INTERNATIONAL JOURNAL OF PLANT, ANIMAL AND ENVIRONMENTAL SCIENCES

Volume-1, Issue-2 :2011 *www.ijpaes.com* *ISSN 2231-4490*

EVALUATION OF HEPATOPROTECTIVE ACTIVITY OF AQUEOUS EXTRACT FROM LEAVES OF *SOLANUM AMERICANUM*

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ABSTRACT : There is a growing interest in herbal remedies because of their effectiveness, minimal side effects in clinical experiments and relatively low cost. *Solanum americanum* is an herbaceous flowering plant, reported in Indian medicinal literature with beneficial effects as anti-inflammatory, anti-spasmodic, anti-vasodilator and anti-jaundice etc. The present study was aimed to investigating the possible hepato protective activity of *S. americanum* in order to evaluate the claim by traditional herbalists in India. The hepatotoxicity produced in rats by administration of CCL_4 in paraffin oil (1:9 v/v) at a dose of 1 ml/Kg. b.wt. for 10 days, was found to be reduced by simultaneous oral administration of aqueous extract of *S. americanum* leaves (200, 400, 600 mg/ Kg. b.wt.) for 10 days, with evidence of decreased levels of serum aspartate amino transferase, alanine amino transferase, alkaline phosphatase and bilirubin. The results were compared with the hepatoprotective effect of the standard drug Silymarin. The results of this study indicated that the aqueous extract of *S. americanum* leaves could afford a significant protection against CCL_4 induced hepatotoxicity in rats and confirm the claim on this plant as a potential hepatoprotective agent in the traditional medicine.

Key words: CCL_4, Hepatoprotective, Solanum americanum, Silymarin.

INTRODUCTION

One of the major functions of the liver is detoxification of xenobiotics and toxins [1]. In many cases, reactive oxygen species produce during detoxification [2]. Over dose of toxin and some drugs or long time use of some drugs could produce large amounts of free radicals that cause oxidative stress and liver injury [3]. Because liver performs many vital functions in the human body, damage of liver causes unbearable problems [1, 4,]. Thus study about hepatoprotective compounds is of importance. Liver cell injury caused by various toxic chemicals like certain antibiotics, chemotherapeutic agents, carbon tetrachloride (CCL_4), thioacetamide (TAA), excessive alcohol consumption and microbes is well-studied. Liver damage is always associated with cellular necrosis, increase in lipid peroxidation and elevation of serum levels of many biochemical markers like SGOT, SGPT, ALP and total bilirubin (TB) [5, 6]. The available synthetic drugs to treat liver disorders in this condition also cause further damage to the liver. Hence, Herbal drugs have become increasingly popular and their use is widespread. Herbal medicines have been used in the treatment of liver diseases for a long time. Plant extracts have been used by traditional medical practitioners for the treatment of liver disorders for centuries [7]. A number of herbal preparations are now available in the market.

Solanum americanum (Solanaceae), the American nightshade, is an herbaceous flowering plant native to the Americas. The plant has a long history of medicinal usage. Traditionally it is being used as emollient, diuretic, antiseptic, laxative and hepatoprotective. Sometimes the fresh juice of this herb is used for curing fever and alleviating pain. The fruit has been used for diabetes and it is known to contain innumerable biological active compounds [8].

MATERIAL AND METHODS

Collection of plant material

Fresh leaves of *S. americanum* were collected during Sep-Dec in Warangal district of Andhra Pradesh, India and were cleaned with distilled water and shade dried at room temperature. The plant was authenticated and a voucher specimen was preserved in our laboratory, Department of Zoology, Kakatiya University, Warangal, A. P., India.

Preparation of Aqueous extract

Shade dried plant material of *S. americ*anum leaves was coarsely powdered and extracted with double distilled water using Soxhlet extraction apparatus for 24 hours. The extract was concentrated using rotary evaporator *invacuo* until the extract acquired semisolid consistency. The extract was finally dried under vacuum in desiccator over phosphorous pentoxide.

Laboratory animals

Wistar strain albino rats weighing between 220-240 gm were brought from National Institute of Nutrition (NIN) Hyderabad, Andhra Pradesh, India and kept in separate cages with sufficient space to move about. The rats were kept under controlled temperature of 21±1^{o}C and 12:12 hr light/dark cycles with enough humidity one week before (acclimatization) the start and also during the experiment as per the rules and regulations of Committee for the Purpose of Control and Supervision on Experiments on Animals (CPCSEA). They were fed with standard laboratory diet as recommended by NIN, Hyderabad. Food and water was allowed *ad libitum* during the experiment.

Experimental design

The animals were divided into six groups of six animals each. Group-1 served as normal control received normal saline (1 ml/kg.p.o) daily once for 10 days. Group-2 served as toxic control and received CCl_4 (1 ml/kg i.p) daily once for 10 days [9]. Group-3 was treated with the standard drug Silymarin (50 mg/kg .p.o) and followed by CCL_4 (1 ml/kg i.p) daily once for 10 days [10]. Groups 4, 5 and 6 were treated with aqueous extract of *S. americanum* leaves at doses of 200, 400 & 600mg/kg p.o. in paraffin oil respectively, followed by CCl_4 (1 ml/kg i.p) daily once for 10 days.

