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Nutritional and therapeutic values of *Musa paradisíaca* - A review

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ABSTRACT: The different parts of *Musa paradisiaca* (Family: Musaceae) are widely used for nutritional and therapeutic purposes. Phytochemical analysis showed that *Musa paradisiaca* contained carbohydrates, reducing sugar, tannins, saponins, alkaloids, glycosides, steroids, phytosterols, phenols, flavonoids, terpenoids and many other secondary metabolites. The recent pharmacological reviews revealed that *Musa paradisiaca* possessed hypolipidemic, antidiabetic, hypotensive, antioxidant, antiulcerogenic, antidiarrhoeal, antimicrobial, antiparasitic, wound healing, anticancer, anti-angiogenic, hepato and nephroprotective, reproductive, antiallergic, antiasthmatic, anti-inflammatory, analgesic, antiurolithiatic, galactagogue, and thrombolytic effects. The current review discussed the traditional uses, ingredients, pharmacological and toxicological effects of *Musa paradisiaca*.
Keywords: banana; constituents; pharmacology.

Valores nutricionais e terapêuticos da *Musa paradisíaca* - Uma revisão

ABSTRACT: As diferentes partes de Musa paradisiaca (Família: Musaceae) são amplamente utilizadas para fins nutricionais e terapêuticos. A análise fitoquímica mostrou que Musa paradisiaca continha carboidratos, açúcares redutores, taninos, saponinas, alcalóides, glicosídeos, esteróides, fitoesteróis, fenóis, flavonóides, terpenóides e muitos outros metabólitos secundários. As recentes revisões farmacológicas revelaram que Musa paradisiaca possuía propriedades hipolipidêmicas, antidiabéticas, hipotensoras, antioxidantes, antiulcerogênicas, antidiarreicas, antimicrobianas, antiparasitárias, cicatrizantes, anticancerígenas, antiangiogênicas, hepato e nefroprotetoras, reprodutivas, antialérgicas, antiasmáticas, antiinflamatórias, analgésicas, efeitos antiurolitiáticos, galactagogos e trombolíticos. A presente revisão discutiu os usos tradicionais, ingredientes, efeitos farmacológicos e toxicológicos da Musa paradisiaca.
Palavras-chave: banana; constituintes; farmacologia.

1. INTRODUCTION

Plants represent a source of many secondary metabolites, which can be used as food additives, pharmaceuticals, flavors, fragrances, colors, agrochemicals and biopesticides, etc. In the current review, databases including Web Science, Pub Med, Scopus and Science Direct, were searched to investigate the traditional uses, chemical constituents, pharmacological and toxicological effects of *Musa paradisiaca*. The roots, leaves, flowers and fruits of *Musa paradisiaca* (Family: Musaceae) were widely used in traditional medicine.

Phytochemical analysis showed that *Musa paradisiaca* contained carbohydrates, reducing sugar, tannins, saponins, alkaloids, glycosides, steroids, phytosterols, phenols, flavonoids, terpenoids and many other secondary metabolites.

The recent pharmacological reviews revealed that *Musa paradisiaca* possessed hypolipidemic, antidiabetic, hypotensive, antioxidant, antiulcerogenic, antidiarrhoeal, antimicrobial, antiparasitic, wound healing, anticancer, anti-angiogenic, hepato and nephroprotective, reproductive, antiallergic, antiasthmatic, anti-inflammatory, analgesic, antiurolithiatic, galactagogue, and thrombolytic effects. The current review will highlight the traditional uses, chemical constituents and pharmacological effects of *Musa paradisiaca*.

2. LITERATURE REVIEW

2.1. Plant profile

2.1.1 Synonyms (CATALOGUE OF LIFE, 2023)

Musa paradisiaca f. dongila, Musa paradisiaca f. funu-nua, Musa paradisiaca f. kilola, Musa paradisiaca f. seluka, Musa paradisiaca f. tuba, Musa paradisiaca subsp. normalis, Musa paradisiaca subsp. sapientum, Musa paradisiaca subsp. troglodytarum, Musa paradisiaca var. *acicularis, Musa paradisiaca* var. *bende, Musa paradisiaca* var. *bilul, Musa paradisiaca* var. *champa, Musa paradisiaca* var. *cinerea, Musa paradisiaca* var. *coarctata, Musa paradisiaca* var. *compressa, Musa paradisiaca* var. *coriacea, Musa paradisiaca* var. *corniculata, Musa paradisiaca* var. *dacca, Musa paradisiaca* var. *dorsata, Musa paradisiaca* var. *dubia, Musa paradisiaca* var. *exsicca, Musa paradisiaca* var. *fatua, Musa paradisiaca* var. *formosana, Musa paradisiaca* var. *glaberrima, Musa paradisiaca* var. *glauca, Musa paradisiaca* var. *granulose, Musa paradisiaca* var. *hookeri, Musa paradisiaca* var. *kitebbe, Musa paradisiaca* var. *lacatan, Musa paradisiaca* var. *longa, Musa paradisiaca* var. *lunaris, Musa paradisiaca* var. *magna, Musa paradisiaca* var. *martabarica, Musa paradisiaca* var. *maxima, Musa paradisiaca* var. *mensaria, Musa paradisiaca* var. *mensaria, Musa paradisiaca* var. *odorata, Musa paradisiaca* var. *oleracea, Musa paradisiaca* var. *papillosa, Musa paradisiaca* var. *pumila, Musa paradisiaca* var. *pumila, Musa*

paradisiaca var. *punctata, Musa paradisiaca* var. *purpurascens, Musa paradisiaca* var. *regia, Musa paradisiaca* var. *rubra, Musa paradisiaca* var. *sanguine, Musa paradisiaca* var. *suaveolens, Musa paradisiaca* var. *subrubea, Musa paradisiaca* var. *ternatensis, Musa paradisiaca* var. *tetragona, Musa paradisiaca* var. *thomsonii, Musa paradisiaca* var. *tombak, Musa paradisiaca* var. *ulnaris, Musa paradisiaca* var. *violacea, Musa paradisiaca* var. *violacea, Musa paradisiaca* var. *viridis, Musa paradisiaca* var. *vittata*

2.1.2 Taxonomic classification (ITIS REPORT, 2021)
Kingdom: Plantae
Subkingdom: Viridiplantae
Infrakingdom: Streptophyta
Superdivision: Embryophyta
Division: Tracheophyta; Subdivision: Spermatophytina
Class: Magnoliopsida
Superorder: Lilianae
Order: Zingiberales
Family: Musaceae
Genus: *Musa*
Species: *Musa paradisiacal*

2.1.3. Common names (U.S. NATIONAL PLANT GERMPLASM SYSTEM, 2023).
Arabic: Moz; Talh, Moz Ferdos;
English: Banana, French plantain, Plantain;
French: Bananier;
German: Banane, Ess-Banane, Mehlbanane;
Portuguese: Banana-caturra, Banana-da-terra, Banana-de-São, Banana-ouro, Banana-prata;
Spanish: Banana

2.1.4 Distribution

Bananas originated in the Asian, and Australian tropics. From the 3rd century BC, it was known in the Mediterranean region, in the 10th century AD, it was carried to Europe. Early in the 16th Century, It was reached the West African coast and South America. Now, it is widely found throughout the tropical and subtropicais countries. India, Philippines, China, Brazil, Indonesia, Mexico, Colombia and Thailand are the top banana producing countries (MAHADEVA RAO, 2014; LAVANYA, et al., 2016).

2.1.5. Description

Tree-like herb, up to 9 m in height. Leaf sheaths tubular, forming a thick trunk. Leaf oblong, ragged, splitting between the transverse parallel veins. Spike c. 1 m, drooping. Peduncle thick. Bracts opening in succession, ovate, concave, dark red,15-20 cm. Outer tepals 22-24mm, 5-toothed, tinged pink. Inner tepals 19-20 mm, ovate, acute, concave. Stamens 5. Fruit oblong, fleshy (FLORA OF PAKISTAN, 2012).

2.1.6. Traditional uses

The fruit was used for its nutritional values all over the world (JAWLA SET et al., 2012). Different parts of this plant (fruit, pulp, leaves) were used in folk medicine for the treatment of peptic ulcer, pain, asthma, burns, diabetes, dysentery, headache, inflammation, rheumatism and tuberculosis (NADKARNI, 1982).

The leaf juice was used to treated insects bites, leaves as an arbortifacient, sap in the treatment of diarrhea, dysentery, hysteria and epilepsy, root in the treatment of general weakness, anemia, as antiscorbutic, aphrodisiac, and diuretic, and stem extracts in the treatment of hyperoxaluric urolithiasis, high blood pressure and kidney disease (POONGUZHALI; CHEJU, 1994; KIBRIA et al., 2019).

2.1.7. Part used medicinally

The roots, leaves, flowers and fruits were used medicinally (KIBRIA et al., 2019).

2.1.8. Physicochemical characteristics

The physicochemical measurements of the of *Musa paradisiaca* stamen were (w/w): loss on drying (5.5%), total ash (5.81%), water-soluble ash (3.79%), acid-insoluble ash (2.61%), water-soluble extractive (7.17%), methanol soluble extractive (2.38%), hexane soluble extractive (1.44%), ethyl acetate soluble extractive (2.24%), and petroleum ether soluble extractive (4.0%) (ASHISH et al., 2017).

2.2. Chemical constituents

The preliminary phytochemical analysis of various parts extracts of *Musa paradisica* showed that the plant contained carbohydrates, reducing sugar, tannins, saponins, alkaloids, glycosides, steroids, phytosterols, phenols, flavonoids and terpenoids (KIBRIA et al., 2019; ASHISH et al., 2017; MAHMOOD et al., 2011).

The flower contains alkaloid (1.56 ±0.2 g/100g), saponin (1.43 ± 0.14 g/100g), total phenolic (5.83 ± 0.78 g/100g), tannin (88.31 ± 4.53 mg/100g) and total flavonoid (3.98 ± 0.01 mg/100g) (MAHMOOD et al., 2011).

