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Original Article

A Review on Pharmacological Activities of Abutilon *Crispum* (Linn)

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ABSTRACT
This research looks at the pharmacological activities of Abutilon crispum, an important plant with possible therapeutic scope. Various methods were employed to test the plant's anti-inflammatory, anti-diabetic, and antioxidant activities. Antioxidant activity was evaluated with hydroxyl radical scavenging assays, where the results showed that with an increase in concentration of the ethanolic extract, scavenging activity increased as well due to the significant differences noticed in comparison with the standard drug Rutin. Serum Glutamic-Pyruvic Transaminase (SGPT) was used to measure the anti-diabetic activity in diabetic rats, with Abutilon crispum extract at the dosages of 200 mg/kg and 400 mg/kg showing significant efficacy in reducing SGPT levels, and being on par with the standard drug Glibenclamide. The anti-inflammatory effect was studied in rats by means of paw edema induced by carrageenan, where it was observed that the aqueous extract of Abutilon crispum showed considerable dose-dependent inhibition of inflammation, and at doze of 200 mg/kg, a considerable level of protection of 89.12% when compared with standard Indomethacin (89.40% inhibition) was observed. These studies further support the relevance of Abutilon crispum particularly in the prevention and treatment of inflammation, diabetes, oxidative stress, and add to its significance in the realm of medicinal plants.
Keywords: abutilon crispum, therapeutic value of abutilon crispum, anti-oxidant activity, anti-diabetic activity,anti-inflammatory activity

INTRODUCTION
Herbal medicine is the oldest type of healthcare known to mankind. Herbs have been employed by every society throughout history. It was an essential component of the evolution of modern civilization. The plant and its parts are the vital source which supplies nutrients, clothes, shelter, and drugs. Most of the medicinal usage of plants appears to have evolved from observation and application in animals by trial and error. Over time, each tribe expanded its knowledge base to include the medical properties of the herbs in their area. Many medications available today are of herbal origin. Herbal medications are used in a wide range of medical applications, including the treatment for common colds to cancer. The herbal medicinal lore was passed down from generation to generation through word of mouth[1].

Abutilon crispum (Linn) belonging to family Malvaceae is trailing perennial, weak, shrub, The plant common distribution in the shady forest undergrowth on hilly slopes. Found in throughout India, It is known as Nelabenda in local area[2]. The plant finds its application in the traditional system of medicine. In India the Plant is used in the treatment of asthma, piles, ulcers, cough, jaundice and diabetics by tribal people of Andhra Pradesh and fruits are used in the treatment of piles in Tamilnadu[3]. Since the plant is reported to have many medicinal uses, the authors have taken up the plant *Abutilon crispum* to give scientific evidence and so was evaluated for anti-inflammatory, anti-oxidant, anti-diabetic activities.

Anti-Oxidant Activity:

Antioxidants are chemicals that prevent oxidation. Oxidation is a chemical reaction that can produce free radicals, resulting in chain reactions that can harm cells inorganisms. In laboratory trials, antioxidant molecules have been found to reduce oxidative stress. However, it is debatable if taking excessive doses of antioxidants in supplement form is beneficial to one's health. There is also some concern that taking antioxidant supplements in large doses could be dangerous. Fruits and vegetables are antioxidant-rich foods. No concerns have been raised about the safety of any amount of antioxidants in food.

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Antioxidants are commonly mentioned in discussions about maintaining good health and preventing disease. These strong chemicals, which are primarily found in fresh fruits and vegetables, inhibit the oxidation of other molecules in the body. Antioxidants are extremely beneficial to good health because if free radicals are not challenged, they can cause a variety of ailments and chronic diseases.

The human body naturally manufactures free radicals and antioxidants to combat their harmful effects. However, in most circumstances, free radicals significantly outnumber natural antioxidants. To maintain the equilibrium, a constant supply of exogenous oxidants is required in order to reap the full benefits of antioxidants. Antioxidants protect the body by neutralising and eliminating free radicals from the bloodstream. Nature contains a diverse range of antioxidants, and because of this, different antioxidants help different sections of the body. For example, beta-carotene is highly useful for eye health; lycopene is beneficial for helping preserve prostate health; flavonoids are especially beneficial for heart health; and proanthocyanins are beneficial for urinary tract health.

Antioxidants And Skin Health Benefits

When skin is exposed to high quantities of ultraviolet radiation, photooxidative damage occurs due to the creation of many forms of reactive oxygen species, such as singlet oxygen, peroxide radicals. These kinds of reactive oxygen damage cellular lipids, proteins and DNA are thought to be the principal causes of erythema, premature skin ageing.

Astaxanthin, followed by beta-carotene and vitamin E, has been demonstrated to be one of the most effective antioxidant combinations for protecting the skin from reactive oxygen species[4].