Biochemical studies

All the animals were sacrificed on 11th day under light ether anesthesia. The blood samples were collected separately in sterilized dry centrifuge tubes by puncturing the retro-orbital venous plexus and allowed to coagulate for 30 min at 37 °C. Then it was centrifuged at 1500rpm (Micro centrifuge) for 15min to separate the serum. The clear serum was subjected to biochemical investigation viz..,serum glutamate oxaloacetate transeaminase (SGOT), serum glutamic Pyruvate transeaminase (SGPT), Alkaline phosphatase (ALP) and Total Bilirubin (TB).

Statistical Analysis

Results were expressed as mean ± standard deviation (S.D.). Where applicable, the data were subjected to one way analysis of variance (ANOVA) [11]. The comparison between the control and experimental groups was done using the Dunnett's test [12].

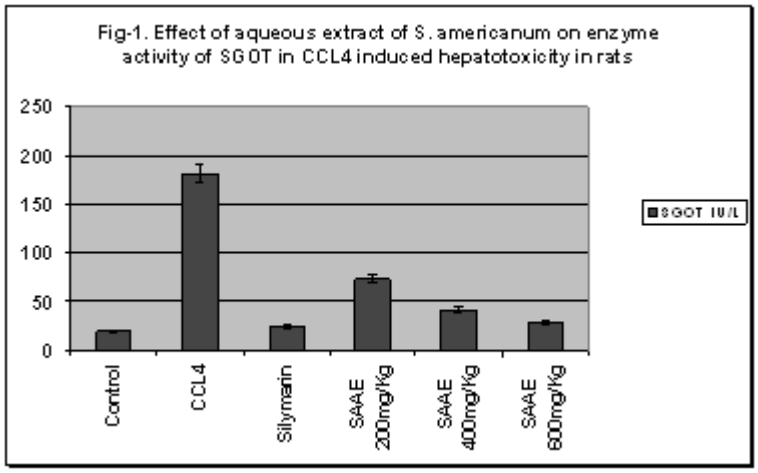
RESULTS AND DISCUSSION

Glutamic pyruvic transaminase, Glutamic-oxaloacetic transaminase and alkaline phosphatase are the principal enzymes of diagnostic value in hepatotoxicity. When the liver is damaged, excess amounts of these enzymes are released in the blood stream and results in an elevated level of SGOT, SGPT and ALP. The total bilirubin (TB) concentration will also be elevated during drug induced hepatotoxicity.

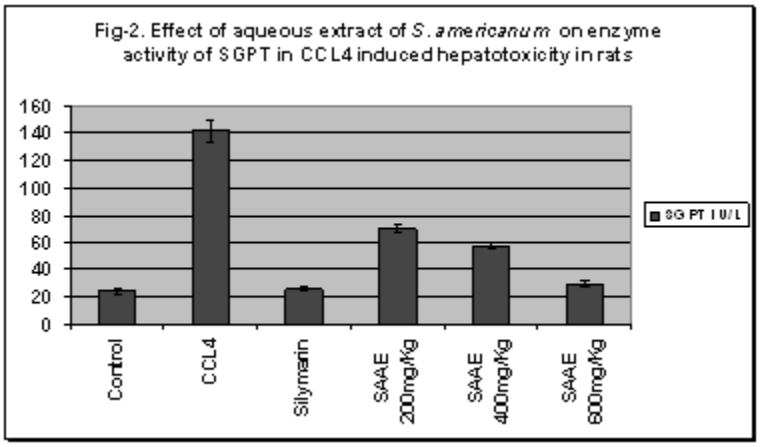
Comparison of serum biochemical parameters normal control and toxic control group revealed that the Carbon tetrachloride (1ml/kg.i.p) intoxication in normal rats produced elevated levels of serum biochemical parameters significantly ($p<0.01$) SGOT (19.9±1.2, 181.8±8.1), SGPT(23.8±1.6, 141.7±7.8), ALP(67.62±3.2, 312.7±14.02), TB(0.57±0.07, 2.12±0.11) indicating acute hepatocellular damage.

The percentage reduction of various serum biochemical parameters in case of standard drug silymarin (50mg/kg.p.o) in CCl_4 intoxicated rats revealed a significant reduction ($p<0.01$) in the levels of SGOT(94.0%), SGPT(92.5%), ALP(82.5%) and TB(92.3%).

When compared to the CCl_4 toxic control group, group 4, 5 and 6 treated with aqueous extract of *S. americanum* at doses of 200, 400 and 600mg/kg; p.o respectively and CCl_4 intoxicated rats exhibited a significant reduction ($p<0.01$) of SGOT(60.8%, 78.6%, 90.4%), SGPT(58.4%, 72.3%, 84.9%), ALP(61.1%, 70.7%, 79.1%) and TB(58.7%, 76.8%, 89.0%) levels respectively. The activity of the extracts is found to be dose dependant. The results were given in Figure-1-5.