The nutritional value of banana (/100g) were: energy 90 kcal, carbohydrates 22.84 g, protein 1.09 g, total fat 0.33 mg, cholesterol 0 mg, dietary Fiber 260 mg, vitamins (folates 20 µg, niacin 0.66 mg, pantothenic acid 0.33 mg, pyridoxine 0.36 mg, riboflavin 0.07 mg, thiamin 0.031 mg, vitamin A 64 IU, vitamin C 8.7 mg, vitamin E 0.10 mg, vitamin K 0.5 µg), electrolytes and minerals (sodium 1 mg, potassium 358 mg, calcium 5 mg, copper 0.07 mg, iron 0.26 mg, magnesium 27 mg, manganese 0.27 mg, phosphorus 22 mg, selenium 1.0 µg, zinc 0.15 mg) and phyto-nutrients (carotene-α 25 µg, carotene-β 26 µg, luteinzeaxanthin 22 µg). The elemental composition of ashes from banana petioles/midrib, leaf blades, floral stalk, leaf sheaths and rachis (% of ash content) were: Si 7.0, 24.9, 7.8, 2.7 and 1.2; Ca 32.3, 8.0, 0.6, 5.5 and 0.6; K 9.4, 11.6, 23.1, 21.4 and 28.0; P 0.7, 0.7, 0.7, 0.9 and 1.7; and Mg 2.9, 1.1, 0.5, 1.9 and 0.3 respectively (RAJESH, 2017; SIDHU; ZAFAR, 2018).

However, chemical composition of banana 5 hybrids and variety showed the following contents: lipids 0.48 ± 0.03 - 0.80 ± 0.01%, proteins 2.14 ± 0.14 - 3.17 ± 0.07%, total sugars 3.32 ± 0.13 - 4.78 ± 0.44%, reducing sugars 0.57 ± 0.05 - 0.59 ± 0.06%, total glucids 93.04 - 95.47%, starch 80.55 - 82.44%, ashes 1.81 - 2.15%, energetic value 392.04 - 395.07 cal/100 g, potassium 222.8 - 244.5 mg/100g, magnesium 23.9 - 83.8 mg/100g, calcium 5.8 - 19.4 mg/100g, sodium 0.6 - 7.4 mg/100g and iron 0.3 - 0.7mg/100g (COULIBALY, et al, 2007). Various phenolics were isolated from *Musa paradisiaca* including ferulic acid, sinapic acid, salicylic acid, gallic acid, p-hydroxybenzoic acid, vanillic acid, syringic acid, gentisic acid, p-coumaric acid, catechin, epicatechin, tannins, and anthocyanins (KANDASAMY; ARADHYA, et al., 2014; RUSSELL et al., 2009). Flavonoids: quercetin, myricetin, kaempferol, cyaniding, apigenin, luteolin, capsaicin, isorhamnetin, caffeic acid, p-hydroxybenzoic acid, shogaol, glycitein and gingerol were

isolated from *Musa paradisiaca* (SHODEHINDE et al., 2013; KEVERS et al., 2007). The flower of *Musa paradisiaca* contained alkaloid (1.56 ± 0.2 g/100g), saponins (1.43 ± 0.14 g/100g), total phenolics (5.83 ±0.78 g/100g), tannins (88.31 ± 4.53 mg/100g) and flavonoids (3.98 ± 0.15 mg/100g) (MAHMOOD et al., 2011).

The amount of 5-hydroxytryptamine in the pulp of unprocessed bananas decreased during maturation, whereas that in the peel increased (VETTORAZZ et al., 1974). Rel-(3S,4aR,10bR)-8-hydroxy-3-(4-hydroxyphenyl)-9-methoxy-4a,5,6,10b-tetrahydro -3H-naphtho [2,1-b] pyran, 1,2-dihydro-1,2,3- trihydroxy-9- (4-methoxyphenyl) phenalene; hydroxyanigorufone; 2-(4-hydroxyphenyl) naphthalic anhydride; and 1,7-bis(4-hydroxyphenyl)hepta-4(E),6(E)-dien-3-one, were isolated from an ethyl acetate-soluble fraction of the methanol extract of the fruits of *Musa paradisiacal* (JAN et al., 2002). Two steryl glycosides, acyl steryl glycosides (sitoindoside-I, II, III and IV), sitosterol gentiobioside, sitosterol *myo*-inosityl-β-D-glucoside were isolated from fruits of *Musa paradisiaca* (GHOSHAL et al., 1985). Tetracyclic triterpene((24*R*)-4α,14α,24-trimethyl-5α-cholesta-8,25(27)-dien-3β-ol), hemiterpenoid glucoside (1,1-dimethylallyl alcohol β-glucoside), benzyl alcohol glucoside, syringin and (6S, 9R)-roseoside were identified in the fruit of *Musa paradisiaca* (DUITA et al., 1983; MARTIN et al., 2000).

Many compounds included palmitic acid, linoleic acid, linolenic acid, hexadecanoic acid, 18-hydroxyoleic acid, dodecanoic acid, ferulic acid, caffeic acid and 7-Phenylheptyl 4-hydroxybenzoate were isolated from *Musa paradisiaca* peel (CORONA et al., 2015). The skin was richer in cellulose and hemicellulose (10 and 13%) than the pulp (1.4 and 1.3%) respectively. The pulp protein was abundantly rich in arginine, aspartic acid and glutamic acid, with low amount of methionine (KETIKU et al., 1973). Polysaccharide components of the pseudo-stem (scape) of *Musa paradisiaca* were purified, and the sugar compositional analysis showed that the water soluble polysaccharide and EDTA-soluble polysaccharide contained only D-Glc, whereas alkali-soluble polysaccharide contained D-Glc, L-Ara and D-Xyl in ~ 1:1:10 ratio, respectively, and alkali-insoluble polysaccharide contained D-Glc, L-Ara and D-Xyl in ~ 10:1:2 ratio, respectively (ANJANEYALU et al., 1997).

2.3. Pharmacological effects

2.3.1. Hypolipidemic effect

Oral administration of 1 mg/100g bw of flavonoids extracted from unripe fruits of *Musa paradisiaca* possessed significant hypolipidemic activities in male rats. It significantly decreased serum level of cholesterol, free fatty acids, phospholipids and triglycerides in the serum, liver, kidney, and brain. It enhanced HMG CoA reductase activity and significantly reduced the activities of glucose-6-phosphate dehydrogenase and malate dehydrogenase. Furthermore, it also significantly enhanced the activities of lipoprotein lipase and plasma LCAT and significantly increased the concentrations of hepatic and fecal bile acids and fecal neutral sterols which indicated higher rate of degradation of cholesterol (VIJAYAKUMAR et al., 2009).

The anti-hypercholesterolemic activity of unripe plantain (*Musa paradisiaca*) products (elastic pastry and roasted plantain) for 21 days was studied in 1% cholesterol-induced hypercholesterolemic rats. Plantain-supplemented diets significantly decreased the high levels of plasma LPO, total cholesterol, triglyceride, LDL cholesterol, and plasma liver biomarkers, and increased HDL in the plasma of treated animals as compared with the control (ADEKIYA et al., 2018).

The antioxidant activities of the aqueous extracts of unripe plantain (*Musa paradisiaca*), were studied using their inhibitory action on sodium nitroprusside induced lipid peroxidation in rat pancreas *in vitro*. The results showed that all the aqueous extracts possessed antioxidant activity. The boiled flour revealed the highest DPPH and OH radical scavenging activity, while raw flour showed the highest Fe^{2+} chelating ability, sodium nitroprusside inhibitory effect and vitamin C content (SHODEHINDE et al., 2013). Hemicellulose from the unripe *Musa paradisiaca* fruit and other neutral detergent fibers decreased the absorption of glucose and cholesterol and caused low serum and tissue levels of cholesterol and triglycerides (USHA et al., 1984).

2.3.2. Antidiabetic effects

The aqueous extract of *Musa paradisiaca* stamen (100, 200, and 400 mg/kg, orally) was evaluated for hypoglycemic effect in normoglycemic and streptozotocin-nicotinamide induced diabetic rats. In normoglycemic rats, the extract (400 mg/kg, po) effectively controls the blood glucose level in a glucose tolerance test within 30-60 min after glucose (2 g/kg) administration without causing hypoglycemia. While, the extract (400 mg/kg, po) effectively controlled the blood sugar level in streptozotocin-nicotinamide induced diabetic rats (ASHISH et al., 2016).

The ethanol and ethanol: water extracts of *Musa paradisiaca* flowers were screened for hypoglycemic effect in normal and alloxan induced diabetic rats. The blood glucose levels were measured daily after oral administration of extracts at doses of 100, 250 and 500 mg/kg/day. Both extracts reversed the permanent hyperglycemia within a week in alloxan induced diabetic rats. The ethanol extract (250 mg/kg) possessed more hypoglycemic effect than a standard oral hypoglycemic drug, glibenclamide (JAWLA SET et al., 2012).

The hypoglycemic effect of oral banana leaf solution was studied in healthy young male albino rats. Fasting blood sugar after three and four days of administration of the banana leaves solution showed that the solution caused a significant hypoglycemic effect compared with control (77.3 vs 92.8 mg/dl) (SILVESTRE et al., 2016).

The hypoglycemic and antidyslipidemic effects of *Musa paradisiaca*, based diets were investigated in alloxan-induced diabetic mellitus rats. *Musa paradisíaca* based diet significantly decreased the elevated fasting blood glucose, with a significant increase in insulin and glycogen concentrations. The diet also increased hexokinase significantly and significantly reduced ($P<0.05$) glucose-6-phosphatase and fructose-1-6-diphosphatase activities. It also caused a significant reduction ($P< .05$) in cholesterol, triacylglycerol, VLDL, LDL and a significant increase ($P< .05$) in HDL compared with a diabetic control group. *Musa paradisiaca* - based diet also significantly ($P< .05$) reversed the activities of aspartate aminotransferase and alanine aminotransferase compared with diabetic control rats (AJIBOYE et al., 2017).

The antidiabetic and hypolipidemic potential of organic extract (100mg/kg, 250 mg/kg and 500 mg/kg, orally) of *Musa paradisiaca* were studied in alloxan induced diabetic rats.

Organic extract of *Musa paradisiaca* flowers and tracheal fluid possessed significant hypoglycemic activity in addition to significant reduction in LDL, and significant elevation in HDL levels in diabetes rats. Organic extract also restored normal pancreases histology in alloxan induced diabetic rats (KHIZAR et al., 2019).