Anti-Diabetic Activity:

Diabetes :

A condition in which sugars, polymers of amino acids, and lipid metabolism is inadequately regulated as a result of a relative or absolute lack of insulin production, insulin resistance, or both at one or more locations in the complicated hormone action pathways[5]. It is an inherited or acquired inability to transfer sugar from the bloodstream into cells. Without enough insulin, the body's cells are unable to absorb enough glucose from the blood; as a result, blood glucose levels rise, a condition known as hyperglycemia. Hyperglycemia can harm vital organs such as the kidneys, liver, eyes, nerves, heart, and blood vessels[6]. Diabetes mellitus is a clinically and hereditarily diverse set of illnesses distinguished by abnormally high amounts of glucose in the blood. Hyperglycemia can be caused by a lack of insulin secretion, resistance to insulin, or a combination of both. Carbohydrate, lipid, and protein metabolism are often disrupted. Glucose metabolism involves the small intestine, pancreas, muscle cells, and liver. If any problem with any of these diabetes organs, it can lead to a deficiency in glucose metabolism and the development of diabetes. Polydipsia, Polyuria, and Polyphagia are the characteristic signs of diabetes. Polydipsia, or extreme thirst, is a way of replenishing the water content of tissues that have been depleted by Polyuria. Polyuria is caused by the amount of glucose in circulating blood, and the accumulation of ketone bodies in the blood serves as a diuretic. Insulin-dependent diabetic symptoms can develop quickly in youngsters, but type 2 diabetes symptoms may be modest or absent[7].

Complications Of Diabetes Mellitus :

Diabetes complications classified as microvascular disease and macro vascular disease, Individuals with diabetes are two to four times more likely to have a stroke. Young people with diabetes have heart disease death rates that are two to four times higher than adults without diabetes. Diabetes is the leading cause of innovative blindness in persons aged 20-74. Diabetes is also the leading cause of kidney failure, responsible for 45 percentages of new cases in 2009. Diabetes accounted for more than 65 percentages of limb and foot amputations that were not caused by accidents or injuries. Nearly 80% of diabetic patients suffer from hypertension, whereas 5-25% of hypertensive people are diabetes. Diabetics are more likely to have high blood pressure, which has been shown to exacerbate their cardiovascular problems[8].

Streptozotocin (Stz) Induced Diabetes Mechanism

Streptozotocin enters the B cell via a glucose transporter (GLUT2) and causes alkylation of DNA. DNA damage induces activation of poly ADP-ribosylation, a process that is more important for the diabetogenicity of streptozotocin than DNA damage itself. Poly ADP-ribosylation leads to depletion of cellular NAD+ and ATP. Enhanced ATP dephosphorylation after streptozotocin treatment supplies asubstrate for xanthine oxidase resulting in the formation of superoxide radicals. Consequently,

hydrogen peroxide and hydroxyl radicals are also generated. Furthermore, streptozotocin liberates toxic amounts of nitric oxide that inhibitsaconitase activity and participates in DNA damage. As a result of the streptozotocin action, B cells undergo the destruction by necrosis[9].

Diabetes Mellitus Treatment And Management :

Diabetes treatment aims to lower and control blood glucose levels, as well as to reduce illness symptoms and consequences. Diabetes is best treated and managed through food and exercise; alternatively, diet combined with herbal or oral hypoglycemic medicines or insulin. It has been demonstrated that weight loss and increased daily energy expenditure reduce insulin resistance and improve glucose tolerance. In reality, guidance on nutrition and exercise are an important element of the treatment for type 2 diabetes[10].

Anti-Inflammatory Activity:

Inflammation:

Inflammation is defined as the local response of living mammalian tissuses to injury from any agent. It is a body defence reaction in order to eliminate or limit the spread of injurious agent, followed by removal of the necrosed cells and tissuses[11].

Moa Of Anti- Inflammatory Agents

The main mechanism of action of NSAIDs is the inhibition of the enzyme cyclooxygenase (COX). Cyclooxygenase is required to convert arachidonic acid into thromboxanes, prostaglandins, and prostacyclins[12]**.** The therapeutic effects of NSAIDs are attributed to the lack of these eicosanoids. Specifically, thromboxanes play a role in platelet adhesion, prostaglandins cause vasodilation, increase the temperature set-point in the hypothalamus, and play a role in anti-nociception. There are two cyclooxygenase isoenzymes, COX-1 and COX-2. COX-1 gets constitutively expressed in the body, and it plays a role in maintaining gastrointestinal mucosa lining, kidney function, and platelet aggregation. COX-2 is not constitutively expressed in the body; and instead, it inducibly expresses during an inflammatory response. Most of the NSAIDs are nonselective and inhibit both COX-1 and COX-2. However, COX-2 selective NSAIDs (ex. celecoxib) only target COX-2 and therefore have a different side effect profile. Importantly, because COX-1 is the prime mediator for ensuring gastric mucosal integrity and COX-2 is mainly involved in inflammation, COX-2 selective NSAIDs should provide anti-inflammatory relief without compromising the gastric mucosa[13]**.**

