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Research Article

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Evaluation of Hepatoprotective Activity of Ethanolic Extract of *Celastrus paniculatus* Leaves

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Abstract Paracetamol (PCM) is widely used as analgesic and antipyretic drug, but at high dose it leads to undesirable side effects, such as hepatotoxicity. This study gives the information about hepatoprotective activity of *Celastrus paniculatus* leaves extract against paracetamol and ethanol induced hepatotoxicity. PCM induced hepatotoxicity was evaluated by an increase ($P<0.05$) in serum aspartate aminotransferase (AST), alanine transaminase (ALT), alkaline phosphatase (ALP) activity and bilirubin level. PCM hepatotoxicity was manifested by an increase ($P<0.05$) lipid peroxidation, depletion of reduced glutathione (GSH) and catalase activity in liver tissue. Administration of ethanolic as well as aqueous plants extract [300mg/kg body weight of rat] protects the PCM induced lipid peroxidation, restored altered serum marker enzymes and antioxidant level towards normal. The results indicate hepatoprotective activity of all studied plants extract against PCM induced toxicity. Ethanolic extract was found more significant than the aqueous extract

Keywords Ethanol, hepatoprotective, paracetamol, silymerine

Introduction

The liver plays a central role in transforming and clearing chemicals and is susceptible to the toxicity from these agents. Certain medicinal agents, when taken in overdoses and sometimes even when introduced within therapeutic ranges, may injure the organ. Other chemical agents, such as those used in laboratories and industries, natural chemicals (e.g., microcystins) and herbal remedies can also induce hepatotoxicity. Chemicals that cause liver injury are called hepatotoxins. PCM is widely used as antipyretic and analgesic drugs, causes hepatotoxicity if taken in the excess amount of dose. The mechanism of hepatotoxicity is firstly the necrosis of Centilobular hepatocytes followed by lipid per oxidative degradation of glutathione and cell necrosis in liver due to the formation of intermediate oxidative product of paracetamol (N-acetyl-P-benzoquinoneimine) [1-5].

The *Celastrus paniculatus* leaves belong to family Celastraceae. It contains beta-sitosterol, total phenol, flavonoids which are responsible for antioxidant, antimicrobial and free radical scavenging activity.

Material and Methods

Drugs and Chemicals

1. Paracetamol
2. Silymarin

Instruments used- Weighing machine, Grinder, Soxhlet, Analytical balance, and Water bath

Plant Material

Celastrus paniculatus leaves were collected from Rajasthan nursery Jaipur. The plant was identified and authenticated by Dr. Bhima Ram Choudhary (Deputy conservator of Forest, Sikar). A herbarium specimen is deposited in our college museum. Herbarium No. RUBL/22/1203. The leaves were shade dried at room temperature and pulverized. Material was shade dried at room temperature and powdered mechanically and passed through a sieve #40.

Animals

The study was carried out in rats of Wistar strains of either sex weighing 150-200 gm, 2-3 months old. They were procured from animal house of the Biological signature analytical laboratory, Ghaziabad and were kept individually under standard laboratory condition. Food pellets and tap water were provided and libitum. Ethical clearance for experimental studies was obtained from institutional animal Ethical Committee, Accuprac Research lab Ahemdabad under Reg. 1709/Rc/S/13/CPCSEA.

Method

Acute toxicity studies for ethanolic, aqueous and 70% ethanolic extracts of *Celastrus paniculatus* belonging to the family 'Celastraceae' were conducted as per OECD using Albino wistar rats. Each animal was administered ethanolic, aqueous and 70% ethanolic extracts solution of the extract by oral route. The test procedure minimizes the number of animals required to estimate the oral acute toxicity of a chemical and in addition estimation of LD_{50}, confidence intervals. The test also allows the observation of signs of toxicity and can also be used to identify chemicals that are likely to have low toxicity.

Principal of the Fixed Dose Procedure

The fixed dose procedure is method for assessing acute oral toxicity that involve the identification of a dose level that cause evidence of non-lethal toxicity (termed evident toxicity) rather than a dose level that cause lethality. Evident toxicity is a term describing clear signs of toxicity following administration of test substance, such that an increase to the next highest fixed dose would result in the development of severe toxic signs and probably mortality.

