



Research Article

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Modulation of lysosomal enzymes activity by *Carica papaya* Linn. and *Solanum torvum* Linn. in carbon tetrachloride vapour induced liver damage in rats

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ABSTRACT

Carbon tetra chloride a major cause of chronic liver damage represents a clinical problem. We investigated the role of *Carica papaya* Linn. and *Solanum torvum* Linn. on lysosomal activity in carbon tetrachloride vapour induced liver damage in rats. Carbon tetrachloride vapour induced liver damage and its prevention by *Carica papaya* Linn. and *Solanum torvum* Linn. were assessed on lysosomal enzyme activity and biochemical parameters like serum alanine amino transferase (SGOT), serum aspartate amino transferase (SGPT), alkaline phosphatase (APL), bilirubin and total protein. The results showed carbon tetra chloride damage associated with activities of lysosomal enzymes viz NAG, glucoronitase, acid phosphatase and also increase in serum alanine aminotransferase, serum aspartate amino transferase, alkaline phosphatase and bilirubin levels. *Carica papaya* Linn. and *Solanum torvum* Linn. reversed the effect of carbon tetrachloride vapour induced liver damage.

Key words: *Carica papaya*, *Solanum torvum*, lysosomal enzyme, carbon tetrachloride vapour.

INTRODUCTION

Modern medicines have little to offer for alleviation of hepatic disease and it is chiefly employed for the treatment of liver disorders [1, 2]. But there are not much drugs available for the treatment of liver disorders. It has been reported that, constitutes of plant origin were evaluated for its possible hepato protective activity against chemical induced liver damage in experimental animals [3-5].

Carica papaya Linn. belongs to *Caricaceae* family and its latex of the unripe fruits contain papain, pectin and malic acid. The fruits contain protein, sugars, cryptoxanthin, violaxanthin, zeaxanthin, β -carotene, neo β -carotene, ascorbic acid, thiamine, riboflavine and other vitamins. Carpasemine has been isolated from the seeds. Leaves contain carposide, carpaine, pseudo carpaine, dehydrocarpaines I and II [6]. Fruits of *Carica papaya* Linn. has been used as a medicine as laxative, digestive, stomachic, diuretic and milky juice of latex of green fruit beneficial in liver enlargement, ringworm infection and diarrhea [7].

Solanum torvum Linn. belongs to family *Solanaceae*. It is known as sundaikai in Tamil and it contain neochlorogenone in leaves, chlorogenin, neochlorogenin and its epimer solasonine, sisalagenone, torrogenin,

sitosterol, D-glucoside, vitamin A in fruits[8]. Whole plant act as digestive, diuretic and sedative, fruits useful in liver and spleen enlargement and leaves act as haemostatic[9].

Long term inhalation of Carbon Tetrachloride vapour in experimental animal produces liver cirrhosis which is similar to human alcoholic cirrhosis. The lysosomes plays an important role in cell death and tissue damage and therefore it is hypothesized that their levels may be altered during the cause of development of cirrhosis [10]. The present study was aimed to evaluate hepatoprotective effect of *Carica papaya* Linn. and *Solanum torvum* Linn. using Carbon Tetrachloride vapour induced liver injury model in wistar rats.

EXPERIMENTAL SECTION

Animals:

Adult wistar rats of either sex weighing 150-200g were used in this experiment. The animals were allowed free access to laboratory chow diet and tap water. They were housed in galvanized iron cages in a thermostatically controlled room and maintained in 12h natural dark/light cycle.

Chemical:

p-nitrophenyl β -glucuronide, p-nitrophenyl-N-acetylglucosaminide, p-nitrophenol and glycine were purchased from Sigma Aldrich. Carbon tetrachloride was obtained from S.D fine chem.,Ltd.,India. All other chemicals were of analytical grade.

Plant Materials:

Fresh milky juice of the *Carica papaya* Linn. and aerial part of *Solanum torvum* Linn. were collected from a village around Pattukottai, Tamilnadu,India.The drugs were collected during the month of May – June 2008. The standard drug Alloxy was purchased from the local Medicinal shop and used as a reference drug in this study.