Serum glucose level, glucose tolerance, lipid profile, hepatic and muscle glycogen contents as well as the activities of hepatic hexokinase and glucose-6-phosphatase were recovered significantly after oral administration of ethyl acetate fractions of *Eugenia jambolana* or *Musa paradisiaca* in separate (*E. jambolana*: 200 mg/kg bw and *Musa paradisiaca*: 100 mg/kg bw) or combined form, for 90 days (twice a day through gavage) in streptozotocin-induced diabetic rats. The loss in body weight of diabetic animals was reversed and serum levels of insulin as well as C-peptide, which were reduced in diabetic rats, were increased significantly after oral administration of the fractions. These effects were further confirmed histologically (PANDA et al., 2009).

The aqueous extracts of roasted and boiled plantains were investigated for α-amylase, α-glucosidase and angiotensin 1 converting enzyme (ACE) inhibitory activity. Higher inhibitory activities on α-amylase, α-glucosidase and angiotensin 1 converting enzyme (ACE) were exhibited by the boiled flour extract. These effect were correlated with phenolic contents, indicating anti-diabetes and anti-hypertension activities (ADAMSON; GANIYU, 2012).

Syringin, a phenyl propanoid glucoside, isolated from *Musa paradisiaca* tepal extract was investigated for its antidiabetic efficacy (50 mg/kg/day orally for 30days) in streptozotocin-induced diabetic rats. Diabetic. The increase in the blood glucose and HbA_{1c} levels, the decline in the plasma insulin and hemoglobin levels in diabetic rats were significantly reversed to near normal limits, after oral administration of syringin. Blood urea, serum creatinine, plasma protein, uric acid and the activities of serum transaminases and alkaline phosphatases were normalized upon syringin treatment (KRISHNAN et al., 2014).

The rats fed with the formulated plantain-based dough meals had lower glycaemic index and glycaemic load, and the blood glucose was significantly reduced compared to cerolina and metformin (FAMAKIN et al., 2016).

The hypoglycemic potential of unripe plantain products was investigated in high fat fed/low dose streptozotocin-induced diabetic rats. Marked increase in the blood glucose, α-glucosidase, α-amylase, and ACE activities with a corresponding decrease in plasma antioxidant status were recorded in diabetic rats. These parameters were significantly reversed by unripe plantain product supplemented diet for 14 days (SHODEHINDE et al., 2015).

The effect of unripe *Musa paradisiaca* was investigated on hepatic dysfunction markers in streptozotocin induced diabetic rats. The diabetic rats had significant alteration ($P < 0.05$) of blood glucose; relative liver weight, relative kidney weight, serum and hepatic AST, ALT, and ALP, serum total and conjugated bilirubin, and serum lipase activities compared with nondiabetic rats. All these parameters were significantly improved ($P < 0.05$) in the rats fed unripe plantain. There were significant decline in the amylase levels of the diabetic rats compared with the nondiabetic, but there was nonsignificant increase ($P > 0.05$) in the amylase levels of the rats fed unripe plantain compared with the nondiabetic rats (ELEAZU; OKAFOR, 2015).

Rats received unripe plantain incorporated feed showed 159.52% decreases in blood glucose, and 24.91% decreases in weights compared with nondiabetic rats, and rats received standard feed, that showed 2.09% and 22.94% increases in blood glucose with 13.42% increase and 45.36% decrease in weights respectively (IROAGANACHI et al., 2015).

The effect of unripe plantain and ginger on renal dysfunction in streptozotocin induced diabetes was studied in rats. Significant decreases in serum urea and creatinine levels and significant increases in both serum total protein and albumin levels ($P=0.033$) were recorded in rats who received unripe plantain pellets compared with rats that received standard feeds (IROAGANACHI et al., 2015).

The ameliorating potentials of unripe plantain (*Musa paradisiaca*) incorporated feeds on the renal and liver growths were studied in diabetic rats. The administration of the test feed for 21 days decreased glucose levels by 38.13% in diabetic rats and amelioration the elevated urinary protein, glucose, specific gravity, and relative kidney weights. The diabetic rats fed unripe plantain incorporated food showed 5.12% and 29.52% decreases in weight and growth rates (ELEAZU et al., 2013).

The fibers of the fruit of *Musa paradisiaca* lowered fasting blood glucose and increased glycogenesis in the liver (USHA et al., 1989).

However, on the other hand, the *Musa paradisiaca* stem juice at a dose of 500 mg/kg, produced a significant rise (28.3%) in blood glucose levels after 6 h of oral administration in normal rats. In addition, the same dose produced a rise of 16.4% in blood glucose levels within 1h during a glucose tolerance test in sub-diabetic rats, and a rise of 16% after 4 h in fasting blood glucose levels of severe diabetic cases (SINGH et al., 2007).

2.3.3. Hypotensive effect

The intake of plantain diet lowered the mean arterial blood pressure to control values, in rats previously treated with desoxycorticosterone acetate (OSIM; IBU, 1991).

The intake of pulp of ripe banana prevented the elevation of blood pressure induced by the intramuscular injection of deoxycorticosterone enantate (25 mg/rat) in rats given access to both water and 2% NaCl solution. The antihypertensive effect of bananas was unrelated to reduced salt intake (PERFUMI et al., 1994).

2.3.4. Antioxidant effect

The aqueous extracts of roasted and boiled plantains were investigated for phenolics and flavonoid contents and antioxidant effects. The total phenol content of the aqueous extracts of roasted and boiled plantains were 89.06±0.03 and 93.12±0.01mg/100g, and total flavonoids were 48.34±0.01 and 61.03±0.0101mg/100g, respectively. The boiled flour showed higher ($P < 0.05$) phenolic contents and reducing power while the roasted flour had higher Vitamin C content (379.21±0.30 vs 247.04±0.04 mg/100g), but there was no significant difference between the ABTS antioxidant activity of both the roasted and boiled (ADAMSON; GANIYU, 2012).
The ethanol extract of *Musa paradisiaca* flower possessed stronger antioxidant activity than aqueous extract (DPPH free radical scavenging assay: IC_{50} values were 1.01 ± 0.16 mg/ml and 1.52 ± 0.13 mg/ml, respectively) (MAHMOOD et al., 2011).

2.3.5. Gastrointestinal effects

Musa paradisiaca possessed potent antiulcer activity in alcohol induced ulcer in rats, evidenced by dose dependant change in gastric mucosal defensive factors like ulcer index, mucin content and non-protein sulfhydryl group (VADIVELAN et al., 2006).

The antiulcerogenic activity of petroleum ether and alcohol extracts of dried unripe banana was studied in mice using indomethacin induced gastric lesions. The ulcer index and histopathological results showed that the petroleum ether extract possessed more antiulcerogenic activity than alcohol extract and standard formulation (MEREKAR et al., 2009).

The antipeptic ulcer effect of the Palo and Horn varieties of banana, was studied in indomethacin and acetic acid-induced gastric lesions in rats. The average lesions length of rats treated with an extract of Palo or Horn bananas at a dose of 1.0 g/kg/day for 3 days before indomethacin were 4.47 ± 1.2 and 1.87 ± 0.44 mm, respectively, while, in the control rats were 14.56 ± 2.43 mm. However, only the Hom *Musa paradisiaca* extract treated group got a beneficial effect manifested by milder degree of histological change than that of the indomethacin induced chronic ulcer group (PANNANGPETCH et al., 2001).

The healing effect of a flavonoid-rich fraction of *Musa paradisiaca* fruit (100, 200 and 400 mg/kg, for 21 days) in the gastric corpus following aspirin-induced gastric lesion was studied in rats. The ulcer index in the gastric corpus of the treated rats was decreased significantly, throughout the experimental period ($P = 0.0001$) compared with control. Histological sections showed a gradual restoration of the epithelial lining in the treated groups. Immuno-histochemical examination showed that *Musa paradisiaca* significantly increased ($P<0.05$) reactivity for both epithelial growth factor receptor and platelet endothelial cell adhesion molecule (ALESE et al., 2017).

Orally administered banana pulp powder (*Musa sapientum* var. *paradisiaca*) induced significant anti-ulcerogenic activity in rats subjected to aspirin, indomethacin, phenylbutazone, prednisolone and cysteamine induced ulcer, and in Guinea-pigs subjected to histamine induced ulcer. Banana powder increased mucosal thickness and [^{3}H]thymidine incorporation into mucosal DNA. Histological studies showed that banana treatment increased staining by alcian blue in the apical cells with staining noted in the deeper layers of the mucosal glands. When sections stained for DNA by the Feulgen reaction, the banana-treated sections showed a greater aggregation and intensity of pink spots compared to controls (GOEL et al., 1986).

Banana pulp powder (*Musa sapientum* var. *paradisiaca*, 0.5 g/kg orally, twice daily for 3 days) was studied for its effects on gastric mucosal resistance. It significantly increased the [^{3}H]thymidine incorporation into mucosal cell DNA, it also significant increased the total carbohydrate (sum of total hexoses, fucose, hexosamine, and sialic acid) content of gastric mucosa. It significantly decreased gastric juice DNA and protein and significantly increased the total carbohydrates and carbohydrate/protein ratio of gastric juice. The results revealed that plantain banana powder strengthened mucosal resistance and promoted the healing of ulcers (MUKHOPADHYAYA et al., 1987).

The antidiarrhoeal activity of the sap of *Musa paradisiaca* was carried out using castor oil-induced diarrhea, castor oil-induced enteropooling, and gastrointestinal motility models. The sap significantly ($P< 0.05$) prolonged the onset time of diarrhea, decreased the number, fresh weight, and water content of feces, and decreased the frequency of defecations in the castor oil-induced diarrhoeal model. It also significantly increased Na^+K^+-ATPase activity in the small intestine, whereas nitric oxide content was decreased. The decreases in the masses and volumes of intestinal fluid by the sap were associated with an increase in the inhibition of intestinal fluid content in the enteropooling model. The sap also decreased the charcoal meal transit in the gastrointestinal motility model (YAKUBU et al., 2015).

A prospective, in-hospital controlled trial was conducted to evaluate the beneficial effect of a green plantain-based diet on stool volume, frequency and weight gain compared to a traditional yogurt-based diet in children with persistent diarrhea. Both groups were not statistically different at admission. Pathogens were isolated from stools in 21.2% and 25% of patients in the experimental and control groups respectively; *Aeromonas hydrophilia* and *Shigela flexneri* were the most frequently isolated bacteria. The experimental group fed on a green plantain diet showed a significantly better response in diminishing stool output and consistency ($P< 0.002$), stool weight, diarrhea duration ($P< 0.001$), and increasing daily body weight gain ($P< 0.001$) than the yogurt-based diet group (ALVAREZ-ACOSTA et al., 2009).

