
ARTICLES

Hepatoprotective Influence of *Adansonia digitata* Pulp

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ABSTRACT. The aqueous extract of the *Adansonia digitata* (Linn.) pulp was tested for hepatoprotective activity against chemical toxicity with CCL₄ in rats. The aqueous extract exhibited significant hepatoprotective activity and consumption of *Adansonia digitata* fruit may play an important part in human resistance to liver damage in areas in which the plant is consumed (2). The mechanism of liver protection is unknown, but could possibly result from triterpenoids, β -sitosterol, β -amyirin palmitate, or/and α -amyirin, and ursolic acid in the fruit. [Article copies available for a fee from The Haworth Document Delivery Service: 1-800-HAWORTH. E-mail address: <docdelivery@haworthpress.com> Website: <<http://www.HaworthPress.com>> © 2003 by The Haworth Press, Inc. All rights reserved.]

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INTRODUCTION

The fruit pulp of the *Adansonia digitata* (Linn.), commonly known as baobab, is an important human nutrition source in East, Central, and West Africa (1,15). The plant, which has traditionally been used as an immunostimulant (3), anti-inflammatory, analgesic (10), pesticide (16), antipyretic, febrifuge, and astringent in the treatment of diarrhea and dysentery (10), has been evaluated as a substitute for imported western drugs (4). No systemic study, however, has reported the possible use of fruit pulp as a hepatoprotective agent. This study investigated the effects of *Adansonia digitata* fruit pulp against carbon tetrachloride induced hepatotoxicity.

MATERIALS AND METHODS

Plant material. Fruit of *Adansonia digitata* (Linn.), purchased in a local market in Makkah, Saudi Arabia, was used in this study. The plant material was botanically identified and authenticated by Dr. S. A. Bazaid, Department of Biology, Umm Al-Quora University. Voucher specimens of the seeds have been deposited in the Department of Veterinary Medicine, College of Agriculture and Veterinary Medicine, Qassim, Saudi Arabia.

The outer white fruit pulp coating the seeds was separated from the seeds by soaking the seeds in cold water (1:1.25, w:v) for 24 h. The suspension of pulp and seeds was subsequently filtered under suction and the filtrate (milky in color) was freeze-dried using a freeze-dryer (Labonco model 75018) to yield white fluffy powder.

Test animals. Mature, Wistar male albino rats (125-150 g) maintained under standard environmental conditions (temperature $25 \pm 2^\circ\text{C}$, relative humidity $60 \pm 10\%$ and 14 h light/10 h dark cycle) were used as test animals in this study. The animals were fed standard laboratory feed and water *ad libitum*. Groups of five animals each were used in all sets of the experiments.

Experimental. Antihepatotoxic activity of the isolated plant filtrate (extract) against CCl_4 induced hepatotoxicity in rats was done according to the procedure of Rao and Mishra (12) (Table 1). The results, ex-

pressed as percent hepatoprotective activity (H), were calculated by the following formula (13):

$$H = \frac{[1 - (A - S)]}{(C - S)} \times 100$$

where A, C, and S were the changes in livers measured in the test animals treated with the *Adansonia digitata* extract plus CCl₄, CCl₄, and saline, respectively.

To assess liver functions, test animals, subjected to one of the various treatments, were anesthetized 24 h after the last treatment. Blood samples were then drawn directly from the inner canthus of the anesthetized rats. Serum enzyme [alanine transferase (ALT), aspartate transferase (AST), and alkaline phosphatase (ALP)] activities and total protein (TP), albumin (Alb), and globulin (Glob) content of the blood were estimated according to methods enclosed with the kits obtained from Sigma (St. Louis, MO, USA).

Statistical analysis. Results were statistically analyzed using the Student's t-test for unpaired data, comparing different treatment groups to that of the saline control. Treatment groups containing extract and CCl₄ were compared with the treatment group containing saline and CCl₄.

TABLE 1. Experimental protocol for testing liver protective effect of aqueous extract of *Adansonia digitata*.