Procedure

As suggested, after acclimatization of animals for 4-5 days, study was carried out as follows:
Healthy, young adult Albino wistar rats (150-200gms), nulliporous and non-pregnant were used for this study food, but not water was withheld for 3-4 hours and further 1-2 hours post administration of sample under study.

1. Fixed dose level of 5, 50, 500 mg/kg were initially chosen as dose level that would be expected to allow the identification of dose producing evident toxicity.
2. During the validation procedure, a fixed dose of 2000mg/kg was added to provide more information on substance of low acute toxicity
3. Dosed one animal at the test dose by oral route.
4. Since, this first test animal survived, four other animals were dosed (orally) on subsequent days, so that a total of five animals were tested.

Observation

Animals were observed individually at least every 5 minutes once during first 30 minutes after dosing, periodically at 2 hrs during the first 24 hours (with special attention during the first four hours) and daily thereafter, for a total of 14 days.

Experimental Protocol

Evaluation of hepato-protective activity in Paracetamol induced hepatotoxicity

Group-I: Animals (-ve Control) were administered normal saline 1ml/kg p.o, for 7 days.
Group-II: Animals (+ve Control) were administered normal saline 1ml/kg p.o, for 7 days.
Group-III: Animals were administered with silymarin 100mg/kg p.o., for 7 days.
Group-IV: Animals were administered with 70% ethanolic extract of CP 200mg/kg p.o, for 7 days.
Group-V: Animals were administered with 70% ethanolic extract of CP 400mg/kg p.o., for 7 days

To study hepato-protective activities

Group-I: Animals (-ve Control) were administered normal saline 1ml/kg p.o, for 5 days.
Group-II: Animals (+ve Control) were administered normal saline 1ml/kg p.o, for 5 days.
Group-III: Animals were administered with silymarin 100mg/kg p.o., for 5 days.
Group-IV: Animals were administered with 70% ethanolic extract of CP 200mg/kg p.o, for 5 days.
Group-V: Animals were administered with 70% ethanolic extract of CP 400mg/kg p.o., for 5 days

Biochemical Assays

Serum marker enzymes of liver function: Serum was separated by cooling centrifugation at 3000 rpm at 4°C for 10min and used for measurement of various biochemical markers such as Serum glutamic oxaloacetic transaminase, Serum glutamic pyruvic transaminase, (AST and ALT) activities, ALP activity, and total bilirubin using commercially available kits.

Statistical Analysis

The values were expressed as mean ± SD. Statistical analysis and comparison between the groups was performed by one way analysis of variance (ANOVA).

Difference between unexposed and exposed (with or without treatment) with a *p*-value < 0.05 was considered significant.

Result

Table 1: Pharmacognostical Screening of Powder

S. no.	Component	Result
1.	Moisture content	11.14%
2.	Ash value	15%

Table 2: Pharmacognostical screening of extract

S. No.	Types of phyto - chemical constituents	Petroleum ether extract	Chloroform extract	Ethanolic extract	Aqueous extract	70% ethanolic extract
1.	Carbohydrates	_	++	++	++	+++
2.	Proteins	_	_	_	++	_
3.	Flavonoids	_	_	++	+	+++
4.	Steroids	_	_	_	_	+
5.	Tannins and phenolic compounds	++	+	++	++	+++

6.	Saponins glycosides	_	_	++	++	+++
7.	Cardiac glycosides	_	+	_	++	_

Table 3: Preliminary phytochemical screening

S. No.	Types of phyto - chemical constituents	Petroleum ether extract	Chloroform extract	Ethanolic extract	Aqueous extract	70% ethanolic extract
1.	Carbohydrates	_	++	++	++	+++
2.	Proteins	_	_	_	++	_
3.	Flavonoids	_	_	++	+	+++
4.	Steroids	_	_	_	_	+
5.	Tannins and phenolic compounds	++	+	++	++	+++
6.	Saponins glycosides	_	_	++	++	+++
7.	Cardiac glycosides	_	+	_	++	_
8.	Starch	_	_	_	++	_
9.	Alkaloids	-	-	++	+	++

Acute toxicity (LD_{50}) studies

Acute toxicity studies for aqueous, ethanolic and 70% ethanolic extracts of *Celastrus paniculatus* belonging to the family Celastraceae were conducted as per OECD guidelines 420 using Wistar rats. Each animal was administered aqueous, ethanolic and 70% ethanolic extracts by oral route. The animals were observed for any changes continuously for the first 2 hr and up to 24 hr for mortality. There were no mortality and noticeable behavioral changes in all the groups tested. The extracts were found to be safe up to 2000 mg/kg body weight.

