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ACALYPHA INDICA LINN - AN IMPORTANT MEDICINAL PLANT: A REVIEW ON PHYTOCHEMICAL AND PHARMACOLOGICAL PROPERTIES

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ABSTRACT

Acalypha indica Linn. Commonly known as Indian copperleaf belongs to the family Euphorbiacae. Acalypha indica L is an erect annual herb with numerous long branches covered with soft hairs. Acalypha cures diseases of the teeth and gums, burns, toxins of Plant and mixed origin, stomach pain, diseases due to Pitha, bleeding piles, irritations, stabbing pain, wheezing, sinusitis and neutralizes predominance of the Kabha factor. In the traditional medicine the preparations from whole plants have been used to counter various diseases and disorders. The present review is therefore, an effort to give a detailed survey of the literature on its pharmacognosy, phytochemistry, pharmacological and traditional uses.

KERWORDS: Acalypha indica Linn, Kabha factor.

1. INTRODUCTION

Acalypha indica Linn. (figure.1) (Tamil - Kuppai-meni; Sanskrit –Arittamanjarie) belonging to the Euphorbiacae family is a common annual shrub that grows as a troublesome weed in gardens, roadsides and throughout the plains of India, Srilanka and tropical Africa. The plant possesses high medicinal value and used widely in all the three systems (Siddha, Ayurveda and Unani) of Indian traditional medicine.[1] It is used in the treatment of cough, respiratory problems, dyspnosea, intestinal infections, rheumatoid arthritis, skin infection and wounds. Besides these, it is also used as a laxative and pain killer. Earlier reports recorded the antioxidant[2,3], analgesic, anti-inflammatory[4] and wound healing activities[5] of the extracts

of A. indica. The extract possesses antimicrobial activity against bacteria[6], fungi[7] and helmintic parasites.[8] In addition they possess larvicidal and ovicidal activities against the malarial vector Anopheles stephensi.[9] The leaf extracts neutralizes the Viper russelli venom induced lethality, cardio toxicity, neurotoxicity, haemorrhage, necrotizing and mast cell degranulation in studies with rats and isolated frog tissue.[10] The whole plant extract are most effective in causing significant anti-implantation and thereby leads to post-coital antifertility.[11] All these medical properties are owing to the presence of different secondary metabolites like alkaloids (Acalyphin and triacetonamine), flavanoids (kaempferol glycosides, mauritianin, clitorin, nicotiflorin and biorobin)[12], n-octacosanol, kaempferol, quebrachitol, ß-sitosterol, stigmasterol, saponins, terpenoids, tannins and resins.[13] Antioxidant production is involved in a number of degenerative diseases such as arthrosclerosis, cancer, cirrhosis, diabetes, arthritis, hemorrhagic shock, coronary artery diseases, cataract, cancer, AIDS and age-related degenerative brain diseases.[14]

Figure.1.

2. Taxonomic Classification

Kingdom: Plantae

Class: Magnoliopsida

Order: Euphorbiales

Family: Euphorbiacae

Subfamily: Acalyphoideae

Genus: Acalypha

Species: Acalypha indica Linn.

3. Morphological Characters

Acalpha indica Linn. Is an annual erect herb 30-75 cm in height Branches are numerous, long, ascending, finely pubescent? Leaves 2.5-7.5 by 2-4.5 cm, ovulate or rhombic ovulate, acute, or sub obtuse crenate serrate, glabrous thin, base cuneate somewhat nerves, petiolate usually longer than the blade, slender, stipulate minute. Flower in numerous lax erect, elongated, auxiliary spikes, and cluster near the summit of the spikes, the females scattered, surrounded by a shortly pedunculate large leafy dentate cuneiform many nerves bract 6-8mm diameter. Ovary hispid, capsule small, quite concealed by the brat. Often only 1 seeded seed ovoid, smooth, pale brown, 1-2mm long. Habitat _ Occurs throughout the plains of India, ascending the hills in Orissa up to 1500 m.

4. PLANT NAME IN DIFFERENT LANGUAGES

Sanskrit: Harita manjari

Hindi: Kuppi, Kuppikhokhali

English: Indian Copperleaf, Indian acalypha,

Indian nettle, Three-seeded-mercury

Malayalam: Kuppaimeni, Kuppi, Kuppikhokhali

Ayurvedic: Kuppi, Muktavarchaa, Harita-manjari

Siddha/Tamil: Kuppaimeni.

