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RESEARCH ARTICLE

HEPATOPROTECTIVE ACTIVITY OF WHOLE PLANT EXTRACT OF *LEPTADENIA PYROTECHNICA* AGAINST PARACETAMOL INDUCED DAMAGE IN RATS

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ABSTRACT

The liver serves as a processing laboratory, redistribution centre and a receiving depot of the body. In the light of these roles, the effect of methanolic extract of whole plant of *Leptadenia pyrotechnica* on paracetamol induced liver damage in wistar rats was assessed. paracetamol (500mg/kg,p.i) was used to induce hepatotoxicity. Eighteen (18) albino rats of wistar strain (150-200gm) were used for the studies and were divided into 3 groups of six (6) rats per each. Group A served as control and received vehicle, group B (paracetamol treated), and group C (extract and paracetamol treated groups). The administered was done via oral gavages with methanolic extract of whole plant of *Leptadenia pyrotechnica* at 150ml/kg/day body weight daily, the administration of the extract lasted for saventh (7) days period after which the animals sacrificed, blood and tissue were obtained for biochemical and histological analysis. Serum enzyme assay results reveals methanolic extract of whole plant of *Leptadenia pyrotechnica* recorded a marked reduction in the elevated activities of the hepatic enzymes viz; SGOT, SGPT, ALP and Total bilirubin levels of rats. More so, the micrograph of paracetamol group compared with control group showed evidence of liver necrosis as indicated by distended hepatocytes, compression of sinusoids, fatty change and vacuolation of cytoplasm. The treated groups of the extract generally showed mild defects when compared with the control group. It is however interesting to know that the 100% *Leptadenia pyrotechnica* treated group showed a healthy liver cells as in the case with the control groups. Hence, from the above findings, it is obvious that methanolic extract of whole plant of *Leptadenia pyrotechnica* has hepatoprotective and hepatocurative potentials in hepatocellular disorders.

Keyword: *Leptadenia pyrotechnica*, hepatoprotective activity and paracetamol.

INTRODUCTION

Liver is one of the largest organs in human body and is the chief site for intense metabolism and excretion. So it has a surprising role in the maintenance, performance and regulating homeostasis of the body. It is involved with almost all the biochemical pathways of growth, fight against disease, nutrient supply, energy provision and reproduction [1]. The major functions of the liver are carbohydrate, protein and fat metabolism, detoxification, secretion of bile and storage of vitamins. Thus, maintenance of a healthy liver is a crucial factor for overall health and well being. Unfortunately the liver is continuously and variedly exposed to environmental toxins and abused by poor drug habits & alcohol and prescribed & over-the-counter drugs, which can eventually lead to various liver ailments like hepatitis, cirrhosis and alcoholic liver disease [2, 3]. Thus, liver diseases are some of the fatal diseases in the world today. They pose a serious challenge to international public health. Modern medicines have little to offer for alleviation of hepatic diseases and it is chiefly the plant based preparations which are employed for their treatment of liver disorders. However, there is not much drugs available for the treatment of liver disorders [4, 5]. Therefore, many folk remedies from plant origin are tested for its potential antioxidant and hepatoprotective liver damage in experimental animal model. Carbon tetrachloride (CCl_4)-induced hepatotoxicity model is widely used for the study of hepatoprotective effects of drugs and plant extracts [6, 7].

Leptadenia pyrotechnica (Forssk.) Decne (Synonym-*L.Spartinum* Wight) locally known as Khimp or Khip (Rajasthan), Khimparlo, Thahawar, Ranser (Gujarat), Broom bush (English) is anerect ,ascending ,shrub up to 1.5m-3m high with green stem and pale green alternating bushy branches with watery sap. Leaf is rarely found and are deciduous when present are 2.5-6.5x 0.2-0.3 cm, sessile, narrowly linear to linear lanceolate, caduceus. Flowers are in cluster lateral umbellate cymes, greenish yellow. Corolla –lobes valvate, outer corona is of 5 scales, stamina corona of raised undulate fleshy ring. Each flower is bisexual pentamerous actinomorphic, sepals joined as base only, corolla sympetalous. Follicles 7.0-14.0x0.5-0.8 cm, terete, lanceolate, tapering to selender beak, glabrous. Seeds are 5-7 mm long, ovate lanceolate, glabrous, comose (hairy) with tufted hairs 2.5-3.5 cm long. Flowering and fruiting occurs from August to January.

It is common throughout the state of Rajasthan and found in dry habitats particularly in desert zones. In India it is commonly found in Banswara, Palod, Dungarpur and Kota [8].