An attempt was made to identify LD_{50} of aqueous, ethanolic and 70 % ethanolic extracts of *Celastrus paniculatus* leaves. Since no mortality was observed at 2000 mg/kg. It was thought that 2000 mg/kg was the cut off dose. Therefore $1/10^{th}$ and $1/20^{th}$ dose (*i.e.* 200 mg/kg and 400 mg/kg) were selected for all further in *vivo* studies.

Hepatoprotective activity

Effect of 70% ethanolic extract of *Celastrus paniculatus* leaves on biochemical markers in CCl_4 induced hepatotoxicity

Results

These is an increase in SGPT levels observed in CCl_4 treated group (322.19 IU/L). The extract has shown a dose dependent effect. SGPT levels were restored to 88.23 IU/L by 400 mg/kg of 70% ethanolic extract of the leaves, which is near to effect of 100 mg/kg silymarin *i.e.* 77.28 IU/L. SGOT levels was increased significantly in CCl_4 treated group i.e. 223.11 IU/L, 400 mg/kg of 70% ethanolic extract of the leaves reduced the elevated levels of SGOT to 109.43 IU/L, which is near to silymarin effect of 98.63 IU/L. In case of total and direct bilirubin, a dose dependent effect of the extract was observed. 400 mg/kg of 70% ethanolic extract reduced the elevated levels of total and direct bilirubin levels by CCl_4 from 4.32 mg/dl and 1.46 mg/dl to 1.45 mg/dl and 0.48 mg/dl respectively. The results of 400 mg/kg 70% ethanolic extract were found to be comparable with the results of 100 mg/kg silymarin on the same marker enzymes. There was no significant rise of total cholesterol and HDL took place in

CCl_4 treated group. Dose dependent effect was observed with the 70% ethanolic extract and result of 400 mg/kg of 70% ethanolic extract is comparable with 100 mg/kg silymarin.

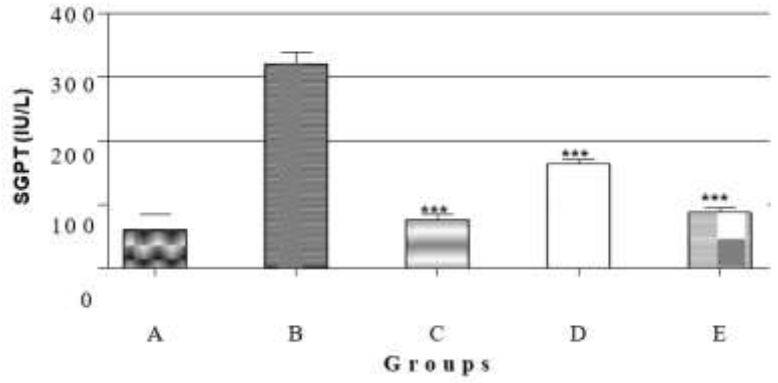
There was an increase in ALP levels observed in CCl_4 treated group (218.32 IU/L). The extract has shown a dose dependent effect. ALP levels were restored to 122.00 IU/L by 400 mg/kg 70% of ethanolic extract of the leaves which is near to effect of 100 mg/kg silymarin *i.e.* 121.00 IU/L.

Table 4: Effects of 70% ethanolic extract of *Celastrus paniculatus* leaves on hepatic enzymes in CCl_4 induced hepatotoxicity

