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Protective role of dandelion against acute liver damage induced in albino rats

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ABSTRACT

Liver diseases are on an increase in our society and numbers of herbal medicines are currently being used, because of their less cost and higher safety margin than the synthetic drugs, for its treatment. Acetaminophen (paracetamol) a commonly used antipyretic and analgesic, seems safe when taken in therapeutic doses but larger amounts may cause fatal hepatic necrosis. Dandelion (*Taraxacum officinale* Weber., locally known as Hand) is abundantly available in Kashmir. It is mainly used for kidney and liver disorders in the traditional system of medicine. Root and leaf preparations are used as choleretic, diuretic and tonic components. Juice of the fresh plants is said to be effective against liver diseases, intermittent fever and hypochondria. However no systematic study is available on the efficacy of *Dandelion* as hepatoprotective agent. In the present study extract of *Dandelion* was screened for its antihepatotoxic activity against acute hepatocellular damage induced in experimental animals. The raised serum AST, ALT, SAP and cholesterol levels were significantly lowered after administration of the extract. Histopathological studies of the livers of rats supported the biochemical findings.

KEYWORDS

Acetaminophen;
Liver damage;
Dandelion;
Curative activity;
Taraxacum officinale.

INTRODUCTION

Liver plays an astonishing array of vital functions in the maintenance and performance of the body. Liver diseases appear to be on increase in our society. Several indigineous plants are claimed to possess hepatoprotective activity[1]. Dandelion (*Taraxacum officinale* Weber., Family: Compositae) commonly known as Hand is a perennial herb growing throughout the Himalayas on alpine meadows and slopes at an altitude of 1500-4000m. It has a long history of being in traditional use, in many systems of medicine in the treatment of hepatobiliary problems.

The root is traditionally used to treat liver and spleen ailments[2], Root and leaf preparations are used as choleretic, diuretic[3], as a bitter tonic in atonic dyspepsia[4] and as a mild laxative in habitual constipation[5]. It has also been found to retain a potential antitumour activity[6]. However, no report is available on the efficacy of Dandelion as an anti-hepatotoxic agent. In this study extract of Dandelion whole plant has been studied for any curative effect against acetaminophen induced liver cell damage.

EXPERIMENTAL

Healthy albino rats (150-250g), wistar strain, were procured from Central Animal House, RRL, Jammu after

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proper approval. They were randomly distributed according to age, weight, sex and were housed under uniform animal husbandry conditions in clean polypropylene cages and fed with rat feed and water ad-libitum. The animals were kept under identical conditions of food water temperature, relative humidity and degree of nursing care and were exposed to 12 hr. light-dark cycle.

The whole plant of Dandelion was purchased from the local market and was identified by a plant taxanomist, Dr. A.R.Naqshi, Department of Botany, faculty of Science, University of Kashmir. A voucher specimen is deposited in the Department of Botany, University of Kashmir under No 02-06-03/1001(KASH). The plant material was freed from extraneous matter and dried in a well-ventilated room, the outside temperature being in the range of 18-32 degree celsius. It was then coarsely powdered and 50% ethanolic extract was prepared[7]. Rats were randomly divided into three groups of eight animals each. Group 1 served as Control and received only 1% gum acacia suspension for five days while rats of Group 2 and Group 3 received single oral dose of acetaminophen (500mg/kg, b.w)[8]. After 48hrs of acetaminophen administration, Group 3 also received 50% ethanolic extract of Dandelion whole plant at the dose of 100mg/100g/day daily for 5 days. Group 2 served as negative control and did not receive any further treatment for next five days.

After the administration of the last dose of drugs, the animals were fasted overnight, blood samples were withdrawn from the retino-bulbar venous plexus, serum was separated and various biochemical parameters like alanine amino tranferase (ALT)[9], aspartate amino transferase (AST)[9] serum alkaline phosphatase (SAP)[10] and cholesterol levels were estimated. Livers were dissected out and after washing, preserved for histopathological studies.

All the procedures were performed in accordance with the Institutional Animal and Ethics Committee (IAEC) at the Department of Pharmaceutical Sciences, University of Kashmir.

Statistical analysis

Values expressed as mean ± SE from the number of replications described in the test.

Total variation present in a set of data has been estimated by ANOVA. The t-value was also calculated for two-sided test. P<0.05* considered significant and p<0.01** as highly significant.

RESULTS

The yield of 50% ethanolic extract of Dandelion whole plant was found to be 14.30 w/w.