Values expressed as AVG±SD, p<0.05, 6 animals per each group.



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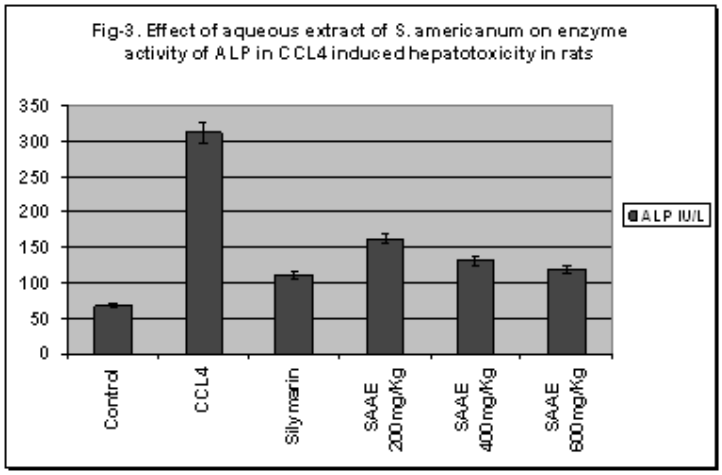

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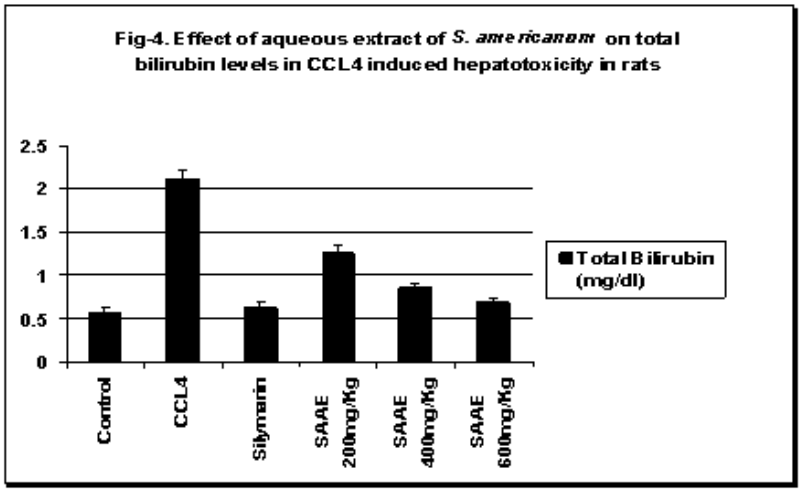

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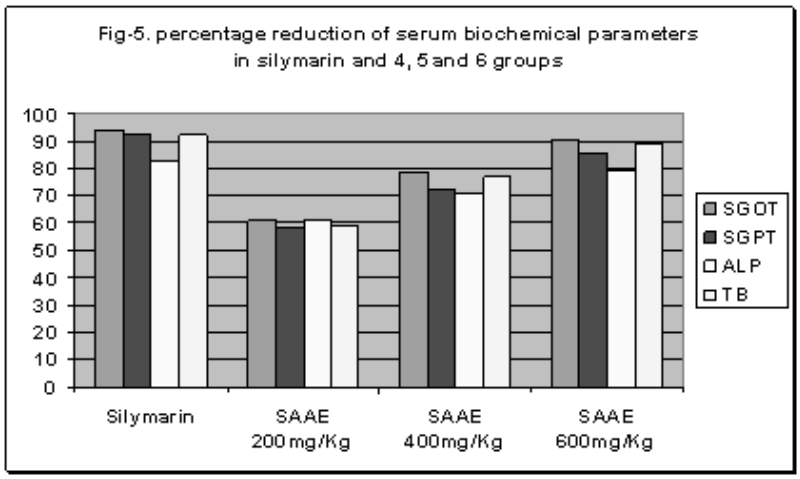

Values expressed as AVG±SD, p<0.05, 6 animals per each group.

CONCLUSION

The result of this investigation indicated that the aqueous extract of *S. americanum* possess hepatoprotective activity against CCl_4 induced liver damage in rats. The phytochemical analysis of *S. americanum* revealed the presence of good amounts of flavonoids. Hence, the hepatoprotective activity of *S. americanum* could be due to the presence of flavonoids which have hepatoprotective properties [13, 14,]. Attempts are being made to isolate and characterize the active principle to which the hepatoprotective activity can attribute.

ACKNOWLEDGMENT

The author B. Satheesh Kumar (CSIR-SRF) gratefully acknowledges Council of Scientific and Industrial Research (CSIR), New Delhi, for awarding research fellowship through joint UGC-CSIR National Eligibility Test.

Abbreviations: SAAE- Solanum americanum Aqueous Extract; **SGOT-** Serum Glutamate Oxaloacetate Transaminase; **SGPT-** Serum Glutamate Pyruvate Transaminase; ALP- Alkaline Phosphatase; **TB-** Total Bilirubin; **CCL_4-** Carbon Tetra Chloride.

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