Plant Profile

Scientific Classification Of *Abutilon Crispum*

Kingdom : Plantae
Clade : Tracheophytes
Clade : Angiosperms
Clade : Eudicots
Clade : Rosids
Order : Malvales
Family : Malvaceae
Genus : Herissantia
Species : H. crispa

Figure 1 : (Abutilon crispum plant)

Binomial name : Herissantia crispa (L.)

Brizicky Synonyms : Abutilon crispum, Gayoides crispum

Abutilon crispum(Linn) belonging to family **Malvaceae** is trailing perennial, weak, sub shrub the stems flexuous, stellate-pubescent.

METHODOLOGY

Anti-Oxidant Activity

Determination Of Hydroxyl Radical Scavenging Activity Method (Deoxyribose Degradation) :

- Hydroxyl radical scavenging activity was measured by studying the competition between deoxyribose and the extract for hydroxy radicals generated from the Fe +2/EDTA/ H2O2 system (Fenton reaction).
- The hydroxyl radical attacks deoxy ribose, which eventually results in the formation of thiobarbituric acid reacting substances (TBARS).
- Fenton reaction mixture consisting of 200 µL of 10 mM ferrous sulphate (FeSO4.7H2O), 200 µL of 10mM EDTA and 200 µL of 10 mM 2-deoxyribose; and was mixed with 1.2 mL of 0.1M phosphate buffer (pH7.4) and 200 µL of plant extract.

- Thereafter, 200 µL of 10 mM H2O2 was added before incubation at 37 0 C for 4 hrs. Then 1 mL of this Fenton reaction mixture treated with 0.2 mLof 8.1% sodium do-decylsulphate, 1.5 mL of 0.8% thiobarbituric acid, 1.5mL of 20% acetic acid.
- The total volume was made to 5 mL by adding distilled water kept in oil bath at 100o C for 1hr. After that mixture has been cooled, 5 mL of 15:1 V/V butanol-pyridine mixture were added.
- Following vigorous shaking the tubes were centrifuged at 4000 rpm for 10min and the absorbance of organic layer containing thiobarbituric acid reactive substances was measured at 532 nm.
- A control was prepared using 0.1 mL of vehicle in the place of plantextract/rutin.

Calculation of percentage inhibition:

The percentage inhibition by the extract was calculated by using the formula

Percentage Inhibiton = Average Control OD- Test Sample OD

Average control X 100

Calculation of 50% inhibition concentration

The optical density obtained with each concentration of the extracts and the rutin was plotted on a figure taking concentrations on X-axis and percentage inhibition on Y-axis. Correlations between the optical densities were established by regression analysis and the best fit line was drawn following regression analysis. From the equation of line IC50 values were calculated[14].

Anti-Diabetic Activity:

Estimation Of Sgpt (Ifcc Method, 986) Methodology :

SGPT is present in high concentrations in liver, kidneys, heart and skeletal muscle tissue. It is also present in lungs, spleen, pancreas, brain and erythrocytes at a lower concentration. Primary liver diseases (Cirrhosis, Viral or toxic hepatitis, Lymphoma, Obstructive Jaundice) as well as liver damage as secondary to other causes result in elevated SGPT levels. Slight elevation of the enzymes is also seen in Myocardial Infarction. SGPT (ALAT) catalyzes the transfer of amino group between L-Alanineand α Ketoglutarate to form Pyruvate and Glutamate. The Pyruvate formed reacts with NADH in the presence of Lactate Dehydrogenase(LDH) to form NAD. The rate of oxidation of NADH to NAD is measured as a decrease in absorbance which is proportional to the SGPT (ALAT) activity in the sample.

L-Alanine + α Ketoglutarate ⟶ Pyruvate + Glutamate.

SGPT

Pyruvate + NADH acetate + NAD^+ ⟶ LDH [15].

Anti-Inflamatory Activity:

Acute Toxicity Studies Of The Aqueous Extract Of *A. Crispum*

Acute toxicity of A. crispum was evaluated using standard laboratory model suggested by Seth et al [16].Adult albino mice of either sex, weighing between 25-33 g were divided into eight groups of six animals each. The control group received 2 ml /kg distilled water orally. The other groups received the extract, at dose levels of 100, 200, 400, 800, 1000, 2000 and 3000 mg/kg in distilled water through oral route. After administration of the dose the animals were observed continuously for first four hours for behavioral changes and for mortality if any at the end of 72 h. However, no mortality was observed.