Treatment	Biochemical parameters mean ± SEM						
	SGPT U/L	SGOT U/L	Total Bilirubin mg/dl	Direct Bilirubin mg/dl	Total Cholesterol mg/dl	HDL mg/dl	ALP IU/L
Negative control (1ml dist. Water p.o. + 1ml/ kg liquid paraffin s.c.)	62.21 ±3.74	74.30 ±4.16	0.96 ± 0.04	0.22 ± 0.01	111.24 ±3.53	7.74 ±0.79	122.14 ±7.02
CCl_4 treated (positive control) (2ml/kg s.c. CCl_4)	322.19 ±7.64	223.11 ±6.38	4.32 ± 0.23	1.46 ± 0.13	167.37 ±8.87	4.81 ±0.29***	218.32 ±14.4
CCl_4 + Silymarin (2ml/kg s.c. + 100mg/kg, p.o.)	77.28 ±7.28***	98.63 ±11.53***	1.34 ±0.09***	0.37 ±0.02***	115.56 ±4.54***	6.88 ±0.17***	121 ±5.28***
CCl_4 + 70% ethanolic extract (2ml/kg s.c. + 200 mg/kg, p.o)	165.14 ±6.67***	154.82 ±9.32***	2. 70 ±0.22***	0.80 ±0.02***	138.67 ±7.13*	5.42 ±0.21	162 ±12.1**
CCl_4 + 70% ethanolic extract (2ml/kg s.c. + 400 mg/kg, p.o)	88.23 ±6.83***	109.43 ±7.60***	1.45 ±0.14***	0.48 ±0.03***	116.15 ±8.30***	6.50 ±0.19***	122 ±9.11***

Values are the mean ± S.E.M. of six rats/treatment.

***P<0.05, **P<0.01 and *** P<0.001 Significance compared to CCl_4 treatment**



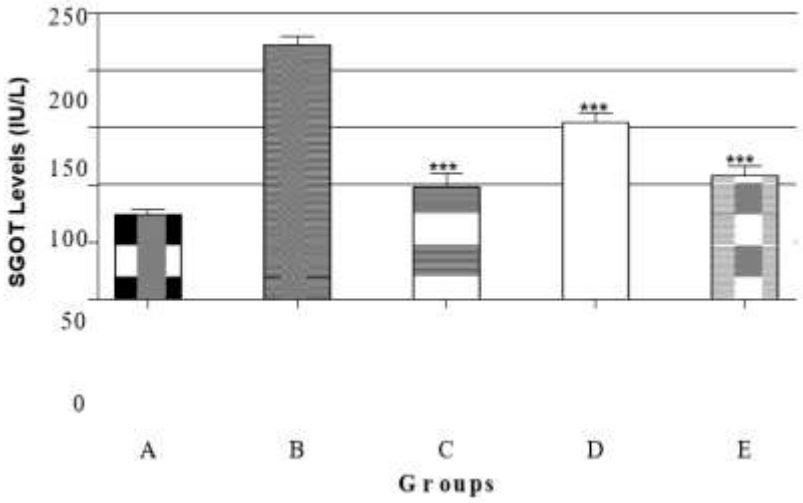
A: Normal Control (1 ml vehicle)

B: CCl_4 (2 ml/kg s.c.)

C: CCl_4 + Silymarin (2 ml/kg s.c. + 100 mg/kg p.o)

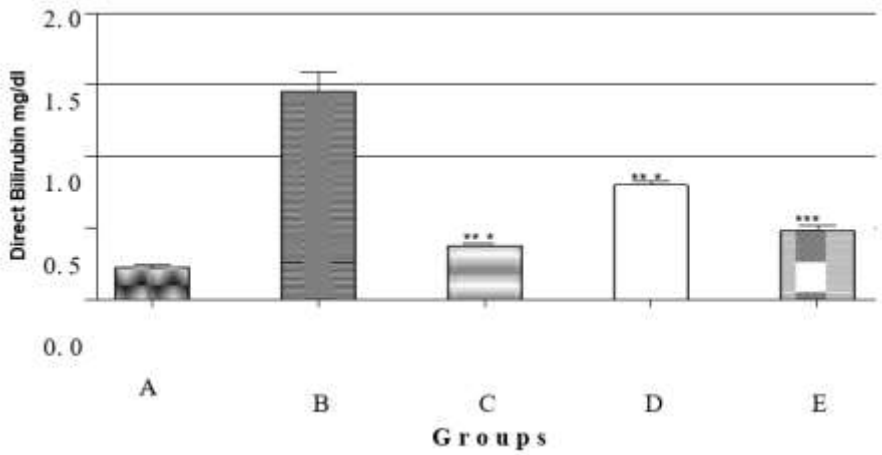
D: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 200 mg/kg p.o) E: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 400 mg/kg p.o)

Figure 1: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in CCl_4 induced hepatotoxicity