Study Design and Drug Treatment Schedule:

Thirty male adult Wister albino rats were located randomly to five groups of six animals each.

Normal Group I:

Rats were orally administered 0.9% normal saline once daily for 15 days.

CCl₄ control group II:

Animals were orally administered 0.9% normal saline once daily for 15 days and also administered Carbon Tetrachloride vapour (150mg/kg), at an interval of 24 h.

Carica pappaya Linn. Group III:

Animals were orally administered Carbon Tetrachloride vapour (150mg/kg) on 1st to 7th day once daily and also administered *Carica pappaya* Linn. on 8th to 15th days daily at 24 h interval.

Solanum torvum Linn. Group IV:

Animals were orally administered Carbon Tetrachloride vapour (150mg/kg) on 1st to 7th day once daily and also administered *Solanum torvum* Linn. on 8th to 15th days daily at an 24 h interval.

Alloxy Group V:

Animals were orally administered Carbon Tetrachloride vapour (150mg/kg) on 1st to 7th day once daily and also administered standard drug (Alloxy 300mg/kg) on 8th to 15th days daily at an 24 h interval.

On the 16th day, all animals were sacrificed under an overdose of anaesthesia. The serum and liver homogenate used for the biochemical estimations.

RESULTS AND DISCUSSION

The herbal drugs are in general non toxic because of some limitation in synthetic drugs. Majority of people are in favour of taking pure herbal ayurvedic drugs in the management of certain diseases in liver [11]. These drugs are

not too popular due to lack of scientific studies. The enzymes leak out in circulating denotes the damage of hepato cells.

Present study have shown that all CCl₄ exposed rats displayed liver disfunction as shown by their elevated levels of total protein , bilirbin , SGPT, SGOT , alkaline phosphatase, acid phosphatase, N-acetyl glucosaminidase, β-glucuronidase.

Amino transferase is an important class of enzymes linking carbohydrate and amino acid metabolism there by clearly establishing the relationship between the intermediates of the citric acid and amino acid. In case of liver damage with hapatocellular lesion and parenchymal cell necrosis, these enzymes are released from the damaged tissue into the blood stream[12]. So the level of SGOT, SGPT increased in blood and liver. In the present study the activities of SGOT, SGPT enzymes were maintained at near normal level in the oral administrated group of standard drug and plant extract as compared with the hepatotoxin group.

Alkaline phosphatase activity on endothelial cell surface is responsible for the conversion of adenosine nucleotide to adenosine a potent vasodilator and anti inflammatory mediator that results from injury [13]. So following accumulation of toxic metabolite can leads to protection of adenosine to alkaline phosphatase. This may be the reason for the increment in ALP in hepatotoxin group.

Bilirubin is a major breakdown product that results from the destruction of RBC which is removed from the blood by the liver through conjugation and secreted in to bile usually becomes elevated as a results of decreased uptake by the liver. Decreased conjugation decrease secretion from the liver or blockage of the bile ducts that is caused in liver damage[14]. Levels of acidphosphatase, NAG, β- glucoronitase enzymes are very sensitive markers employed in the diagnosis of liver diseases. When the hepatocellular plasma membrane is damaged, the enzymes normally present in the cytosol are released into the blood stream[15]. This can be quantified to assess that type and extent of liver injury. The oral administration of plant extract and alloxy 100 mg/kg were significantly reduced the level of marker enzymes.

Table 1: Evaluation of hepatoprotective activity of *Carica papaya* Linn. and *Solanum tarvum* Linn. on protein and bilirubin content in CCl₄ vapour induced hepatotoxicity in rats

S. No.	Subjects	Serum Total protein g/dl	Liver Total Protein g/dl	Total Serum Bilirubin	Total Liver Bilirubin
1.	Normal	7.376 ±0.30	7.421 ± 0.33	0.98 ± 0.14	0.99 ± 0.16
2.	Control	6.063 ± 0.42	6.066 ± 0.45	2.77 ± 0.23	2.80 ± 0.25
3.	<i>Carica papaya</i> Linn.,	6.758 ± 0.38	6.761 ± 0.47	1.23 ± 0.14	1.28 ± 0.17
4.	<i>Solanum tarvum</i> Linn.,	6.820 ± 0.44	6.823 ± 0.49	1.12 ± 0.20	1.16 ± 0.24
5.	Alloxy	7.483 ± 0.51	7.487 ± 0.54	1.10 ± 0.22	1.14 ± 0.27