The digestion and absorption of the carbohydrate of *Musa paradisiaca* from the small bowel were studied by feeding ileostomy subjects bananas of six batches of different ripeness and measuring the amounts of carbohydrate excreted in the effluent. The starch content of *Musa paradisiaca* depended on the ripeness being 37% of dry weight in the least ripe and 3% in the most ripest. Excretion of carbohydrates in ileostomy effluent 4–19 g/day and was related to the starch content. The amount of *Musa paradisiaca* starch not hydrolyzed and absorbed from the human small intestine and therefore passing into the colon may be up to 8 times more than the nonstarch polysaccharides (dietary fiber) present in this food, and depends on the state of ripeness when the fruit is eaten (ENGLYST et al., 1986).

2.3.6. Antimicrobial effects

The ethanol and ethanol: water extracts of *Musa paradisiaca* flowers were screened for antibacterial and antifungal activity against standard strains of *Bacillus subtilis, Bacillus cereus, Escherichia coli, Klebsiella pneumonia, Proteus mirabilis, Pseudomonas aeruginosa, Streptococcus pneumoniae, Staphylococcus aureus, Salmonella typhimurium, Candida albicans* and *Cryptococcus albidus*. The ethanol and ethanol: water extracts exhibited antimicrobial activity with minimum inhibitory concentrations ranging from 5.62-25.81 and 7.60-31.50 µg/ml, respectively (JAWLA SET et al., 2012).

The antibacterial activity of the pulp extract of three different banana species was tested against *Staphylococcus aureus*, *Streptococcus mutans*, *Pseudomonas aeruginosa* and *Escherichia coli*. The acetone and methanol extracts of all banana species possessed different zones of growth inhibition at 10 mg/disc against Gram-negative bacteria (*Escherichia coli* and *Pseudomonas aeruginosa*) ranging from 7 to

8.5 mm, while no difference was seen against Gram positive bacteria (*Streptococcus mutans* and *Staphylococcus aureus*). Aqueous extracts, didn't possess antibacterial activity against the tested microorganisms (JALANI et al., 2014).

Methanolic extract of *Musa paradisiaca* stem showed antibacterial activity against *Pseudomonas aeruginosa* (21 mm) and *Staphylococcus aureus* (19 mm) at concentration of 500 µg/disc (AMUTHA et al., 2016).

The antimicrobial effects of methanol, ethanol and acetone extracts of *Musa paradisiaca* peel and fruit were tested against Gram negative (*Escherichia coli, Salmonella typhi, Salmonella typhi, Shigella dysentrariae, Klebsiella pneumonia*) and Gram positive bacteria (*Staphylococcus aureus* and *Bacillus subtilis*). *Musa paradisiaca* peel methanolic (17-40 mm) and ethanolic extract (17-27 mm) showed a higher zone of inhibition against the tested bacteria, than fruit methanolic (7-20 mm) and ethanolic extract (0-17 mm). Acetone extract showed the least antibacterial activity against the tested bacteria (ASOSO et al., 2016).

The antibacterial activity of petroleum ether, chloroform, ethanol leaves extracts of *Musa paradisiaca* cv. *puttabale* was investigated against *Bacillus subtilis*, *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. The ethanol and chloroform extracts of *Musa paradisiaca* showed broad spectrum antibacterial activity against the tested microorganisms (12-17 mm) and (11-14 mm) respectively, with high inhibitory potency against *Escherichia coli* (17 and 14 mm) and *Staphylococcus aureus* (17 and 12 mm), respectively (NAIKWADE et al., 2014).

The antimicrobial activity of crude extract was investigated against *Escherichia coli, Staphylococcus aureus, Bacillus subtilis, Pseudomonas aeruginosa, Candida albicans, Candida tropicalis* and *Aspergillus niger*. The zone of growth inhibition of the extract against *Bacillus subtilis* was 21mm, *Staphylococcus aureus* 18mm, *Escherichia coli* 17.9mm, *Pseudomonas aeruginosa* 18mm, *Candida albicans* 24mm, *Candida tropicalis* 23mm and *Aspergillus niger* 22.3mm, while, MICs of the extract were: *B. subtilis* 55, *S. aureus* 65, *E. coli* 85, *P. aeruginosa* 75, *C. albicans* 50, *C. ttropicalis* 50 and *A. niger* 55µl (KARADI et al., 2011).

The leave hexane, ethyl acetate and methanol extracts of *Musa* sp. were investigated for antibacterial effects against multi-drug resistant microbes causing nosocomial infection. Ethyl acetate extracts possessed the highest activity against the tested pathogens particularly *Escherichia coli*, *Pseudomonas aeruginosa* and *Citrobacter* sp (KARUPPIAH et al., 2013).

2.3.7. Antiparasitic effects

The anthelmintic activity from corm ethanol extracts of *Musa paradisiaca* cv. *puttabale* was investigated using *Pheretima posthuma* as an experimental model. The results showed that the ethanol extract (100 mg/ml) possessed significant anthelmintic activity in time of paralysis: 42.33±1.45 min compared with control (142.67± 1.45 min) and death time was 54.00±0.58 min compared with control (168.00± 1.53 min) (KRISHNA et al., 2013).

Aqueous and methanol extracts of *Musa paradisiaca* possessed anthelmintic activity by inhibiting hatching of eggs of nematodes. Lethal LC_{50} values of crude aqueous and crude aqueous-methanol extracts of *Musa paradisiaca* leaves were 0.0207 and 0.4813, respectively (HUSSAIN et al., 2010). The antiparasitic effect of stem and leaf aqueous, methanolic and/or dichloromethane extracts was studied against *Haemonchus contortus* using egg hatch assay, larval development assay, L3 migration inhibition assay and adult worm motility assay. The significant inhibition of larval development (for each extract: > 67%) and the negative effect of the dichloromethane extract of leaf on the motility of the adult worm (43% of motility inhibition, after 24 hrs of incubation) compared to the negative controls, suggest anthelmintic properties of *Musa paradisiaca* stem and leaf against *H. contortus* (MARIE-MAGDELEINE et al., 2014).

The leishmanicidal effect of *Musa paradisiaca* was investigated using promastigotes and amastigotes of *L. chagasi*. Two fractions of the aqueous ethanolic extract of *Musa paradisiaca* showed IC_{50} values of 1.70 and 1.83 µg/ml against promastigotes and 14.18 and 16.54 µg/ml against amastigotes (ACCIOLY, 2012).

The leishmanicidal activity of triterpenes and sterols isolated from *Musa paradisiaca* fruit peel was studied against L. infantum chagasi promastigotes and amastigotes. Three triterpenes (cycloeucalenone, 24-methylene-cycloartenol and 31-norcyclolaudenone) and a mixture of two sterols (beta-sitosterol and stigmasterol) isolated from the plant, showed statistically similar activity against promastigote compared to pentamidine except for cycloeucalenone, furthermore, all compounds acting against amastigotes, excluding 31-norcyclolaudenone (SILVA et al., 2014).

The antiparasitic effect of banana roots (*Musa paradisiaca*) was evaluated in rabbits infected with coccidiosis. A significant decrease in oocyst output was recorded in both banana root treatment and sulphadimidine sodium treatment (P≤ 0.05) (MATEKAIRE et al., 2005).

2.3.8. Wound healing effects

The wound healing activity of aqueous and methanolic extracts of *Musa sapientum* var. *paradisiaca* was studied using excision, incision and dead space wound models in rats. Both extracts (100 mg/kg), increased wound breaking strength and levels of hydroxyproline, hexuronic acid, hexosamine, and superoxide dismutase, reduced glutathione in the granulation tissue and decreased the percentage of the wound area, scar area and lipid peroxidation in the incision and dead space wounds models compared with the control group (AGARWAL, et al., 2009).

The wound healing activity of methanolic, hexanoic and chloroformic extracts of *Musa paradisiaca* peel was investigated in induced incision wounds in mice. Antioxidant capacity was evaluated by the DPPH method. The groups treated with the methanolic and hexanoic extracts showed better wound healing effects in comparison with the group treated with chloroformic extract, with inhibition of DPPH radical bleaching of 89-90% (PADILLA-CAMBEROS, et al., 2016).

The wound healing activity of methanolic extract of *Musa paradisiaca* stem was investigated using red-hot steel rod from above the hind limb region. The methanolic extract showed greater healing activity than control in rats (AMUTHA et al., 2016). The wound healing activity of leaves and pseudostem of *Musa paradisiaca* was studied in rats. On the 14th day, the lesions treated with the leaf extract ointment showed a smaller area, which histopathologically, showed a more organized healing process (SANTOS et al., 2016).

2.3.9. Anticancer and anti-angiogenic effects

The cytotoxic activity of methanol extract of *Musa paradisiaca* was studied using brine shrimp lethality bioassay. LC_{50} values of the extract were 22.336 ± 0.41µg/ml compared with the standard vincristine sulfate (8.50 ± 0.16µg/ml) (CHOWDHURY et al., 2016).

The anticancer activity of the extracts of *Musa paradisiaca* inflorescence was investigated against HT29 human colon cancer cells. *In vitro* results showed that methanol extract of *Musa paradisiaca* inflorescence possessed cytotoxic effect against HT29 cells. It induced DNA damage and arrested the cell cycle at the G2/M phase. The extract upregulated pro-apoptotic Bcl2 and down-regulated anti-apoptotic Bax proteins. These effects reduced the mitochondrial membrane potential, ATP production; and enhanced cytochrome c release, which triggers the apoptotic pathway (ARUN et al., 2018).

The banana soluble fiber fermented with *Lactobacillus casei* and *Bifidobacterium bifidum* and enriched with short chain fatty acids, initiated apoptotic signalling in HT29 colon cancer cells leading to cell death. They possessed cytotoxic activity, they induced DNA damage and enhanced generation of reactive oxygen species, causing apoptosis. The induction of apoptosis was associated with mitochondrial membrane potential reduction, enhanced delivery of cytochrome c and interference with the expression of pro/antiapoptotic proteins. The HT29 proteins expression, particularly the upregulation of apoptosis- inducing factor-AIFM1 leading to apoptosis of HT29 cells, was altered by exposure to BS (ARUN et al., 2019).