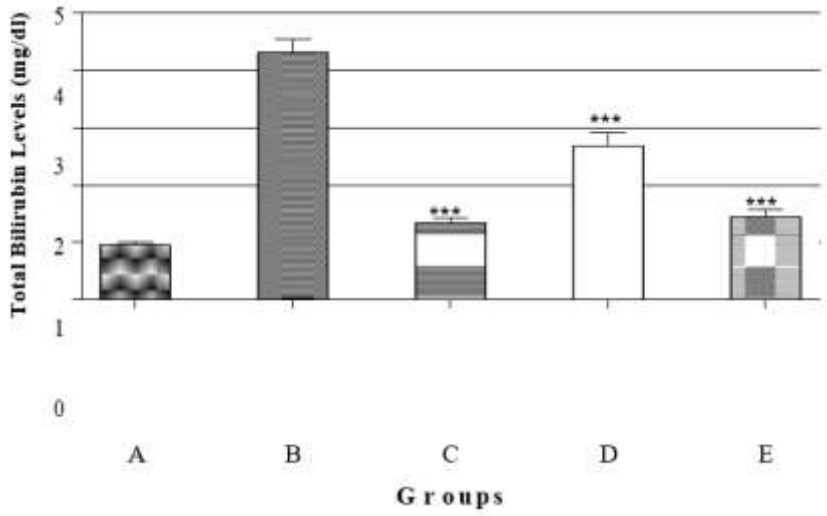
A: Normal Control (1 ml vehicle)
B: CCl_4 (2 ml/kg s.c.)
C: CCl_4 + Silymarin (2 ml/kg s.c. + 100 mg/kg p.o)
D: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 200 mg/kg p.o)
E: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 400 mg/kg p.o)

Figure 2: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in CCl_4 induced hepatotoxicity



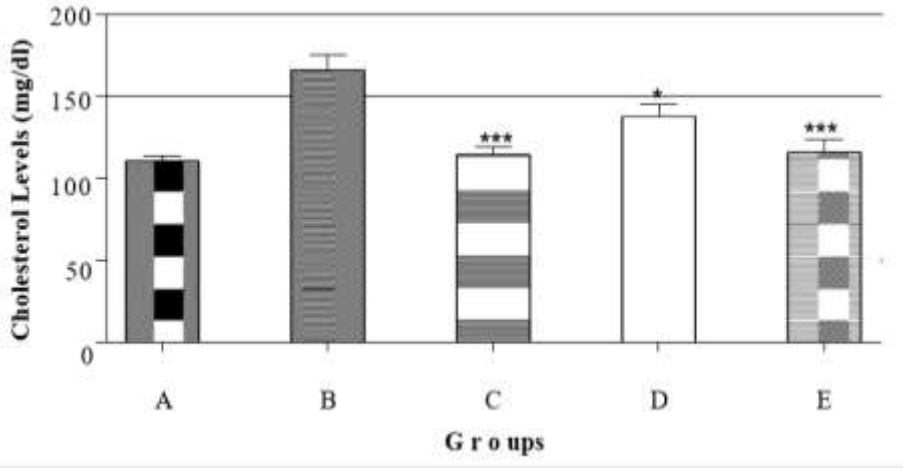
A: Normal Control (1 ml vehicle)
B: CCl_4 (2 ml/kg s.c.)
C: CCl_4 + Silymarin (2 ml/kg s.c. + 100 mg/kg p.o)
D: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 200 mg/kg p.o)
E: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 400 mg/kg p.o)

Figure 3: Effects of 70% ethanolic extract of Celestrus Paniculatus on hepatic enzymes in CCl_4 induced hepatotoxicity



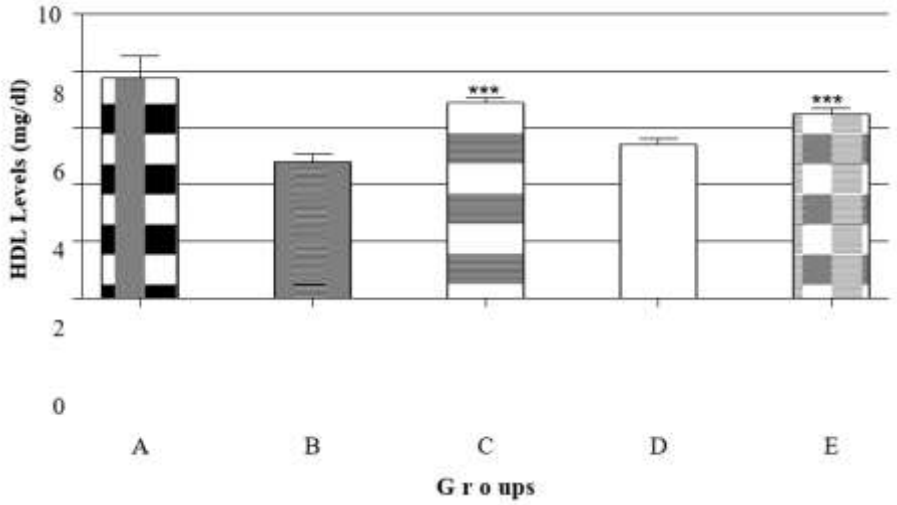
A: Normal Control (1 ml vehicle) B: CCl_4 (2 ml/kg s.c.)
C: CCl_4 + Silymarin (2 ml/kg s.c. + 100 mg/kg p.o)
D: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 200 mg/kg p.o) E: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 400 mg/kg p.o)

