Effect of Dried Fruits of Solanum nigrum Linn against CCl4-Induced Hepatic Damage in Rats

Kuppuswamy Raju,∗a Govindaraju Anbuganapathi,b Velusamy Gokulakrishnan,a Balasubramanian Rajakpoor,c Balasundarm Jayakan,c and Sellamuthu Maniand

∗PG & Research Department of Botany; bPG & Research Department of Zoology, Kandaswami Kandar’s College; Velur 638 182, Namakkal, Tamil Nadu, India; cDepartment of Pharmacology, Vinayaka Mission’s College of Pharmacy; Yercaud Road, Salem 636 008, Tamil Nadu, India; and dDepartment of Botany, Bharathiar University; Coimbatore 641 046, Tamil Nadu, India. Received June 9, 2003; accepted August 18, 2003

Ethanol extract of Solanum nigrum L. was investigated for its hepatoprotective activity against CCl4-induced hepatic damage in rats. The ethanol extract showed remarkable hepatoprotective activity. The activity was evaluated using biochemical parameters such as serum aspartate amino transferase (AST), alanine amino transferase (ALT), alkaline phosphatase (ALP) and total bilirubin. The histopathological changes of liver sample in treated animals were compared with respect to control.

Key words Solanum nigrum; carbon tetrachloride (CCl4); hepatoprotective activity

Numerous medicinal plants and their formulation are used for liver disorders in ethnomedical practice as well as traditional system of medicine in India.1) Herbs play a vital role in the management of various liver disorders. In the absence of a reliable liver protective drug in the modern medicine, a number of medicinal preparation in ayurvedha are recommended for the treatment of liver disorders.2) The present work was taken up to evaluate the effects of ethanol extract of the dried fruits of Solanum nigrum L. against CCl4-induced hepatic damage in rats.

Solanum nigrum (Family: Solanaceae) is a shrub found throughout India, which is traditionally used for inflammatory, diuretic and liver disorders.3) The phytochemical studies revealed the presence of an alkaloid called solamargine, nigrumin I, nigrumin II4) and a glycoside named solasodine.5)

MATERIALS AND METHODS

Materials The fruits of Solanum nigrum were collected from Kolli hills, Namakkal District, Tamil Nadu in the month of November and authenticated at the Botanical Survey of India, Coimbatore, India. The fruits were washed and cut into small pieces, shade dried and powdered. The coarse powder was subjected to continuous hot extraction in a soxhlet by using ethanol (95% v/v). The ethanol was removed by distillation under reduced pressure. These extracts were suspended in 5% gum acacia and used in the present experiments. LD50 value for the ethanol extract of S. nigrum fruits was determined in Swiss albino mice as described by Miller and Tainter.6)

Animals Male albino rats were procured from Perundurai Medical College, Perundurai and bred in the college animal house. They were fed on commercial diet (Hindustan lever, Bangalore) and water ad libitum during the experiments. The room temperature was maintained at 25±1°C. Three groups (I—III) each comprising of six animals weighing between 130—160 g were selected. Group I served as control and received 0.2 ml of gum acacia daily for 7 d orally. Group II rats were similarly treated as group I. Groups III were treated with ethanol extract of S. nigrum fruits at a dose of 250 mg/kg respectively for 7 d.7)

On the seventh day carbon tetrachloride (1.25 ml/kg, p.o.) was administered 30 min after the last dose to all rats except rats in group I. After 36 h, all the rats were sacrificed under light ether anesthesia, blood was collected in sterile centrifuge tube and allowed to clot. Serum was separated by centrifuging at 2500 rpm for 15 min and used for the estimation of serum aspartate amino transferase (AST),8) alanine amino transferase (ALT),9) alkaline phosphatase (ALP)10) and total bilirubin.10)

After the animals were sacrificed, the abdomen of each was cut opened and the liver removed. The ratio of wet liver weight per 100 g of animal body weight was calculated. The livers were preserved in neutral buffered formalin and were processed for paraffin embedding, following the standard microtechnique.11) Five micron sections of livers, stained with alainhaemotoxylin and eosin were observed under microscope for the histopathological changes.

RESULTS

LD50 value of ethanol extract of the fruits of S. nigrum was found to be 2 g/kg. The results of biochemical parameters revealed the elevation of serum enzyme levels in CCl4 treated group indicating that CCl4 induced damage to the liver (Table 1). A significant (p<0.001) reduction was observed in AST, ALT, ALP and total bilirubin in the group treated with ethanol extract of dried fruits of S. nigrum in comparison with those observing CCl4 treated group. The enzyme levels were almost restored to the levels found in control and test group of rats.

Intoxication of the rats with CCl4 resulted in enlargement of liver that was pale reddish brown in colour. The group treated with ethanol extract of dried fruits of S. nigrum, showed liver size, which was similar to that found in the normal rats. However, a significant (p<0.001) restoration in liver weight was obtained in group treated with ethanol extract of dried fruits of S. nigrum (Fig. 1).
DISCUSSION

Carbon tetrachloride has been widely used for inducing experimental hepatic damage due to free radical formation during its metabolism by hepatic microsome,\textsuperscript{12,13) which is turn to causes the lipid peroxidition of cellular membrane leading to the necrosis of hepatocytic. This is evident from the elevated activities of the serum marker enzymes such as AST, ALT, ALP and total bilirubin.

The efficacy of any hepatoprotective drug is essentially dependent on its ability in reducing the harmful effects or maintaining the normal hepatic physiology that has been disturbed by a hepatotoxin. In the present study, administration of \textit{S. nigrum} fruits extract decreased the \textit{CCl}_4 induced elevated enzyme levels in group III animals. This suggest the maintenance of structural integrity of hepatocytic cell membrane or regeneration of damaged liver cells by the extract.

Histopathological examination of the liver sections of rats treated with toxicant showed intense centrilobular necrosis and fatty changes. The rats treated with extracts along with toxicant showed sign of protection against these toxicant to a considerable extent as evident from the formation of normal hepatic cards and absence of necrosis and vacuoles.

Decrease in serum bilirubin after treatment with the extract in liver damage indicates the effectiveness of the extract in normal functional status of the liver. The histopathological observation demonstrate the protective role of the extract against liver damage. Thus, it is evident from the present study that ethanol extract of dried fruits of \textit{S. nigrum} has been remarkable hepatoprotective effect in \textit{CCl}_4-induced liver damage. The hepatoprotective mechanism of this herbal drug as well as active principles is not known. Further investigation is required to characterize the active hepatoprotective principle and its mechanism of action.

REFERENCES