The anti-angiogenic and pro-apoptotic effects of ethyl acetate and n-butanol extracts of *Musa paradisiaca* roots were investigated against mammary neoplasia. The cytotoxic effects of extracts (2-200 µg/ml) on MCF-7, MDA-MB-231 and endothelial cell proliferation and *in vitro* angiogenesis were evaluated by MTT, ^{3}[H]thymidine uptake and endothelial cell tube formation assays. The cell proliferation, angiogenesis and VEGF secretion were investigated by using Ehrlich ascites tumour (EAT) model followed by rat corneal micro-pocket and chicken chorioallantoic membrane (CAM) assays. Ethyl acetate extract of the root showed high cytotoxicity (IC_{50} 60 µg/ml), it inhibited cell proliferation (up to 81%), and tube formation (76%). The treatment with the extract *in vivo,* decreased body weight (50%), cell number (14.7-fold), secreted VEGF (~90%), neoangiogenesis in rat cornea (1.5-fold) and CAM (1.6-fold) besides EAT cells accumulation in sub-G1 phase (18.38%) (HARSHA et al., 2017).

2.3.10. Protective effects

The hepatoprotective effects of the alcoholic and aqueous extracts of stem of *Musa paradisiaca* were investigated in CCl_4 and paracetamol induced hepatotoxicity in rats. CCl_4 and paracetamol administration caused significant biochemical and histological deteriorations in the liver. Pretreatment with alcoholic and aqueous extract (500 mg/kg), reduced the elevated levels of the serum (SGOT, SGP, ALP and bilirubin levels) and reversed the hepatic damage towards the normal (NIRMALA et al., 2012).

The nephroprotective effects of methanolic extract of different parts of *Musa paradisiaca* (bract, flower, trachea and tracheal fluid) were studied in gentamicin-induced nephrotoxicity in mice. Gentamicin increased blood urea nitrogen, blood urea, and serum creatinine, and induced histopathological changes in mice. Treatment with bract methanolic extract (100 and 250mg/kg, bw) and the extract of the flowering stalk (trachea) (250 and 500mg/kg, bw) significantly prevented biochemical and histological changes produced by gentamicin (ABBAS et al., 2017).

2.3.11. Reproductive effects

The effect of oral administration of the aqueous extract of *Musa paradisiaca* root (25, 50, and 100 mg/kg bw, for 14 days) on the testicular function parameters was investigated in male rat testes. The extract significantly ($P< 0.05$) increased the total protein, sialic acid, glycogen, cholesterol, activities of alkaline phosphatase, γ-glutamyltransferase, acid phosphatase, the concentration of testicular testosterone and relative testes weight. However, the extract decreased the concentrations of both serum LH and FSH (YAKUBU et al., 2013).

The effects of the unripe fruit of *Musa paradisiaca* (500 and 1000 mg/kg for 28 days) on the testis and testosterone levels were studied in male rats. The testis of the treated groups showed more rapid cell dividing, more population of sperm cells, and also showed more positivity for Feulgen staining and PAS reaction. Both serum and testicular testosterone levels were reduced. In the animals treated with the low dose, serum testosterone was significantly decreased (0.67 ± 0.03 ng/ml) compared to the control group (1.88 ± 0.15 ng/ml) ($P < 0.05$) (ALABI et al., 2017).

The effects of the administration of mature green fruits of *Musa paradisiaca* (500 and 1000 mg/kg/day) on semen quality were studied in adult male rats. Significant improvement in the semen parameters was noted in rats treated with the lower dose of the plantain flour. Still, rats that received the high dose showed a marked and very significant reduction in sperm cell concentration and percentage of morphologically normal spermatozoa (ALABI et al., 2013).

The effects of *Musa paradisiaca* (orally, 250 and 500 mg/kg/day, for one month) on semen quality were studied in adult male mice. A significant increment in the semen parameters was recorded in the group that received the lower dose of *Musa paradisiaca* fruit flour. Still, males who received the high dose significantly increased sperm cell concentration and percentage of morphologically and histologically normal spermatozoa (ADNAN et al., 2017).

2.3.12. Antiallergic and antiasthmatic effects

The antiallergic potential of a banana pseudo-stem powder was tested in mice sensitized with ovalbumin. A single oral dose (60 mg/kg bw) could not inhibit systemic anaphylaxis in mice. However, a daily (0.6, 2, 6 and 20 mg/kg bw/ day) oral treatment significantly reduced active and passive anaphylaxis (GARCÍA MESA et al., 2019).

The antiasthmatic potential of the hydroalcoholic extract of *Musa paradisiaca* flower was evaluated using histamine or acetylcholine-induced bronchospasm in Guinea pigs, compound 48/80-induced mast cell degranulation in albino rats, and histamine-induced constriction in isolated Guinea pig trachea. Treatment with extract significantly ($P<0.001$) decreased the bronchospasm induced by histamine or acetylcholine in Guinea pigs, the degranulation of mast cells in rats, and histamine-induced constriction in isolated Guinea

pig trachea when compared with the inducer group. In addition, the extract showed a dose-dependent antiasthmatic effect (PATRO et al., 2016).

2.3.13. Anti-inflammatory and analgesic effects

The methanol extract of *Musa paradisiaca* at 200 and 400 mg/kg orally was tested for anti-inflammatory activity using xylene induced ear edema, carrageenan induced paw edema and dextran induced paw edema models. The extract showed significant (P< 0.05), dose dependent anti-inflammatory activity in all models compared with the control (BISWAS et al., 2012).

The analgesic efficacy of aqueous extract of leaves of *Musa paradisiaca* (250mg/kg and 1000 mg/kg) was evaluated in mice by hot plate reaction time and acetic acid induced writhing models. The extract possessed significant analgesic activity in both models, possibly due to central and peripheral analgesic effects (GUPTA et al., 2011).

2.3.14. Antiurolithiatic effect

The efficacy of the antiurolithiatic effect of the aqueous-ethanol extract of *Musa paradisiaca* was studied in urolithiasis induced in a hyperoxaluric rat model using ethylene glycol for 28 days along with 1% ammonium chloride for the first 14 days. Administration of ethylene glycol and ammonium chloride resulted in increased crystalluria and oxaluria, hypercalciuria, polyuria, crystal deposition in urine, raised serum urea, and creatinine as well as nitric oxide concentration and erythrocytic lipid peroxidation. The aqueous-ethanol extract of *Musa paradisiaca* significantly restored the impairment in kidney function test as that of standard treatment, cystone in a dose-dependent manner (PANIGRAHI et al., 2017).

2.3.15. Galactagogue activity

The galactagogue activity of *Musa paradisiaca* flower petroleum ether, ethanol and water extracts was evaluated in rats. Rats treated with aqueous extract produced higher milk than the control and ethanol groups. Aqueous extract increased milk production by 25%, while petroleum ether extract by 18%. The mean yields produced by the rats during the suckling period for aqueous, petroleum ether, ethanol extracts and control were 4.62±2.45, 4.37±1.93, 3.65±1.89 and 3.69±1.79 g/pup/ day (MAHMOOD et al., 2012).

2.3.16. Thrombolytic activity

The thrombolytic activity of methanol extract of the root of *Musa paradisiaca* was studied using the *in vitro* clot lysis method. The extract showed (46.26 ±1.54%) clot lysis as compared to standard streptokinase (67.32±0.34%) (CHOWDHURY et al., 2016).

2.3.17. Side effects and toxicity

The acute toxicity of the *Musa paradisiaca* peel extract was carried out orally in mice using 125, 250, 500, 1000, and 2000 mg/kg bw. No early (24 hrs) or delayed (2 wks) mortality or toxicity were recorded in all doses (PADILLA-CAMBEROS, et al., 2016).

The aqueous extract of *Musa paradisiaca* stamen at a maximum dose (5000 mg/kg) showed no toxicity or behavioral changes in rats (ASHISH et al., 2016). The hydroalcoholic extract of *Musa paradisiaca* flower was safe up to 2000 mg/kg bw, orally in albino rats, it was well tolerated with no mortality and signs of toxicity (PATRO et al., 2016). In acute toxicity, no toxicity signs or death were recorded in rats, and the LD_{50} value of fermented extract of *Musa paradisiaca* was >5 g/kg, orally. In the sub-acute toxicity in rats, oral ingestion of the fermented extract of *Musa paradisiaca* caused no significant toxic effects (P< 0.05) in relative organ weight, body weight percentage, hemoglobin, red blood cell count, electrolyte levels, lymphocyte count, basophils count, aspartate aminotransferase (AST) and alkaline phosphatase (ALP) levels. However, significant differences (P< 0.05) were observed in white blood cells, eosinophils, platelets, neutrophils, monocyte counts, urea, creatinine, alanine aminotransferase and high-density lipoprotein levels. No histological changes were recorded in liver and kidney sections (UGBOGU et al., 2018).

5. CONCLUSIONS

Man depended on nature as a source of foodstuffs, flavors, medicines, shelters, fragrances, clothing, insecticides and fertilizers. There are thousands of plants worldwide, most of which have not been investigated yet for their medical activities. The current review discussed the ingredients and pharmacological effects of *Musa paradisiaca* as a promising medicinal plant for many therapeutic purposes due to its effectiveness and safety.