Figure 4: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in CCl_4 induced hepatotoxicity



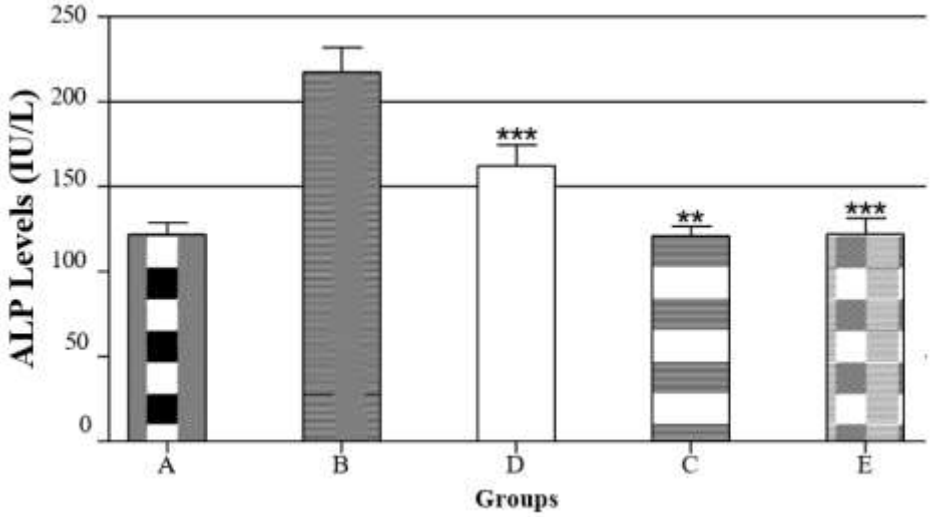
A: Normal Control (1 ml vehicle)
B: CCl_4 (2 ml/kg s.c.)
C: CCl_4 + Silymarin (2 ml/kg s.c. + 100 mg/kg p.o)
D: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 200 mg/kg p.o)
E: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 400 mg/kg p.o)

Figure 5: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in CCl_4 induced hepatotoxicity



A: Normal Control (1 ml vehicle)
B: CCl_4 (2 ml/kg s.c.)
C: CCl_4 + Silymarin (2 ml/kg s.c. + 100 mg/kg p.o)
D: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 200 mg/kg p.o)
E: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 400 mg/kg p.o)

Figure 6: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in CCl_4 induced hepatotoxicity



A: Normal Control (1 ml vehicle)
B: CCl_4 (2 ml/kg s.c.)
C: CCl_4 + Silymarin (2 ml/kg s.c. + 100 mg/kg p.o)
D: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 200 mg/kg p.o)
E: CCl_4 + 70% Ethanolic extract (2 ml/kg s.c. + 400 mg/kg p.o)

Figure 7: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in CCl_4 induced hepatotoxicity

Effects of 70% ethanolic extract of *Celestrus Paniculatus* leaves on biochemical markers in Paracetamol induced hepatotoxicity

Results

There was an increase in SGPT levels observed in paracetamol treated group (209.77U/L). The extract had shown a dose dependent effect. SGPT levels were restored to 83.00 U/L by 400 mg/kg of 70% ethanolic extract of the leaves, which is near to effect of 100mg/kg silymarin *i.e.* 79.35 U/L. SGOT levels has been increased significantly in paracetamol treated group i.e. 261.2 U/L 400 mg/kg of ethanolic extract of the leaves reduced the elevated levels of SGOT to 118.1 U/L, which is near to silymarin effect of 110.4 U/L.