Folk: Khokali, Kuppi, Aamaabhaaji.

5. MEDICINAL VALUE

- Acalypha indica constitute an effective source of both traditional and modern medicines.
- About 80% of rural population depends upon the herbal medicine for their primary health care.
- Useful in treating pneumonia, asthma, rheumatism and several other ailments.
- Dried leaves of Acalypha indica were made into a poultice to treat bedsores and wounds.
- Acalypha indica root is prescribed as a tonic, astringent, febrifuge and strong purgative.
- Leaves posses anti periodic and laxative properties, the leaves are used in jaundice, piles, ulcers and also externally skin eruptions, ring worms, eczema.
- The roots are used in chest pain, joint pain, and migraine and blood dysentery and the extract of the root lowered the blood sugar level up to 30%.
- Other properties of the herb include anti-inflammatory, anti-helmintic, antibacterial, anti-fungal, anti-oxidant, neuro-protective, anti-venom and antiulcer activity.

6. CHEMICAL CONSTITUENTS

- The Arial parts contain a cyanogenic glycoside called acalyphin (a 3-cyanopyridone derivative) as well as flavonoids, such as kaempferol (figure-2) mauritianin, clitorin, nicotiflorin and biorobin, Tannins, β- sitosterol (figure-3), acalyphamide, aurantiamide, succinamide, and flindersin (a pyranoquinolinone alkaloid) have also been isolated. The chemicals that attract cats are the iridoid compounds isodihydronepetalactone and isoiridomyrmecin.
- Leaves and twigs contain acalyphamide and other amides, quinone, sterols, cyanogenic glycoside.
- The fresh Acalypha indica plant has wide variety nutrients such as carbohydrates, Proteins, vitamins, and fat. This plant also contains mineral micronutrients.
- Acalypha indica has high iron content, followed by zinc, copper, nickel and chromium which are useful for patients with mineral deficiencies problems. This plant has a high moisture content of up to 80% and a total ashes value of 16% suitable for body hydration. As a leafy low-cost vegetable, this plant can provide a good balance in nutrients at minimal costs.
- Acalypha indica also has a high phenolic content like geraniin, and glucogallin were useful as antioxidants. Stated that there were five compounds from the ethanolic extract of the leaves which acted as antioxidants. Gallic acid (figure-4), Ellagic acid (figure-5), corilagin (figure-6), chebulagic acid (figure-7) kauren- 18-oic-acid, 16 α, 17-dihyroxy-ent-kauran 19-oic-acid and 4,4′,5,5′,6,6′ hexahydroxy diphenic acid, can be found inside this plant.

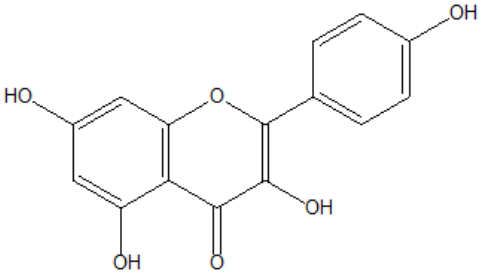
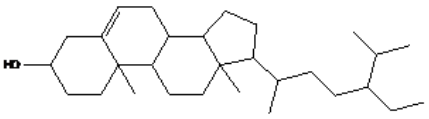


figure.2



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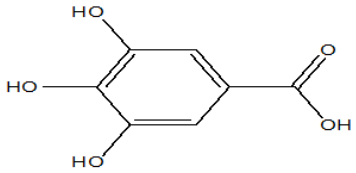

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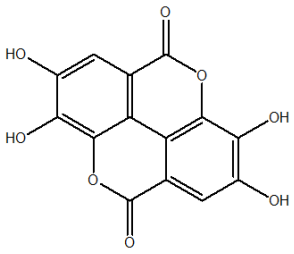

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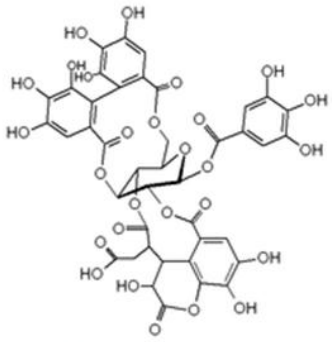