6. REFERÊNCIAS

ABBAS, K.; RIZWANI, G. H.; ZAHID, H.; QADIR, M. I. Evaluation of nephroprotective activity of *Musa paradisiaca* L in gentamicin-induced nephrotoxicity. **Pakistan Journal of Pharmaceutical Sciences**, v. 30, n. 3, p. 881-890, 2017. https://pubmed.ncbi.nlm.nih.gov/28653934/

ACCIOLY, M. P.; BEVILAQUA, C. M.; RONDON, F. C.; DE MORAIS, S. M.; MACHADO, L. K.; ALMEIDA, C. A.; DE ANDRADE, H. F. JR.; CARDOSO, R. P. Leishmanicidal activity *in vitro* of *Musa paradisiaca* L. and *Spondias mombin* L. fractions. **Veterinary Parasitology**, v. 187, n. 1-2, p. 79-84, 2012. https://pubmed.ncbi.nlm.nih.gov/22521971/

ADAMSON, S. S.; GANIYU, O. Aqueous extracts from unripe plantain (*Musa paradisiaca*) products inhibit key enzymes linked with type 2 diabetes and hypertension *in vitro*. **Jordan Journal of Biological Sciences**, v. 5, n. 4, p. 239-246, 2012. https://jjbs.hu.edu.jo/files/v5n4/Paper%20Number%203m.pdf

ADEKIYA, T. A.; SHODEHINDE, S. A.; ARULEBA, R. T. Anti-hypercholesterolemic effect of unripe *Musa paradisiaca* products on hypercholesterolemia-induced rats. **Journal of Applied Pharmaceutical Science**, v. 8, n. 10, p. 90-97, 2018. 10.7324/JAPS.2018.81012

ADNAN, S.; NOORY, N. Study effect of different doses of *Musa paradisiaca* fruit on the semen quality of mice male as model for human being. **World Journal of Pharmaceutical Research**, v.6, n. 6, p. 169-177, 2017. https://wjpr.s3.ap-south-1.amazonaws.com/article_issue/1496210562.pdf

AGARWAL, P. K.; SINGH, A.; GAURAV, K.; GOEL, S.; KHANNA, H. D.; GOEL, R. K. Evaluation of wound healing activity of extracts of plantain banana *(Musa sapientum* var. *paradisiaca*) in rats. **Indian Journal**

of Experimental Biology, v. 47, n. 1, p. 32-40, 2009. https://pubmed.ncbi.nlm.nih.gov/19317349/

AJIBOYE, B. O.; OLOYEDE, H. O.; SALAWU, M. O. Antihyperglycemic and antidyslipidemic activity of *Musa paradisiaca*- based diet in alloxan-induced diabetic rats. **Food Science & Nutrition**, v. 6, n. 1, p. 137-145, 2017. https://pubmed.ncbi.nlm.nih.gov/29387371/

ALABI, A. S.; OMOTOSHO, G. O.; TAGOE, C. N. B.; AKINOLA, O. B.; ENAIBE, B. U. Effects of unripe *Musa paradisiaca* on the histochemistry of the testis and testosterone levels in adult albino rats. **Nigerian Journal of Physiological Sciences**, v. 32, n. 1, p. 105-108, 2017. https://pubmed.ncbi.nlm.nih.gov/29134985/

ALABI, A. S.; OMOTOSO, G. O.; ENAIBE, B. U.; AKINOLA, O. B.; TAGOE, C. N. Beneficial effects of low dose *Musa paradisiaca* on the semen quality of male Wistar rats. **Nigerian Medical Journal**, v. 54, n. 2, p. 92-95, 2013. https://pubmed.ncbi.nlm.nih.gov/23798793/

ALESE, M. O.; ADEWOLE, S. O.; AKINWUNMI, K. F.; OMONISI, A. E.; ALESE, O. O. Aspirin-induced gastric lesions alters EGFR and PECAM-1 immunoreactivity in wistar rats: modulatory action of flavonoid fraction of *Musa paradisiaca*. **Open Access Macedonian Journal of Medical Sciences**, v. 5, n. 5, p. 569-577, 2017. https://pubmed.ncbi.nlm.nih.gov/28932294/

ALVAREZ-ACOSTA, T.; LEÓN, C.; ACOSTA-GONZÁLEZ, S.; PARRA-SOTO, H.; CLUET-RODRIGUEZ, I.; ROSSELL, M. R.; COLINA-CHOURIO, J. A. Beneficial role of green plantain (*Musa paradisiaca*) in the management of persistent diarrhea: a prospective randomized trial. **Journal of the American College of Nutrition**, v. 28, n. 2, p. 169-176, 2009. https://pubmed.ncbi.nlm.nih.gov/19828902/

AMUTHA, K.; SELVAKUMARI, U. Wound healing activity of methanolic stem extract of *Musa paradisiaca* Linn. (banana) in Wistar albino rats. **International Wound Journal**, v. 13, n. 5, p. 763-767, 2016. https://pubmed.ncbi.nlm.nih.gov/25224162/

ANJANEYALU, Y. V.; JAGADISH, R. L.; SHANTHA RAJU, T. Polysaccharide components from the scape of *Musa paradisiaca*: main structural features of water-soluble polysaccharide component. **Glycoconjugate Journal**, v. 14, n. 4, p. 507-512. https://pubmed.ncbi.nlm.nih.gov/9249151/

ARUN, K. B.; MADHAVAN, A.; THOMAS, S.; NISHA, P. *Musa paradisiaca* inflorescence induces human colon cancer cell death by modulating cascades of transcriptional events. **Food Function**, v. 9, n. 1, p. 511-524, 2018. https://doi.org/10.1039/C7FO01454F

ARUN, K. B.; MADHAVAN, A.; RESHMITHA, T. R, THOMAS, S.; NISHA, P. Short chain fatty acids enriched fermentation metabolites of soluble dietary fibre from *Musa paradisiaca* drives HT29 colon cancer cells to apoptosis. **PLoS One**, v. 14, n. 5, p. e0216604, 2019. https://doi.org/10.1371/journal.pone.0216604

ASHISH, M.; REDDY, K. R. C.; GAUTAM, D. N. S.; MAURYA, S. K.; ANKIT, S. *In-vivo* potential of *Musa paradisiaca* Linn. (Stmn.) in streptozotocin-induced diabetic rats. **International Journal of Green Pharmacy**, v. 10, n. 2, p. 111-116, 2016. https://doi.org/10.22377/ijgp.v10i2.651

ASHISH, M.; REDDY, K. R. C.; MAURYA, S. K.; ANKIT, S.; GAUTAM, D. N. S. Pharmacognostical and phytochemical study of *Musa paradisiaca* Linn. (Stmn.). **International Journal of Green Pharmacy**, v. 11, n. 2, p. 74-79, 2017. https://doi.org/10.22377/ijgp.v11i02.917

ASOSO, O. S.; AKHARAIYI, F. C.; ANIMBA, L. S. Antibacterial activities of plantain (*Musa paradisiaca*) peel and fruit. **Der Pharmacia Lettre**, v. 8, n. 5, p. 5-11, 2016. https://www.scholarsresearchlibrary.com/abstract/antibacterial-activities-of-plantain-musa-paradisiaca

BISWAS, C.; BASAK, D.; CHAKROVERTY, R.; BANERJEE, A.; MAZUMDER, U. K. Effect of methanol extract of *Musa paradisiaca* (Linn) stem juice on chemically induced acute inflammation. **International Journal of Pharmacy and Pharmaceutical Sciences**, v. 4, p. 148-150, 2012. https://innovareacademics.in/journal/ijpps/Vol4Suppl5/4517.pdf

CATALOGUE OF LIFE. ***Musa paradisiaca***, 2023 https://www.catalogueoflife.org/data/taxon/6RQNL

CHOWDHURY, K. A. A.; HOSEN, S. M. Z.; ISLAM, M. N.; HUQ, I.; CHY, N. U.; KABIR, I.; AUNIQ, R. B. J.; UDDIN, R.; SHOIBE, M.; CHOWDHURY, M. A. G. Cytotoxic and thrombolytic activity of roots of *Musa paradisiaca* (Linn). **Pharma Innovation Journal**, v. 5, n. 8, p. 97-100, 2016. https://www.thepharmajournal.com/archives/2016/vol5issue8/PartB/5-7-3-680.pdf

CORONA, M. A. J.; GÓMEZ-PATIÑO, M. B.; FLORES, M. D. P.; RUIZ BLANC, L. A. M.; MARTINEZ, M. B.; ARRIETA-BAEZ, D. An integrated analysis of the *Musa paradisiaca* peel, using UHPLC-ESI, FT-IR and confocal microscopy techniques. **Annals of Chromatography and Separation Techniques**, v. 1, n. 1, e1005, 2015. https://www.jsmcentral.org/sm-chromatography/fulltext_acst-v1-1005.pdf

COULIBALY, S.; NEMLIN, G. J.; KAMENAN, A. Chemical composition, nutritive and energetic value of plantain (*Musa* ssp.) hybrids CRBP 14, CRBP 39, FHIA 17, FHIA 21 and orishele variety. **Tropicultura**, v. 25, n. 1, p. 2-6, 2007. http://www.tropicultura.org/text/v25n1/2.pdf

DUITA, P. K.; DAS, A. K.; BANERJI, N. A. Tetracyclic triterpenoid from *Musa paradisiaca*. **Phytochemistry**, v. 22, n. 11, p. 2563-2564, 1983. https://doi.org/10.1016/0031-9422(83)80165-4

ELEAZU, C. O.; IROAGANACHI, M.; ELEAZU, K. C. Ameliorative potentials of cocoyam (Colocasia esculenta L.) and unripe plantain (*Musa paradisiaca* L.) on the relative tissue weights of streptozotocin-induced diabetic rats. **Journal of Diabetes Research**, v. 2013, e160964, 2013. https://doi.org/10.1155/2013/160964

ELEAZU, C. O.; OKAFOR, P. Use of unripe plantain (*Musa paradisiaca*) in the management of diabetes and hepatic dysfunction in streptozotocin induced diabetes in rats. **Interventional Medicine and Applied Science**, v. 7, n. 1, p. 9-16, 2015. https://doi.org/10.1556/imas.7.2015.1.2

ENGLYST, H. N.; CUMMINGS, H. J. Digestion of the carbohydrates of banana (*Musa paradisiaca sapientum*) in the human small intestine. **The American Journal of**

Clinical Nutrition, v. 44, n. 1, p. 42-50, 1986. https://doi.org/10.1093/ajcn/44.1.42

FAMAKIN, O.; FATOYINBO, A.; IJAROTIMI, O. S.; BADEJO, A. A.; FAGBEMI, T. N. Assessment of nutritional quality, glycaemic index, antidiabetic and sensory properties of plantain (*Musa paradisiaca*) - based functional dough meals. **Journal of Food Science and Technology**, v. 53, n. 11, p. 3865-3875, 2016. https://doi.org/10.1007/S13197-016-2357-Y

FLORA OF PAKISTAN. ***Musa paradisiaca***, 2012, http://www.efloras.org/florataxon.aspx?flora_id=5&taxon_id=222000252

GARCÍA MESA, M. T.; DUMÉNIGO GONZÁLEZ, A.; ACOSTA, L. L. Antiallergic potential of a pseudo-stem powder of *Musa paradisiaca* L. (banana). International Journal of Phytocosmetics and Natural Ingredients, v. 6, p. 5, 2019. https://doi.org/10.15171/ijpni.2019.05