In case of total and direct bilirubin, a dose dependent effect of the extract was observed. 400 mg/kg 70% ethanolic extract had reduced the elevated levels of total and direct bilirubin levels by paracetamol from 4.17 mg/dl and 0.71 mg/dl to 1.36 mg/dl and 0.36 mg/dl respectively. The results of 400 mg/kg of 70% ethanolic extract were found to be comparable with the results of 100 mg/kg silymarin on the same marker enzymes.

There was no significant rise of total cholesterol and HDL took place in paracetamol treated group. Dose dependent effect was observed with the 70% ethanolic extract and results of 400 mg/kg 70% ethanolic extract is comparable with 100 mg/kg silymarin.

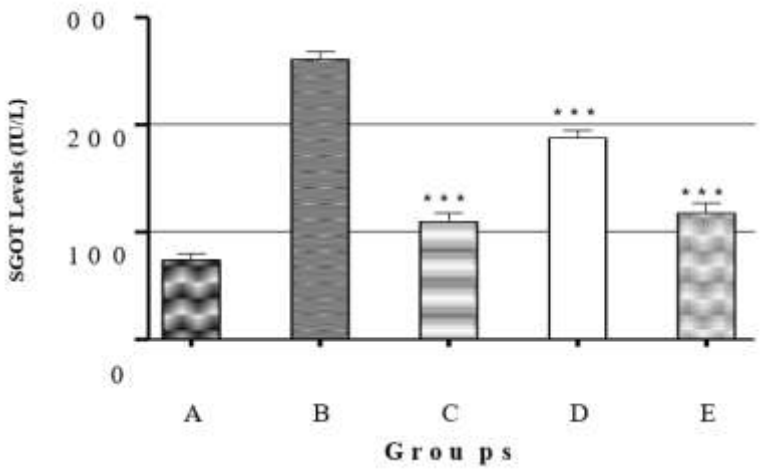
There was an increase in ALP levels observed in paracetamol treated group (365.22 U/L). The extract has shown a dose dependent effect. ALP levels were restored to 155.24 U/L by 400 mg/kg 70% ethanolic extract of the leaves which is near to effect of 100 mg/kg silymarin *i.e.* 170.10 U/L.

Table 5: Effect of 70% Ethanolic extract of *Celastrus paniculatus* leaves on hepatic enzymes in paracetamol induced hepatotoxicity

Treatment	Biochemical parameters mean ± SEM					
	SGPT IU/L	SGOT IU/L	Total Bilirubin mg/dl	Direct Bilirubin mg/dl	Total Cholesterol mg/dl	HDL mg/dl
Negative control (1ml dist. Water p.o. + 1ml/ kg liquid paraffin s.c.)	65.7 ±7.16	74.0 ±5.79	0.96 ± 0.40	0.278 ±0.037	121.60 ±3.24	8.36±0.523
Paracetamol (positive control) (1ml dist. Water p.o. + 2ml/ kg liquid paraffin s.c.)	209.7 ±6.55	261.2±6.85	4.17 ± 0.18	0.710 ±0.045	214.84 ±7.62	4.31±0.418
Paracetamol + Silymarin (2gm/kg s.c. + 100mg/kg, p.o.)	79.8 ±7.18***	110.4 ±8.31***	1.15 ±0.10***	0.328 ±0.020***	116. 58 ±2.93***	7.17±0.470***
Paracetamol + 70% ethanolic extract (2gm/kg s.c. + 200 mg/kg, p.o)	151.3 ±7.49***	188.2 ±7.04***	2.57 ±0.10***	0.516 ±0.039**	171.21 ±1.81***	5.22±0.345
Paracetamol + 70% ethanolic extract (2gm/kg s.c. + 400 mg/kg, p.o)	83.6 ±7.73***	118.1 ±8.31***	1.36 ±0.12***	0.366 ±0.033***	126.81 ±2.73***	6.85±0.614**