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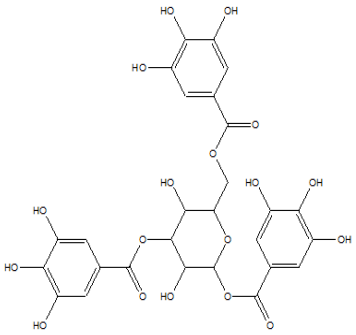

figure-6

7. PHYTOCHEMICAL SCREENING OF ACALYPHA INDICA[15]

Phytochemical constituents are the basic source for the establishment of several pharmaceutical industries. The constituents present in the plant play a significant role in the identification of crude drugs. Phytochemical screening is very important in identifying new sources of therapeutically and industrially important compounds like alkaloids, flavonoids, phenolic compounds, saponins, steroids, tannins, terpenoids etc. previously the crude drugs were identified by comparison with the standard descriptions available, but recently due to advancement in the field of pharmacognosy various techniques have been following for the Standardization of crude drugs.

7.1 General test for phytochemical screening

7.1.1. Alkaloids Test

- **Dragendroff's test**

Take few ml of test solution and add 2-4 drops Dragendroff's reagent. It forms the reddish brown color precipitate in the test solution. It indicates the presence of alkaloids.

7.1.2. Amino Acid Test

- **Ninhydrine test**

Take 2ml of test solution and add 1ml Ninhydrine solution and boil the solution. The solution turns to violet color it indicates the presence of amino acids.

7.1.3. Carbohydrates Test

- **Mollish test**

To the test solution add few drops alcoholic a-naphthol and add few drops of concentrated sulphuric acid through the walls of the test tube. It forms purple to violet color ring appears at the junction of the test tube. It indicates the presence of carbohydrates in the solution.

7.1.4. Volatile Oil Test

- Take the test solution in test tube add few 1ml of Sudan solution. If red color obtained by globules in the test tube. It indicates the presence of volatile oil in test solution.

7.1.5. Tannins Test

- **Ferric chloride test**

To the test solution add 2ml of ferric chloride solution. It turns to blue color it indicates the presence of hydrolysable tannins. It turns to blue color it indicates the presence of condensed tannins.

7.1.6. Test For Phytosterols

- **Salkowski reaction**

Plant extract in a test tube add 1ml of concentrated H_2SO_4 the sides of the test tubes. Appearance of reddish-brown color in chloroform layer indicates presence of phytosterols.

7.1.7. Saponins Glycosides Test

- Take little quantity of plant extract shake up too few minutes if froth formation occurs the presence of saponins.

7.1.8. Anthroquinone Test

- Take little quantity of plant extract then add magnesium metal piece to this add lead acetate solution produce the green precipitate indicate the presence of anthraquinones.

7.1.9. Flavonoids Test

- **Shinoda test**

Little quantity of sample to thus add concentrated HCL then it produce green color it indicate the presence of flavonoids.

7.1.10. Test For Phenols

- To the sample solution little quantity of alcohol and ferric chloride solution and it produce purple color.

8. PHARMACOLOGICAL PROPERTIES

8.1 Anti-Inflammatory Activity of Acalypha Indica

- The fresh juice of Acalypha indica leaves was investigated for anti-inflammatory activity in four groups of overnight fasted albino rats. All the four groups of animals of six each are pretreated orally with control, standard (Indomethacin), Acalypha indica and combination of both Acalypha indica and Indomethacin one hour before carrageenan injection. Acute edema was induced in right hand paw of rats by injecting 0.1 ml of 1% carrageenan solution. The paw volume was measured using a plethysmometer at 0-4 hours after injection. The results indicated that fresh juice of leaves of Acalypha indica exhibited effective inhibition of paw volume and edema [16]