GHOSHAL, S. Steryl glycosides and acyl steryl glycosides from *Musa paradisiaca*. **Phytochemistry**, v. 24, n. 8, p. 1807-1810, 1985. https://doi.org/10.1016/S0031-9422(00)82556-X

GOEL, R. K.; GUPTA, S.; SHANKAR, R.; SANYAL, A. K. Anti-ulcerogenic effect of banana powder (*Musa sapientum* var. *paradisiaca*) and its effect on mucosal resistance. **Journal of Ethnopharmacology**, v. 18, n. 1, p. 33-44, 1986. https://doi.org/10.1016/0378-8741(86)90041-3

GUPTA, S. GARG, V. K.; SHARMA, P. K.; SINGH, A. Analgesic activity of aqueous extract of *Musa paradisiaca*. **Der Pharmacia Sinica**, v. 2, n. 4, p. 74-77, 2011. https://www.imedpub.com/articles/analgesic-activity-of-aqueous-extract-of-musa-paradisiaca.pdf

HARSHA, R. M.; GHOSH, D.; BANERJEE, R.; SALIMATH, B. P. Suppression of VEGF-induced angiogenesis and tumor growth by *Eugenia jambolana, Musa paradisiaca*, and *Coccinia indica* extracts. **Pharmaceutical Biology**, v. 55, n.1, p. 1489-1499, 2017. https://doi.org/10.1080/13880209.2017.1307422

HUSSAIN, A.; KHAN, M. N.; SAJID, M. S.; IQBAL, Z.; KHAN, M. K.; ABBAS, R. Z.; RAZA, M. A.; NEEDHAM, G. R. *In vitro* screening of the leaves of *Musa paradisiaca* for anthelmintic activity. **The Journal of Animal & Plant Sciences**, v. 20, n. 1, p. 5-8, 2010. https://thejaps.org.pk/docs/20-1-2010/Hussain_et_al.pdf

IROAGANACHI, M.; ELEAZU, C. O.; OKAFOR, P. N.; NWAOHU, N. Effect of unripe plantain (*Musa paradisiaca*) and ginger (*Zingiber officinale*) on blood glucose, body weight and feed intake of streptozotocin-induced diabetic rats. **The Open Biochemistry Journal**, v. 9, p. 1-6, 2015. https://doi.org/10.2174/1874091x01509010001

IROAGANACHI, M.; ELEAZU, C.; OKAFOR, P. Effect of unripe plantain (*Musa paradisiaca*) and ginger (*Zingiber officinale*) on renal dysfunction in streptozotocin-induced diabetic rats. **Journal of the Pancreas**, v. 16, n. 2, p. 167-170, 2015. https://pubmed.ncbi.nlm.nih.gov/25791550/

ITIS REPORT. ***Musa paradisiaca***, 2021, https://www.itis.gov/servlet/SingleRpt/SingleRpt?search_topic=TSN&search_value=42391#null

JALANI, F. M. M.; MOHAMAD, S.; SHAHIDAN, W. N. S. Antibacterial effects of banana pulp extracts based on different extraction methods against selected microorganisms. **Asian Journal of Biomedical Pharmaceutical Sciences**, v. 4, n. 36, p. 14-19, 2014.

JAN, D. S.; PARK, E. J.; HAWTHORNE, M. E.; VIGO, J. S.; GRAHAM, J. G.; SANTARSIERO, B. D.; MESECAR, A. D.; FONG, H. H. S.; METHA, R. G.; PEZZUTO, J. M.; KINGHORN, A. D. Constituents of *Musa paradisiaca* cultivar with the potential to induce the phase II enzyme, quinone reductase. **Journal of Agricultural and Food Chemistry**, v. 50, n. 22, p. 6330-6334, 2002. https://doi.org/10.1021/jf0206670

JAWLA, S.; KUMAR, Y.; KHAN, M. S. Y. Antimicrobial and antihyperglycemic activities of *Musa paradisiaca* flowers. **Asian Pacific Journal of Tropical Biomedicine**, v. 2, n. 2, p. S914-918, 2012. https://doi.org/10.1016/S2221-1691(12)60336-0

KANDASAMY, S.; ARADHYA, S. M. Polyphenolic profile and antioxidant properties of rhizome of commercial banana cultivars grown in India. **Food Bioscience**, v. 8, p. 22–32, 2014. https://doi.org/10.1016/S2212429214000443

KARADI, R. V.; SHAH, A.; PAREKH, P.; AZMI, P. Antimicrobial activities of *Musa paradisiaca* and *Cocos nucifera*. **International Journal of Research in Pharmaceutical and Biomedical Sciences**, v. 2, n. 1, p. 264-267, 2011.

KARUPPIAH, P.; MUSTAFFA, M. Antibacterial and antioxidant activities of *Musa* sp. leaf extracts against multidrug resistant clinical pathogens causing nosocomial infection. **Asian Pacific Journal of Tropical Biomedicine**, v. 3, n. 9, p. 737-742, 2013. https://doi.org/10.1016/S2221-1691(13)60148-3

KETIKU, A. O. Chemical composition of unripe (green) and ripe plantain (*Musa paradisiaca*). **Journal of the Science Food Agriculture**, v. 24, n. 6, p. 703-707, 1973. https://doi.org/10.1002/jsfa.2740240610

KEVERS, C.; FALKOWSKI, M.; TABART, J. DEFRAIGNE, J. O.; DOMMES, J.; PINCEMAIL, J. Evolution of antioxidant capacity during storage of selected fruits and vegetables. **Journal of Agricultural and Food Chemistry**, v. 55, p. 8596–8603, 2007. https://doi.org/10.1021/jf071736j

KHIZAR, A.; RIZWANIA, G. H.; ZAHIDA, H.; SHAREEF, H.; TAQI, M. M. *Musa paradisiaca* L. may restore pancreatic morphology and function to trigger its anti-diabetic and hypolipidemic activities in alloxon-induce diabetic rats. **Medicinal & Aromatic Plants**, v. 9, n. 3, p. 1-8, 2019. https://doi.org/10.35248/2167-0412.19.8.333

KIBRIA, A. A.; KAMRUNNESSA RAHMAN, M.; KAR, A. Extraction and evaluation of phytochemicals from banana peels (*Musa sapientum*) and banana plants (*Musa paradisiaca*). **Malaysian Journal of Halal Research Journal**, v. 2, n. 1, p. 22-26, 2019. https://doi.org/10.2478/mjhr-2019-0005

KRISHNA, V. K.; KUMAR, K. G.; PRADEEPA, K. SANTOSH KUMAR, S. R.; VIJAY, K. Anthelmintic activity of *Musa paradisiaca* (L) *cv puttabale*. **International Journal of Pharmaceutical Sciences and Drug Research**, v. 5, n. 2, p. 67-69, 2013. https://ijpsdr.com/index.php/ijpsdr/article/download/245/217

KRISHNAN, S. S. C.; SUBRAMANIAN, I. P.; SUBRAMANIAN, S. P. Isolation, characterization of syringin, phenylpropanoid glycoside from *Musa paradisiaca* tepal extract and evaluation of its antidiabetic effect in streptozotocin-induced diabetic rats. **Biomedicine & Preventive Nutrition**, v. 4, n. 2, p. 105-111, 2014. https://doi.org/10.1016/j.bionut.2013.12.009

LAVANYA, K.; ABI BEAULAH, G.; VANI, G. *Musa paradisiaca*- A review on phytochemistry and pharmacology. **World Journal of Pharmaceutical and Medical Research**, v. 2, n. 6, p. 163-173, 2016. https://www.wjpmr.com/download/article/17112016/1480313008.pdf

MAHADEVA RAO, U. S.; MOHD, K. S.; MUHAMMAD, A.; AHMAD, B. A.; MOHAMAD, M. ALI, R. M. Taxonomical, phytochemical and pharmacological reviews of *Musa sapientum* var. *paradisiaca*. **Research Journal of Pharmacy and Technology**, v. 7, n. 11, p. 1356-1361, 2014.

MAHMOOD, A.; NGAH, N.; NOR OMAR, M. Pahang. Phytochemicals constituent and antioxidant activities in *Musa paradisiaca* flower. **European Journal of Scientific Research**, v. 66, n. 2, p. 311-318, 2011.

MAHMOOD, A.; OMAR, M. N.; NGAH, N. Galactagogue effects of *Musa paradisiaca* flower extract on lactating rats. **Asian Pacific Journal of Tropical Biomedicine**, v. 5, n. 11, p. 882-886, 2012. https://doi.org/10.1016/S1995-7645(12)60164-3

MARIE-MAGDELEINE, C.; UDINO, L.; PHILIBERT, L.; BOCAGE, B.; ARCHIMEDE, H. *In vitro* effects of *Musa paradisiaca* extracts on four developmental stages of *Haemonchus contortus*. **Research in Veterinary Science**, v. 96, n. 1, p. 127-132, 2014. https://doi.org/10.1016/j.rvsc.2013.12.004

MARTIN, T. S.; OHTANI, K.; KASAI, R.; YAMASAKI, K. A hemiterpenoid glucoside from *Musa paradisiaca*. **Scholars International Journal of Traditional and Complementary Medicine**, v. 54, n. 4, p. 190-192, 2000. https://saudijournals.com/media/articles/SIJTCM-24-45-56-c.pdf

MATEKAIRE, T.; MUPANGWA, J. F.; KANYAMURA, E. F. The efficacy of banana plant (*Musa paradisiaca*) as a coccidiostat in rabbits. **International Journal of Applied Research in Veterinary Medicine**, v. 3, n. 4, p. 326-331, 2005. http://www.jarvm.com/articles/Vol3Iss4/MATEKAIRE%20IJARVM%20V3N4W.pdf

MEREKAR, A. N.; KUCHEKAR, B. S.; NIRMAL, S. A.; MULE, T. L.; SAWANT, P. S.; PATTAN, S. R. Nonpolar extract of *Musa paradisiaca* fruit as a antiulcerogenic agent. **Pharmacologyonline**, v. 2, p. 46-52, 2009.