Treatment	Dose, route and length of treatment
Saline (control)	1 ml saline orally daily for 5 consecutive days
Extract	1 mg/kg body wt. orally daily for 15 consecutive days
CCl ₄ + saline	0.5 ml CCl ₄ /kg body wt. i.v. + 1 ml saline orally daily for 5 consecutive days
CCl ₄ + extract	0.5 ml CCl ₄ /kg body wt. i.v. daily for 5 consecutive days + 1 mg extract/kg body wt. orally for 15 consecutive days, beginning 3 days after last CCl ₄ treatment
Extract + CCl ₄	1 mg extract/kg body wt. orally for 1 day and then extract + CCl ₄ 0.5 ml/kg body wt. i.v. daily for 5 consecutive days followed by extract for 15 days after last CCl ₄ treatment

RESULTS

The administration of the aqueous extract of the *Adansonia digitata* fruit pulp exhibited hepatoprotective activity, resulting in normalized serum levels of ALT, AST, and ALP if given before CCl₄ (Table 2). The fruit pulp extract also reversed hepatotoxin-induced changes in the serum enzyme concentration. The liver protective ability of *Adansonia digitata* extract was 76, 77, and 87 percent for ALT, AST, and ALP, respectively, if the extract was given after the commencement of CCl₄ toxicity.

DISCUSSION

Any decreases in the level of serum ALT, AST, and ALP activity are indication of hepatic disease (6). Defects in protein metabolism, evidenced by changes in TP and/or Alb level, are used to indicate the severity of the hepatic disease (6). The near normal level of serum enzyme activity and blood total protein and albumin levels observed in this in-

TABLE 2. Effects of aqueous fruit pulp extract of the *Adansonia digitata* on CCl₄ induced hepatotoxicity.

Treatment	Blood parameters ¹						
	ALT	AST	ALP	TP	Alb	Glob	A/G
	----- (IU/liter) -----			----- (g/dl) -----			
Saline control	48.43 ± 1.03	103.1 ± 3.2	137.3 ± 1.1	5.98 ± 0.17	1.88 ± 0.01	4.09 ± 0.18	0.46 ± 0.02
Extract	45.78 ± 1.19	110.4 ± 2.6	135.9 ± 1.5	6.57 ± 0.10	1.99 ± 0.01	4.58 ± 0.10	0.44 ± 0.01
CCl ₄ + saline	85.60 ± 1.01	297.4 ± 1.6	287.4 ± 1.6	4.11 ± 0.02	1.31 ± 0.03	2.80 ± 0.01	0.47 ± 0.01
CCl ₄ + Extract ²	57.90 ± 0.84	149.3 ± 1.2	157.4 ± 0.9	5.67 ± 0.07	1.63 ± 0.02	4.06 ± 0.07	0.40 ± 0.01
Extract + CCl ₄ ³	50.31 ± 1.98	126.6 ± 1.8	149.5 ± 1.8	5.92 ± 0.17	1.80 ± 0.03	4.12 ± 0.18	0.44 ± 0.02

¹ Means ± SEM from five replicates, P < 0.01.

² CCl₄ treatment followed 3 days later with *Adansonia digitata* extract for 15 days.

³ *Adansonia digitata* extract for 24 h before CCl₄ for 5 days and continued for 15 days after ending CCl₄ treatments.

vestigation indicated that a fruit extract of *Adansonia digitata* could protect the liver against CCl₄ if given before chemical toxicity prevailed.

The observed protection and restoration of CCl₄-induced liver damage by the extract, suggests a complex series of mechanisms involved in the hepatoprotective property of *Adansonia digitata* fruit. In Africa, the consumption of *Adansonia digitata* fruit is undoubtedly an important factor in normal human resistance against liver damage due to endemic causes (2). This protection could result from the fruit content of triterpenoids (10), β -sitosterol (11,14), β -amyrin palmitate (11), or/and α -amyrin, and ursolic acid (14). Lin and Tome (8) have previously demonstrated that a mixture of β -sitosterol, β -amyrin palmitate, and α -myrin exhibit protective activities against liver damage induced by CCl₄. Anti-inflammatory, analgesic (10), immunostimulant (3), and antimicrobial (5,7,9) activities of *Adansonia digitata*, collectively or singly, may also play a role in hepatoprotective activity of the fruit pulp.

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