8.2 Antibacterial and Antifungal Activities of Acalypha Indica

- The ethyl acetate, hexane and methanol extracts from the leaves, stem and roots of Acalypha indica were tested for their antibacterial activities against Bacillus subtilis, Staphylococcus aureus and Klebsiella pneumoniae. The results indicated that the leaves and root extracts of ethyl acetate showed quite promising inhibition of the growth of all three bacterial species and the hexane extracts showed moderate activities.[17] The aqueous extracts of Tridax procumbens, Cleome viscosa, Acalypha indica and Boerhaavia erecta at two different weights of residues, 30 and 40mg were tested for antibacterial activities by the filter paper disc diffusion method. The results indicated that maximum inhibition was observed against Aeromonas hydrophilic and Bacillus cerues [18]. The hexane, chloroform, acetone and methanol extracts of fresh, dried and powdered samples of leaf, stem and roots of Acalypha indica were prepared by Soxhlet apparatus. The RF values of the plant extract (0.371± 0.0009) and a synthetic antifungal compound, Clotrimazole (0.371) were verified by subjecting to TLC and HPLC analyses. The results indicated that active compound present in root, leaf and stem extracts were 538, 415, 171 µg/g and showed more potent in controlling Candida albicans, Aspergillus Niger and Escherichia coli.[19] The acetone, chloroform, ethanol and diethyl ether extracts of Acalypha indica, Solanum trilobatum, Aegle marmelos, Adhatoda vasica, Aristolochia latas, Datura metel, Glycyrrhiza glabra, Solanum incanum, Eucalyptus globulus,

Azadirachta indica and Vitex negundo were evaluated for antibacterial properties against Salmonella typhi, Pseudomonas aeruginosa, Staphylococcus aureus, Shigella flexneri and Klebsiella pneumonia. The results indicated that the ethanol plant extract showed best inhibition amongst the other extracts being used.[20] The hexane, chloroform, ethyl acetate and methanol extracts from the leaves of Acalypha indica were evaluated for antibacterial activities against gram positive (Staphylococcus aureus, Staphylococcus epidermidis, Bacillus cereus, Streptococcus faecalis) and gram negative (Klebsiella pneumoniae, Escherichia coli, Proteus vulgaris, Pseudomonas aeruginosa) bacteria. The results indicated that all the extracts exhibited antibacterial activities against gram positive organisms with the inhibitory concentrations between 0.156-2.5 mg/ml.[21]

8.3 Antioxidant Capacity of Acalypha Indica

- The aqueous ethanolic leaf extracts of Becium dhofarense, Pulicaria crispa, Allophylus rubifolius, Olea europaea, Acacia senegal, Pluchea arabica, Anogeissus dhofarica, Moringa peregrina, Cordia perrottettii, Ficus lutea and Acalypha indica were tested for antioxidant activity using in vitro DPPH (diphenylpicryl-hydrazyl) assay method. The results showed that all extracts having anti-oxidant activities in DPPH method at 89-93%, after 15 min of incubation at a test concentration of 50µg/ml.[22]

8.3 Post-Coital Anti-Fertility Activity

- Four successive solvent extracts such as chloroform, ethanol, and petroleum ether and aqueous of the whole plant of Acalypha indica are tested for post-coital antifertility activity in female albino rats. Of these, petroleum ether and ethanol extracts at (600 mg/kg body weight) showed estrogenic activity. The chloroform and aqueous extracts do not exhibit estrogenic activity.[23]

8.4 Wound Healing Effect of Acalypha Indica

- The ethanolic extracts of Heliotropium indicum, Plumbago zeylanicum and Acalypha indica were tested for their wound healing activity in rats using excision and incision wound models following tropical application. The results indicated that ten percent weight/volume extracts of Acalypha indica being prepared with saline showed wound healing activity with low tensile strength (low rate of maturation of collagen) when being compared with Heliotropium indicum.[24]

8.5 Anti-Venom Properties of Acalypha Indica

- The ethanol leaf extract of Acalypha indica was tested for neutralization activity of Viper russelli (Russell's viper) venom in rats and isolated frog tissue. The results indicated that the ethanol leaf extract in the dose levels of 500 and 750mg/kg inhibited the Viper russelli venom induced lethality, haemorrhage, necrotizing and mast cell degranulation in rats and cardiotoxic, neurotoxic effects in isolated frog tissue in dose dependent manner. The extract also inhibited the venom induced lipid peroxidation in RBC, decreased GSH and catalase levels of rat kidney tissue.[25]