Whole plant seeds and flowers are used for different purpose. Its fiber is used as antihistaminic and expectorant [9]. Fresh juice of the plant is used for abortion[10].Plant sap is applied to eczema and other skin disease and is also given in diabetes [11].Whole plant is used in treating wound in Yemen folks and proved to

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have antibacterial activity against *Staphylococcus aureus* & *Bacillus subtilis*[12,13]. The latex or the leaf paste is applied over the thorn injury for thorn removal [14].Whole plant infusion is mixed with buttermilk and given for uterine prolapse and stomach disorders in sariska region of Rajasthan [15]. It is used to cure constipation and is considered good for health in Bikaner region of Rajasthan [16]. In the sudanodeccanian region of central Sahara it is traditionally used in fever, cough, kidney disorders, stones, urinary disease [17]. The present investigation was undertaken to evaluate the hepatoprotective activity of methanolic extracts of the whole parts of *L. pyrotechnica* using paracetamol induced hepatotoxicity test *in vivo* experimental model.

MATERIALS AND METHODS

Plant material

The plant of *Leptadenia pyrotechnica* was collected from "Kagore" village of Jaipur, Rajasthan, India in the month of January. It was authenticated by Dr. D. C. Saini, Sr. Scientist, Birbal Sahni Institute of Palaeobotany, Lucknow, Uttar Pradesh, India. [Voucher registration number 15531]

Preparation of extract

The successive extraction of powdered material was carried out in several batches using different solvents in increasing order of polarity in a soxhlet apparatus by hot percolation technique. The solvents used were petroleum ether, chloroform, acetone, methanol and distilled water. The powdered material of *Leptadenia pyrotechnica* was evenly packed in a soxhlet extractor for about 36 hours with different solvents. The temperature was maintained (25°C- 100°C) on an electric heating mantle with thermostat control. The extracts were then concentrated by evaporating the solvent under reduced pressure. Preliminary phytochemical studies were carried out on methanolic extract to assess the presence of various phytoconstituents [18-19] and hepatoprotective activity of the methanol extract of whole plant of *Leptadenia pyrotechnica*.

Experimental animals

Wistar albino rats of either sex, weighing 150 to 200 gm, were housed in groups of four per cage under controlled light (12:12 light: dark cycle) and temperature (25 ± 2°C). Environmental and behavioral assessment was conducted during the light cycle. Food (Golden feed, New Delhi, India) and water *ad libitum* was provided. The animals were acclimatized to laboratory conditions for seven days before commencement of experiments. All the procedure described, were reviewed and approved by Institutional Animal Ethical Committee.

Toxicity studies Acute toxicity study was performed for Methanolic extracts of *Leptadenia pyrotechnica* according to the acute toxic classic method as per OECD guidelines [20] (Ecobichon, 1997). Female albino rats were used for acute toxicity study. The animals were kept fasting for overnight providing only water, after which the various extracts were administered orally at the dose of 150 mg/kg and observed for 14 days. If mortality was observed in two animals out of three animals, then the dose administered was assigned as toxic dose. If the mortality was observed in one animal, then the same dose was repeated to confirm the toxic dose. If mortality was not observed, the procedure was repeated for further higher doses such 50,100,150,200, 400,500 & 2000mg/kg body weight. The animals were observed for toxic symptoms for 72 h.

Hepatoprotective Activity

Paracetamol induced hepatotoxicity

Hepatoprotective Activity

Paracetamol induced hepatotoxicity

Animals were randomly divided into three groups of six animals each.

The animals were divided into five groups. Group I - served as control and received vehicle, Group II- served as toxic control and received paracetamol at a dose of 500 mg/ kg, Group III-served as test and received plant methanolic extract at a dose of 150 mg/kg.

Group I served as vehicle control and received distilled water group II served as toxic control and group III serves as test group received 150 mg/kg *L. Pyrotechnica.* The pretreatment was given to all the groups for 7 days. Toxic control received paracetamol (500mg/kg) in distilled water for 7 days, respectively. On the 7th day blood sample was withdrawn and the biochemical parameters were estimated: ALP. SGOT, SGPT and Total Bilirubin content using enzyme analyzer.[21]

Biostatistical Interpretation

The statistical significance was assessed using one-way analysis of variance (ANOVA) followed by Dunnett's Test. The values were expressed as mean ± SEM and $P<0.05$ was considered significant.