MUKHOPADHYAYA, K.; BHATTACHARYA, D.; CHAKRABORTY, A.; GOEL, R. K.; SANYAL, A. K. Effect of banana powder (*Musa sapientum* var. *paradisiaca*) on gastric mucosal shedding. **Journal of Ethnopharmacology**, v. 21, n. 1, p. 11-9, 1987. https://doi.org/10.1016/0378-8741(87)90089-4

NADKARNI, K. M. **Indian Materia Medica**. vol I. 3 ed. Bombay Popular Prakashan, p. 822-827, 1982. https://archive.org/details/in.ernet.dli.2015.112096

NAIKWADE, P. V.; GAURAV, S.; SHARAYU, D.; KAILAS, J. Evaluation of antibacterial properties of *Musa paradisiaca* L. leaves. **Proceeding of the National Conference on Conservation of Natural Resources & Biodiversity for Sustainable Development**, 2014. https://jbsd.in/Proceeding/Naikwade%2080-84.pdf

NIRMALA, M.; GIRIJA, K.; LAKSHMAN, K.; DIVYA, T. Hepatoprotective activity of *Musa paradisiaca* on experimental animal models. **Asian Pacific Journal of Tropical Biomedicine**, v. 2, n. 1, p. 11-15, 2012. https://doi.org/10.1016/S2221-1691(11)60181-0

OSIM, E. E.; IBU, J. O. The effect of plantains (*Musa paradisiaca*) on DOCA-induced hypertension in rats. **Journal of Pharmacognosy**, v. 29, n. 1, p. 9-13, 1991. https://doi.org/10.3109/13880209109082841

PADILLA-CAMBEROS, E.; FLORES-FERNÁNDEZ, J. M.; CANALES-AGUIRRE, A. A.; BARRAGÁN-ÁLVAREZ, C. P.; GUTIÉRREZ-MERCADO, Y.; LUGO-CERVANTES, E. Wound healing and antioxidant capacity of *Musa paradisiaca* Linn. peel extracts. **Journal of Pharmacy & Pharmacognosy Research**, v. 4, n. 5, p. 165-173, 2016. https://jppres.com/jppres/pdf/vol4/jppres16.124_4.5.165.pdf

PANDA, D. K.; GHOSH, D.; BHAT, B.; TALWAR, S. K.; JAGGI, M.; MUKHERJEE, R. Diabetic therapeutic effects of ethyl acetate fraction from the roots of *Musa paradisiaca* and seeds of *Eugenia jambolana* in streptozotocin-induced male diabetic rats. **Methods and Findings in Experimental and Clinical Pharmacology**, v. 31, n. 9, p. 571-584, 2009. https://doi.org/10.1358/mf.2009.31.9.1435645

PANIGRAHI, P. N.; DEY, S.; SAHOO, M., DAN, A. Antiurolithiatic and antioxidant efficacy of *Musa paradisiaca* pseudostem on ethylene glycol-induced nephrolithiasis in rat. **Indian Journal of Pharmacology**, v. 49, n. 1, p. 77-83, 2017. https://pubmed.ncbi.nlm.nih.gov/28458427/

PANNANGPETCH, P.; VUTTIVIROJANA, A.; KULARBKAEW, C.; TESANA, S.; KONGYINGYOES, B.; KUKONGVIRIYAPAN, V. The antiulcerative effect of Thai *Musa* species in rats. **Phytotherapy Research**, v. 15, n. 5, p. 407-410, 2001. https://pubmed.ncbi.nlm.nih.gov/11507732/

PATRO, G.; PANDA, M.; DAS, P.; BHAIJI, A.; PANDA, A.; SAHOO, H. B. Pharmacological evaluation of *Musa paradisiaca* (Linn.) on bronchial asthma. **Egypt Pharmaceutical Journal**, v. 15, n. 1, p. 25-30, 2016.

PERFUMI, M.; MASSI, M.; DE CARO, G. Effects of banana feeding on deoxycorticosterone - induced hypertension and salt consumption in rats. **International Journal of Pharmacognosy**, v. 32, n. 2, p. 115-125, 1994. https://doi.org/10.3109/13880209409082982

POONGUZHALI, P. K.; CHEJU, H. The influence of banana stems extract on urinary risk factors for stones in normal and hyperoxaluric rats. **British Journal of Urology - International**, v. 74, n. 1, p. 23-25, 1994. https://doi.org/10.1111/j.1464-410X.1994.tb16539.x

RAJESH, N. Medicinal benefits of *Musa paradisiaca* (Banana). **International Journal of Biology Research**, v. 2, n. 2, p. 51-54, 2017.

RUSSELL, W. R.; LABAT, A.; SCOBBIE, L.; DUNCAN, G. J.; DUTHIE, G. G. Phenolic acid content of fruits commonly consumed and locally produced in Scotland. **Food Chemistry**, v. 115, p. 100-104, 2009. https://doi.org/10.1016/j.foodchem.2008.11.086

SANTOS, J. M.; CAMPESATTO, E. A.; DE OMENA, I. C. A.; GRILLO, L. A. M.; DE ARAÚJO, E. C.; BASTOS, M. L. Potential study of healing *Musa paradisiaca* L. **Journal of Chemical and Pharmaceutical Research**, v. 8, n. 8, p. 182-184, 2016. https://www.jocpr.com/articles/potential-study-of-healing-musa-paradisiaca-l.pdf

SHODEHINDE, S. A.; ADEMILUYI, A. O.; OBOH, G.; AKINDAHUNSI, A. A. Contribution of *Musa paradisiaca* in the inhibition of α-amylase, α-glucosidase and Angiotensin-I converting enzyme in streptozotocin induced rats. **Life Sciences**, v. 133, p. 8-14, 2015. https://doi.org/10.1016/j.lfs.2015.03.026

SHODEHINDE, S. A.; OBOH, G. Antioxidant properties of aqueous extracts of unripe *Musa paradisiaca* on sodium nitroprusside induced lipid peroxidation in rat pancreas *in vitro*. **Asian Pacific Journal of Tropical Biomedicine**, v. 3, n. 6, p. 449-457, 2013. https://doi.org/10.1016/S2221-1691(13)60095-7

SIDHU, J. S.; ZAFAR, T. A. Bioactive compounds in banana fruits and their health benefits. **Food Quality and Safety**, v. 2, p. 183-188, 2018. https://doi.org/10.1093/fqsafe/fyy019

SILVA, A. A.; MORAIS, S. M.; FALCÃO, M. J.; VIEIRA, I. G.; RIBEIRO, L. M.; VIANA, S. M.; TEIXEIRA, M. J.; BARRETO, F. S.; CARVALHO, C. A.; CARDOSO, R. P.; ANDRADE-JUNIOR, H. F. Activity of cycloartane- type triterpenes and sterols isolated from *Musa paradisiaca* fruit peel Against *Leishmania infantum* chagasi. **Phytomedicine**, v. 21, n. 11, p. 1419-1423, 2014. https://doi.org/10.1016/j.phymed.2014.05.005

SILVESTRE, M. B. Hypoglycemic potential of banana leaves (*Musa paradisiaca*) in albino rats. **International Journal of Food Engineering**, v. 2, n. 1, p. 71-74, 2016. http://www.ijfe.org/uploadfile/2016/0512/20160512064012939.pdf

SINGH, S. K.; KESARI, A. N.; RAI, P. K.; WATAL, G. Assessment of glycemic potential of *Musa paradisiaca* stem juice. **Indian Journal of Clinical Biochemistry**, v. 22, n. 2, p. 48-52, 2007. https://link.springer.com/content/pdf/10.1007/BF02913313.pdf

U.S. NATIONAL PLANT GERMPLASM SYSTEM. ***Musa paradisíaca***. 2023, https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomydetail?id=23261

UGBOGU, E. A.; UDE, V. C., ELEKWA, I.; ARUNSI, U., O.; UCHE-IKONNE, C.; NWAKANMA, C. Toxicological profile of the aqueous-fermented extract of *Musa paradisiaca* in rats. **Avicenna Journal of Phytomedicine**, v. 8, n. 6, p. 478-487, 2018. https://pdfs.semanticscholar.org/40d0/605429ec4ebf8f2abe5f443591ece3764aee.pdf

USHA, V.; VIJAYAMMAL, P. L.; KURUP, P. A. Effect of dietary fiber from banana (*Musa paradisiaca*) on metabolism of carbohydrates in rats fed cholesterol free diet. **Indian Journal of Experimental Biology,** v. 27, n. 5, p. 445-449, 1989.

USHA, V.; VIJAYAMMAL, P. L.; KURUP, P.A. Effect of dietary fiber from banana (*Musa paradisiaca*) on cholesterol metabolism. **Indian Journal of Experimental Biology**, v. 22, n. 10, p. 550-554, 1984.

VADIVELAN, R.; ELANGO, K.; SURESH, B.; RAMESH, B. R. Pharmacological validation of *Musa paradisiaca* bhasma for antiulcer activity in albino rats- A preliminary study. **Ancient Science of Lif,** v. 25, n. 3-4, p. 67-70, 2006.

VETTORAZZ, G. 5-Hydroxytryptamine content of bananas and banana products. **Food and Cosmetics Toxicology**, v. 12, p.107-133, 1974. https://doi.org/10.1016/0015-6264(74)90326-5

VIJAYAKUMAR, S.; PRESANNAKUMAR, S.; VIJAYALAKSHMI, N. R. Investigations on the effect of flavonoids from banana, *Musa paradisiaca* L. on lipid metabolism in rats. **Journal of Dietary Supplements**, v. 6, n. 2, p. 111-123, 2009. https://doi.org/10.1080/19390210902861825

YAKUBU M.T.; OYEYIPO, T. O.; QUADRI, A.L.; AKANJI, M. A. Effects of aqueous extract of *Musa paradisiaca* root on testicular function parameters of male rats. **Journal of Basic and Clinical Physiology and Pharmacology**, v. 24, n. 2, p. 151-157, 2013. https://doi.org/10.1515/jbcpp-2012-0059

YAKUBU, M. T.; NURUDEEN, Q. O.; SALIMON, S. S.; YAKUBU, M. O.; JIMOH, R. O.; NAFIU, M. O.; AKANJI, M. A.; OLADIJI, A. T.; WILLIAMS, F. E. Antidiarrhoeal activity of *Musa paradisiaca* sap in wistar rats. **Evidence-Based Complementary and Alternative Medicine**, v. 2015, e683726, 2015. https://doi.org/10.1155/2015/683726

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