8.6 Effect of Acalypha Indica on Malarial Vector

- Different leaves extracts Acalypha indica (benzene, chloroform, ethyl acetate and methanol) were tested for larvicidal, ovicidal activity and oviposition attractancy against the malarial vector Anopheles stephensi. The results indicated that extracts exhibited promising for larvicidal activity with LC50 values 19.25, 27.76, 23.26 and 15.03 ppm respectively. For ovicidal activity, the percent hatchability is inversely proportional to the concentration of the extracts and directly proportional to the eggs. The highest oviposition effective attractancy observed was 90.09%, 94.20%, 85.43% and 95.75% for benzene, chloroform, ethyl acetate and methanol extracts respectively.[26]

8.7 Diuretic Activity of Acalypha Indica

- Diuretic activity of methanolic extract of Acalypha indica was evaluated in albino mice. The results indicated that Acalypha indica showed maximum diuretic action at the dose of 400 mg/kg body weight after five hours of ingestion when compared with standard drug frusemide at the dose of 20mg/kg body weight.[27]

8.8 Acaricidal Activity of Acalypha Indica

- In vitro acaricidal property of Acalypha indica leaves paste was tested for 48h and results showed that maximum inhibition observed after 48h with the suppression of lesions. In vivo acaricidal property of Acalypha indica leaves was tested for 14days based on the live mite count and lesion score in naturally infested broiler rabbits. The results indicated that Acalypha indica leaves paste showed lethal effect on live mites after 4h of treatment.[28]

8.9 Anti Ulcer Activity of Acalypha Indica

- Albino rats either sex weighing about 100-130g (pregnancy was excluded) were taken in a individual animal cages and fasted (water allowed) for 48 hours prior to pyloric ligation,

care being taken to avoid coprophagy. Under light ether anesthesia the abdomen was opened by a small midline incision below the xiphoid process; pyloric portion of the stomach is slightly lifted out and ligated avoiding traction to the pylorus or damage to its blood supply. The stomach is replaced carefully, and the abdominal wall was closed interrupted sutures. The drugs are administered orally two hours prior to pyloric ligation. They are deprived of both food and water during the postoperative period, and are sacrificed at the end of 6th hours after operation. Stomach is dissected out and the contents are drained into the tube and this is subjected to analysis for pH and for free and total acidity. The stomach is then open along the greater curvature and is examined for any ulceration. The degree of ulceration is graded from zero to five depending on the size and severity of ulcers.[29]

8.10 Anti Hyper Lepidimic Activity of Acalypha Indica

- **Preparation of standard drugs**

Simvastatin 10 mg/kg was used as the reference standard drug for evaluating the antihyperlipidemic activity which was made into suspension in distilled water using Tween-80 as a suspending agent. **Acute toxicity test**:[30] The ethanol and aqueous extract of Acalypha indica Linn was screened for acute toxicity, following the standard method (OECD/OCDE No: 423). Albino mice of female sex weighing 20-25 gm were used in this study. Animals were maintained on normal diet and water prior to and during the course of experiment. The dose of ethanol and aqueous extract was prepared with saline and was administered by oral. The acute toxicity was tested at the doses of 5, 50 300 and 2000mg/kg.

- **Diet-induced hyperlipidemic model**

The animals were selected, weighed then marked for individual identification. In this model, rats were made hyperlipidemic by the oral administration of atherogenic diet (AGD) was for 10 days by mixing with regular pellet diet and rats were given free access to the feed ad libitum. The rats were then given plant extracts suspended in 0.2% tween 80 at the dose of 200mg, 400mg /kg b.w once daily in the morning through by oral for 10 consecutive days. During these days, all the groups also received atherogenic diet in the same dose as given earlier. The control animals received the hyperlipidemic diet and the vehicle.[31]

8.11 Analgesic Activity

- The methanolic extract of A. indica L. showed significant analgesic activity in mice in a dose - dependent manner. Analgesic activity of the methanol extract was studied in mice by acetic acid induced writhing reflex method. Methanol extract at doses of 200 mg and 400 mg/kg body weight was used and was compared with the standard drug aminopyrine at a dose of 50 mg/kg body weight.[32]