RESULTS & DISCUSSION

Hepatoprotective activity

Paracetamol induced hepatotoxicity

Hepatoprotective activity of the methanolic extracts of the whole parts of *L. pyrotechnica* was evaluated by using paracetamole induced hepatotoxicity. The whole plant methanolic extract at a dose of 150 mg/kg body weight and Paracetamol as negative standard at a dose of 500 mg/kg was used and the plasma level of SGOT, SGPT, ALP and Total bilirubin was recorded in the results as shown in Table 1, Fig no. 1, Fig no. 2, Fig no. 3, Fig no. 4 and Fig no. 5.

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Table 1: Effect of L. pyrotechnica on paracetamol induced liver toxicity

GROUP	SGOT	SGPT	ALP	TOTAL BILIRUBIN
I (Control)	45.17±2.40	57.33±2.33	16.13±1.36	1.60±0.14
II (Paracetamol)	118.50±1.72	114.00±2.67	32.24±1.96	6.20±0.63
III (*L.pyrotechnica*)	58.33±2.00**	59.50±1.99**	17.11±1.34*	2.18±0.15**

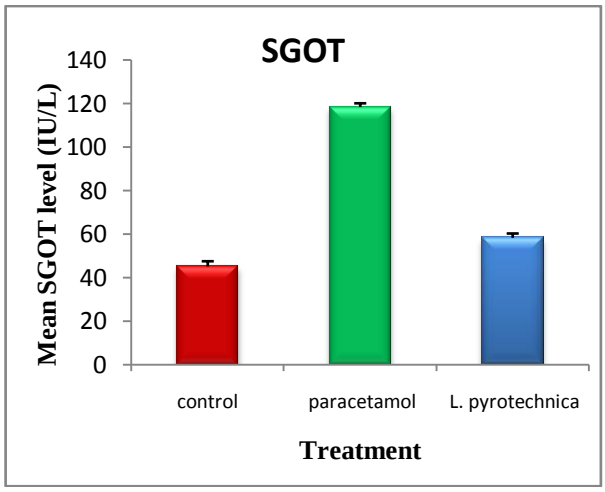

Figure 1: Representing the SGOT after treatment with Paracetamole and *L. pyrotechnica.*

Administration of PCM cause a profound elevation in the serum SGOT levels in rat compared to normal group. From the data in the table it is clearly demonstrared that the extract of *L. pyrotechnica* administration causes a significant reduction in enzyme activity in dose dependant manner.

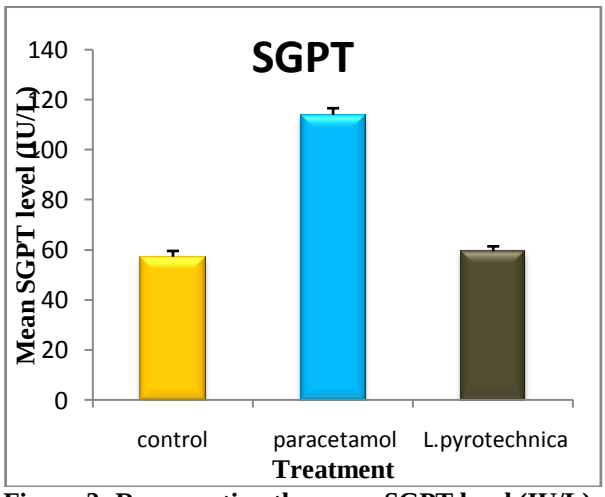

Figure 2: Representing the mean SGPT level (IU/L) after treatment with paracetamole and *L. pyrotechnica.*

Administration of PCM cause a profound elevation in the serum SGPT levels in rat compared to normal group. From the data in the table it is clearly demonstrared that the extract of *L. pyrotechnica* administration causes a significant reduction in enzyme activity in dose dependant manner.

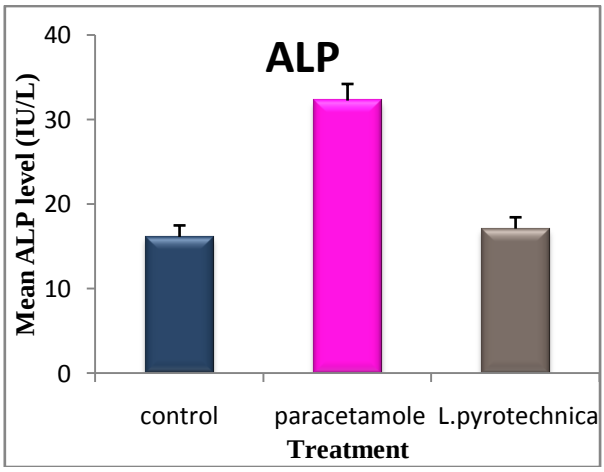

Figure 3: Representing the mean ALP level (IU/L) after treatment with Paracetamole and *L. pyrotechnica.*

Administration of PCM cause a profound elevation in the serum SGPT levels in rat compared to normal group. From the data in the table it is clearly demonstrared that the extract of *L. pyrotechnica* administration causes a significant reduction in enzyme activity in dose dependant manner.

