicated that the extract of green peel recorded more significant activities than that of yellow peel at other solvents extracts[17].

Diuretic activity

Ash of the peel of *M.sapientum* showed an increase in urine volume and K as well as other electrolyte excretion than normal saline in a study in rats. Successive ethanolic extract also give this diuretic effect[22].

Antihypertensive activity

The effect of plantains on deoxy-corticosterone acetate (DOCA) induced elevation of mean arterial blood pressure in albino rats has been studied. The consumption of plantain diet by rats, previously treated with DOCA lowered the mean arterial blood pressure to control values. Also, no significant change in the mean arterial blood pressure compared to control was seen in the rats, which were administered DOCA following a previous diet of plantain. Chronic consumption of plantain is capable of lowering DOCA induced elevated mean arterial blood 22 pressure and also prevent the onset of DOCA induced hypertension in the rats[23].

Anti-allergic activity

Ripe *M.sapientum* pulp water extract has been reported to have significant anti-allergic activity on antigen-induced degranulation in RBL-2H3 cells with an IC 50 value of 13.5 ± 2.4[24].

CONCLUSIONS

The bioactive extract should be standardized on the basis of active compounds. The bioactive extract should undergo safety studies. Almost, 70% modern medicines in India are derived from natural products. Medicinal plants play a central role not only as traditional medicines but also as trade commodities, meeting the demand of distant markets. India has a very small share (1.6%) of this ever-growing global market. To compete with the growing market,there is urgency to expeditiously utilize and scientifically validate more medicinally useful plants.

Conflict of interest: None

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