8.12 Anthelmintic Activity

- Antihelmintic potential was evaluated using alcoholic extract of root of Acalypha indica and Pheretima posthuma as test worm. Three concentrations (10, 25 and 50 mg/ml) of alcoholic extract and its various fractions were tested in the bioassay. Albendazole (10 mg/ml) was included as standard reference and distilled water as control. The results indicated that the alcoholic extract significantly demonstrated paralysis and also caused death of worms especially at higher concentration of (50 mg/ml).[33]

8.13 Neuro-protective and Neuro-Therapy Activity

- The neuro-protection and neuro-therapy studies done on the frog. Frogs were doused with 5, 10, 15, 20, 25 mg. Pancuronium bromide 0.2%, 4 mg, was used for a positive control as muscle relaxant. Neuroprotective study was done by ringer extract pancuronium bromide, and neuro-therapy study was ringer pancuronium bromide extract procedures. The parameters measured in these studies were the electrical activities such as amount and duration (second) of re-polarization, depolarization, resting potential, and the height of spike after electrical stimulation. Neuro-protection effect of extract was determined by the ability of muscle to show the electrical response after incubating with pancuronium bromide for 10 minutes, and after incubating with extract for 10 minutes for neuro-therapy effect. In the dose of 15 mg and 20 mg/mL of A. indica Linn. Extract showed better activities than the dose of 25 mg of extract, both as neuro-protection and neuro-therapy effects.[34]

8.14 Post-coital Infertility Activity

- The petroleum ether and ethanol extracts were found to have ant implantation activity when they were given to female albino rats. This effect was reversible upon withdrawal of the treatment with the extracts. This effect is due to some estrogenic activity as evidenced by histological studies of the uterus.[35]

8.15 Antitubercular Activity

- Anti-tuberculosis activity was tested against five plants extract namely A. indica, A. vasica, A. cepa, A. sativum and A. Vera. The resulted inhibition of these plants extract mentioned are 95, 32, 37, 72, 32 per cent, respectively for MDR isolate DKU156 and 68, 86, 79, 72, 85 per cent, respectively for another MDR isolate JAL-1236, while for sensitive M. tuberculosis H37Rv, inhibition was found to be 68, 70, 35, 63 and 41 per cent, at 4 per cent v/v concentration in L-J medium. There was no inhibition against rapid grower M. fortuitum (TMC-1529). In BacT/ALERT also, extracts of these plants showed significant inhibition against M. Tuberculosis [36]

8.16 Molluscicidal activity

- The molluscicidal activity was tested using Lymnaea acuminata as test animal. Ten experimental animals were kept in a glass aquarium. Snails were treated with different conditions such as ethanolic extract, methanolic extract, distilled water extract, chlorinated water extract, Tap water extract containing 2 liters each and 5 mg fresh aerial plant extract. Control group were provide with molluscicides. Toxicity was observed after 24 and 48 hrs. The weight of the ethanolic extract, methanolic extract, distilled water extract, chlorinated water extract; Tap water extract was taken as the final strength per liter of aquarium water. Dose dependent toxicity was observed against the test animals. The 24-hrs LC50 of the ethanolic extract of R. communis were higher in comparison to A. indica and E. hirta.[37]

8.17 use of acalypha indica l. in homeopathy

- For children suffering from obstinate constipation leaves are used. They are powdered into the paste and made into balls which relaxes the sphincter-ani and produces free motion. Juices from fresh leaves can exist engaged inside scabies furthermore additional crust disease. Juices can also be mixed with lime and onion which gives stimulating effect in rheumatism. The juice of the plant is used along with cotton and inserted into each nostril.[38]

8.18 Anti-diabetic activity

- The investigation is carried out to study the ant diabetic activity on methanol and acetone [70:30] extract of acalypha indica. In normal and alloxone induced diabetic method. The anti diabetic effect of methanol and acetone on acalypha indica linn. Was evaluated in

normal and alloxone induced diabetic effect on rats. Decrease the blood glucose level of to animals to show the extract of exhibit significant effect of ant diabetic activity when compared to the diabetic control group. The result also induced dose depend effect. The ant diabetic activity produced by the extract may be due to uptake increased glucose level or by increase pancreatic cell function or due to absorption of intestinal glucose uptake. To study the supports of the use of herbal drug as ant diabetic drug.[39]

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