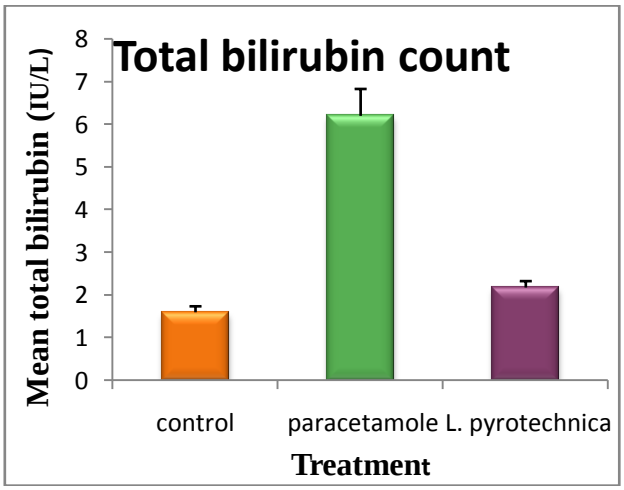

Figure 4: Representing the mean total bilirubin count after treatment with Paracetamole and *L. pyrotechnica.*

Administration of PCM cause a profound elevation in the serum SGPT levels in rat compared to normal group. From the data in the table it is clearly demonstrared that the extract of *L. pyrotechnica* administration causes a significant reduction in enzyme activity in dose dependant manner.

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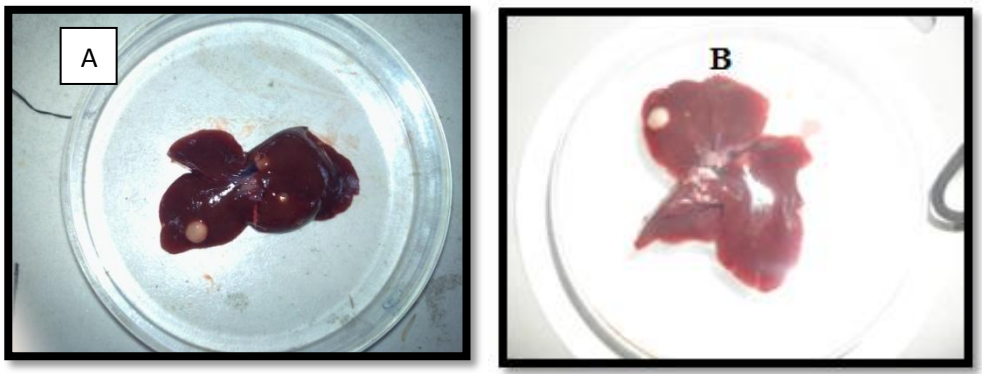

Figure 5: Image A and B showing the liver damage by the regular use of paracetamol after 7 consequetive days.

Paracetamol is a well known anti pyretic and analgesic, which produces hepatic necrosis in high doses and of the most commonly used hepatotoxins in the experimental study of liver disease. Paracetamol damages liver by covalently binding of its toxic metabolite N-acetyl-p-benzoquinone imine to sulphydryl group of proteins resulting in cell necrosis and lipid peroxidation induced by decrease in glutathione in the liver. This is evidenced by an elevation in the serum marker enzyme SGOT, SGPT, ALP and total bilirubin.

The efficacy of any hepatoprotective drug is dependent on its capacity of either reducing harmful effect or maintaining the normal hepatic physiology, which has been disturbed by hepatotoxin. The rats treated with extract alone showed sign of protection against against the toxic control.[22]

In conclusion, Although, the exact of the hepatoprotective activity mechanisms of the phytoconstituents have not been elucidated, the results of the present study validate from a preclinical point-of-view, the popular use of medicinal plant in treatment of hepatic disease. These studies are valuable for identifying lead compounds for hepatoprotective drugs, keeping in mind the side effect of antibiotic drug. Further, human studies are needed to prove the safety and efficacy of long term administration of methanol extract of whole plant of *L. pyrotechnica* as potential hepatoprotective agent in routine clinical practice.

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