Acetaminophen treated rats of Group 3 showed significant rise (*p<0.05) in AST levels compared to control rats of Group 1 (289.90±18.94 IU/L). A significant fall (p<0.02) in the AST levels was observed when Dandelion was administered concurrently with acetaminophen (Group III) (TABLE 1).

The ALT levels were increased in acetaminophen treated rats of Group 2 as compared to vehicle control Group 1. A fall p<0.02 in ALT levels was observed in the rats of Group 3. A rise in the SAP levels was observed in acetaminophen treated rats of Group 2. Rats treated with Dandelion (Group 3) showed a significant fall in SAP levels compared to acetaminophen treated Group 2.

There was significant rise in serum cholesterol levels in Group 2 as compared to Group 1. However a fall in serum cholesterol levels in Group 3, that had received the extract and acetaminophen, was observed.

Histopathological examination of acetaminophen treated rats of Group 2 showed marked centrilobular

TABLE 1 : Effect of 50% ethanolic extract of dandelion, on serum enzyme levels, against acetaminophen induced acute hepatocellular damage in rats

Enzymes	Group-1 Control (1% gum acacia)	Group-2 Paracetamol (500mg/kg), orally, in single dose	Group-3 Paracetamol + dandelion extract (100mg/100g/day) × 5 Days	Statistically Compared groups
Aspartate aminotransferase (AST IU/L)	289.90 ± 18.94	434.62± 56.39***	267.15± 10.07***	2 Vs 1, 3 Vs 2
Alanine aminotransferase (ALU IU/L)	84.60 ± 1 5.84	100.80 ± 10.37***	86.40± 6.49**	2 Vs 1, 3 Vs 2
Serum alkaline phosphatase (SAP mM Units)	704.91 ± 13.42	928.4 ± 18.27***	794.43± 14.20***	2 Vs 1, 3 Vs 2
Serum cholesterol(mg/100ml)	93.68 ± 11.11	124.19± 5.73***	98.21± 18.16**	2 Vs 1, 3 Vs 2

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necrosis in the liver sections. Focal necrosis of hepatocytes was seen in 40% of the rats. Centrivenous congestion was also observed in 23% rats of this Group compared to normal livers of Group 1.

50% ethanolic extract of Dandelion when administered at the dose of 100mg/100g/day for 5 days after paracetamol administration revealed anisonuleosis, microvesicular steatosis, sinusoidal congestion and binucleated cells in the livers (Group 3). Slight vein congestion was seen in one of the livers and regenerative activity was observed in 63% livers of rats in this Group.

DISCUSSION

Liver holds a position of singular importance in overall functions of the human body. Its normal functioning can be disturbed by various infections, infiltrations or toxic agents such as alcohol, drugs and environmental factors[11].

Acetaminophen is a widely used antipyretic and analgesic, which seems safe when taken in therapeutic doses but larger amounts may cause fatal hepatic necrosis[12]. This necrosis is primarily centrilobular but may also extend through midzonal area towards the peripotal area[13].

Acetaminophen has been used in a single oral dose of 500mg/kg b.w, by Pandey and Shrivastava[8] for producing degenerative changes. In our studies, also acetaminophen was administered in a single oral dose of 500mg/kg 48 hrs before the administration of drug suspension.

The assessment of liver function was done by performing various biochemical estimations like AST, ALT, SAP and cholesterol as acetaminophen toxicity leads to prominent increase in these levels[14].

Acetaminophen produced a significant rise in AST, ALT, SAP and cholesterol reflecting liver cell injury. (TABLE 1) Dandelion (100mg/100g/day) given daily for 5 days after administration of single dose of acetaminophen (500mg/kg) reduced the AST, SAP and cholesterol levels while producing highly significant fall ($p<0.01$***) in ALT levels. The average body weight and liver weight of the rats was reduced after administration of the extract.

The attributivity of the observed alterations of serum enzyme levels to hepatic damage of health was confirmed by histopathological studies of liver in acetaminophen treated group which showed severe fatty degeneration of cells around the portal tract (Figure 2) while Dandelion (100mg/100g/day) treated group revealed only mild fatty changes and regenerative activity in 63% of rats. These observations point towards protective role of Dandelion against acute liver cell damage induced in albino rats. However further work is needed to establish the efficacy of extract of Dandelion against other hepatotoxic models and to isolate the active constituents present in it which are responsible for antihepatotoxic potential of the plant.

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