Test Animals For The Anti-Inflammatory Activity

Adult Wistar Albino rats (150-200g) of either sex were used in the studies. The animals were kept in standard polypropylene cages at room temperature of 30 ± 20C and 60-65 %relative humidity.

Anti-Inflammatory Activity Of The Aqueous Extract Of *A. Crispum*

The test extracts were dissolved or suspended in 0.5% w/v sodium carboxy methyl cellulose in distilled water was assessed in healthy adult albino rats by carrageenan induced hind paw oedema method [17] using indomethacin (10 mg/kg), suspended in 0.5 % w/v sodium carboxy methyl cellulose in distilled water as reference drug .The test samples were administered orally to experimental rats 1h prior to injection of carrageenan (0.1 ml of 1%w/v solution) in normal saline in to the sub planter region of left hind paw of each rat. The control paw was injected with an equal volume of saline. All the groups of animals received one of the following through oral route: 0.5%w/v sodium CMC (2 ml/kg),

indomethacin (10 mg/kg), aqueous extracts (100 and 200 mg/kg). The paw volume was measured at 0 h, 1 h, 2 h, 4 h and 6 h respectively. The paw swelling was calculated by a plethysmograph as the volume of mercury displaced by the inflamed paw (ml.). The anti-inflammatory effect was expressed as percent inhibition of oedema. the results are expressed as mean S.E.M. Significance of difference between control and treated groups was determined using Student's t-test[18].

RESULTS AND DISCUSSION

1.Antioxidant Activity Of *Abutilon Crispum* Leaves

Hydroxyl Radical scavenging activity

The scavenging activity of hydroxyl radical of Abutilon crispum leaf extract is concentration dependent although superiority is observed with Rutin at lower concentrations. The extract demonstrated 21.91% at 10µg/mL while Rutin had 25.76%. The extract at 20 and 30µg/mL demonstrated 33.07% and 35.53% respectively as Rutin had 35.34% and 43.59%. The results at 30µg/mL were statistically significant in favor of Rutin ($p < 0.05$). With 40µg/mL and above, both the extract and Rutin demonstrated significant improvement in scavenging activity. The extract demonstrated 64.38% at 50µg/mL which is significantly lower than Rutin's 68.38%, but Rutin was outperformed at 100µg/mL with 79.38% compared to Rutin's 76.60% ($p < 0.01$). The IC50 values confirms superiority of Rutin at lower concentrations, with Rutin having 35.23µg/mL compared to the extract at 46.00µg/mL and significant differences at varying concentrations ($p < 0.05$ and $p < 0.01$) [14].

2.Anti-Diabetic Activity Of Abutilon Crispum

SGPT (Serum Glutamic-Pyruvic Transaminase)

SGPT levels followed a similar trend. In the normal control group, SGPT was 42.51 ± 3.02 IU/L, while in the diabetic control group, it rose to 72.50 ± 2.53 IU/L ($p < 0.001$). Treatment with Glibenclamide significantly reduced SGPT levels to 50.75 ± 2.84 IU/L ($p < 0.001$ vs Group II), demonstrating the drug's ability to restore liver enzyme balance. The ethanolic extract of Abutilon crispum also reduced SGPT levels, with the 200 mg/kg dose bringing it down to 54.75 ± 3.38 IU/L, and the 400 mg/kg dose further reducing it to 53.50 ± 3.12 IU/L. Both doses showed significant reductions ($p < 0.05$ vs Group II), with the higher dose nearing the effectiveness of Glibenclamide. These results suggest that Abutilon crispum extract can alleviate liver stress caused by diabetes, similar to the standard anti-diabetic drug[15].

3.Anti-Inflammatory Activity Of Abutilon Crispum:

From the acute toxicity studies, it was observed that the aqueous extract at tested dose levels produced increased urination and marked analgesia. No mortality was observed with the animals even after observation for a period of 72 h. The results of the present study revealed that the aqueous extract possess significant inhibition of carrageenan induced paw edema at tested dose levels. The percentage inhibition of paw oedema was found to be dose-dependent. The percentage protection with 100 mg/kg and 200 mg/kg at 6th h was found to be 62.034% and 89.12% respectively (Standard Indomethacin with 89.401% of inhibition) [18].

CONCLUSION

The results of the study expands knowledge regarding the importance of medicinal plants, notably, Abutilon crispum. It has been learned from different experiments in the study that this species possesses anti-inflammatory, anti-diabetic, and antioxidant activities. This study illustrates the possible pharmaceutical value of Abutilon crispum, and more importantly, reiterates the need to study natural resources for their therapeutical value.

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