Table 2: Evaluation of hepatoprotective activity of *Carica papaya* Linn. and *Solanum tarvum* Linn. on SGPT, SGOT content in CCl₄ vapour induced hepatotoxicity in rats

S. No.	Subjects	Serum SGPT (IU /L)	Liver SGPT (IU /L)	Serum SGOT(IU /L)	Liver SGOT (IU /L)
1.	Normal	47.3 ±0.26	52.3 ± 0.27	142.4 ± 0.06	145.6 ± 0.08
2.	Control	84.02 ± 0.72	86.04 ± 0.74	185.02 ± 0.49	192.05 ± 0.52
3.	<i>Carica papaya</i> Linn.,	46.82 ± 0.53	48.85 ± 0.56	142.49 ± 0.12	153.52 ± 0.15
4.	<i>Solanum tarvum</i> Linn.,	44.32 ± 0.72	46.37 ± 0.78	130.48 ± 0.25	132.53 ± 0.28
5.	Alloxy	52.71 ± 0.25	52.73 ± 0.27	153.39 ± 0.32	150.39 ± 0.35

In view of our finding *Carica papaya* Linn. and *Solanum tarvum* Linn. significantly showed hepatoprotective activity by delaying the development of liver damage induced by carbon Tetrachloride vapour via, necrosis, fibrosis to cirrhosis. Plant extracts prevented the leakage of lysosomal enzymes by increasing the stability or decreasing vulnerability of lysosomal membrane possibly due to its antioxidant property.

Table 3: Evaluation of hepatoprotective activity of *Carica papaya* Linn. and *Solanum tarvum* Linn. on Acid Phosphatase, Alkaline Phosphatase content in CCl₄ vapour induced hepatotoxicity in rats.

S. No.	Subjects	Serum Acid Phosphatase (IU /L)	Liver Acid Phosphatase (IU /L)	Serum Alkaline Phosphatase (IU /L)	Liver Alkaline Phosphatase (IU /L)
1.	Normal	1.562 ±0.02	5.7 ± 0.2	4.86 ± 0.2	6.64 ± 0.1
2.	Control	3.36 ± 0.07	9.917 ± 0.09	6.84 ± 0.03	9.73 ± 0.4
3.	<i>Carica papaya</i> Linn.,	2.64 ± 0.03	6.70 ± 0.05	5.46 ± 0.06	8.93 ± 0.7
4.	<i>Solanum tarvum</i> Linn.,	2.30 ± 0.02	6.9 ± 0.06	6.01 ± 0.07	8.76 ± 0.3
5.	Alloxy	1.96 ± 0.08	6.3 ± 0.04	5.98 ± 0.63	7.84 ± 0.4

Table 4: Evaluation of hepatoprotective activity of *Carica papaya* Linn. and *Solanum tarvum* Linn. on N acetyl Glucosaminidase, β-glucuronidase content in CCl₄ vapour induced hepatotoxicity in rats

S. No.	Subjects	Serum NAG (IU /L)	Liver NAG (IU /L)	Serum β-glu (IU /L)	Liver β- glu (IU /L)
1.	Normal	6.2 ± 0.14	3.24 ± 0.15	4.73 ± 0.03	6.90 ± 0.07
2.	Control	9.4 ± 0.03	5.73 ± 0.2	6.18 ± 0.04	8.68 ± 0.04
3.	<i>Carica papaya</i> Linn.,	7.4 ± 0.02	4.68 ± 0.04	5.84 ± 0.08	6.49 ± 0.06
4.	<i>Solanum tarvum</i> Linn.,	8.1 ± 0.07	4.96 ± 0.06	5.63 ± 0.06	5.98 ± 0.03
5.	Alloxy	6.9 ± 0.03	3.92 ± 0.03	4.98 ± 0.03	5.90 ± 0.08

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