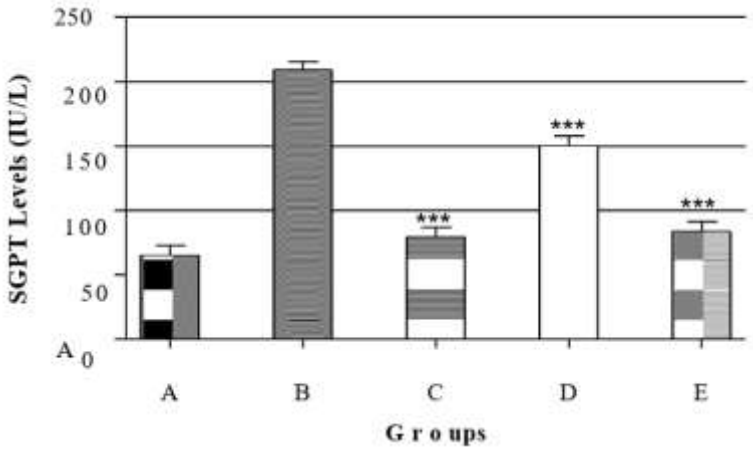
Values are the mean ± S.E.M. of six rats/treatment.

*P> 0.05, ** P> 0.01 and *** P> 0.001 Significance compared to paracetamol treatment.



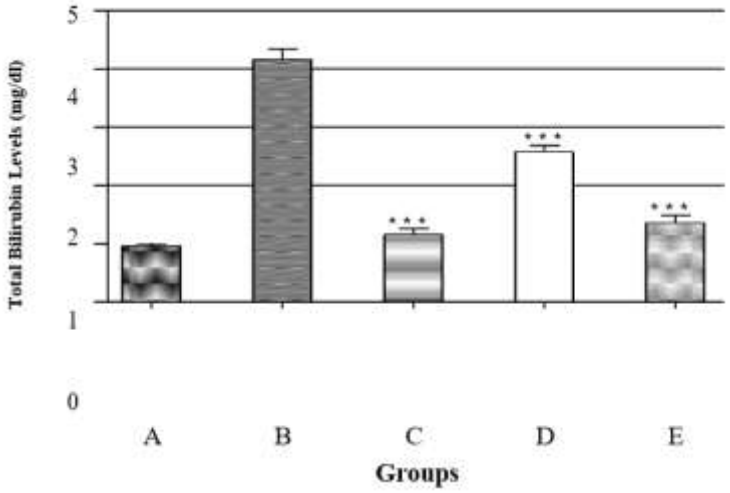
A: Normal Control (1 ml vehicle)
B: Paracetamol (2 gm/kg p.o.)
C: Paracetamol + Silymarin (2 gm/kg p.o. + 100 mg/kg p.o)
D: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 200 mg/kg p.o)
E: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 400 mg/kg p.o)

Figure 8: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in paracetamol induced hepatotoxicity



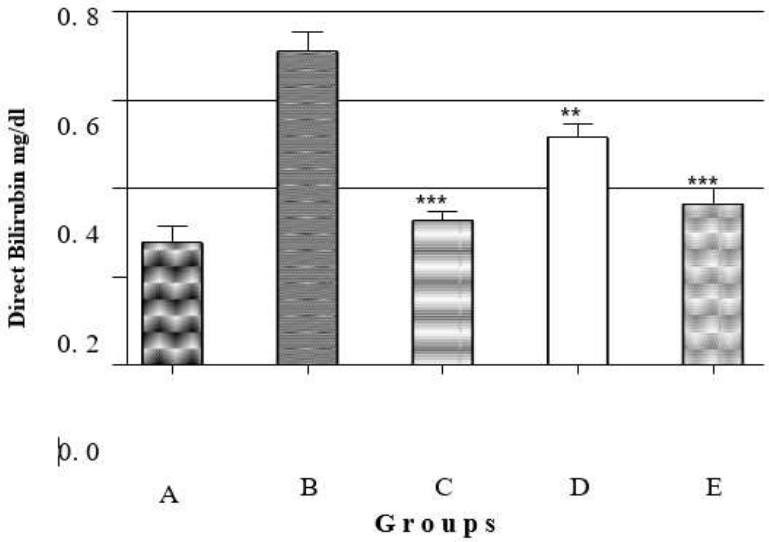
A: Normal Control (1 ml vehicle)
B: Paracetamol (2 gm/kg p.o.)
C: Paracetamol + Silymarin (2 gm/kg p.o. + 100 mg/kg p.o)
D: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 200 mg/kg p.o)
E: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 400 mg/kg p.o)

Figure 9: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in paracetamol induced hepatotoxicity



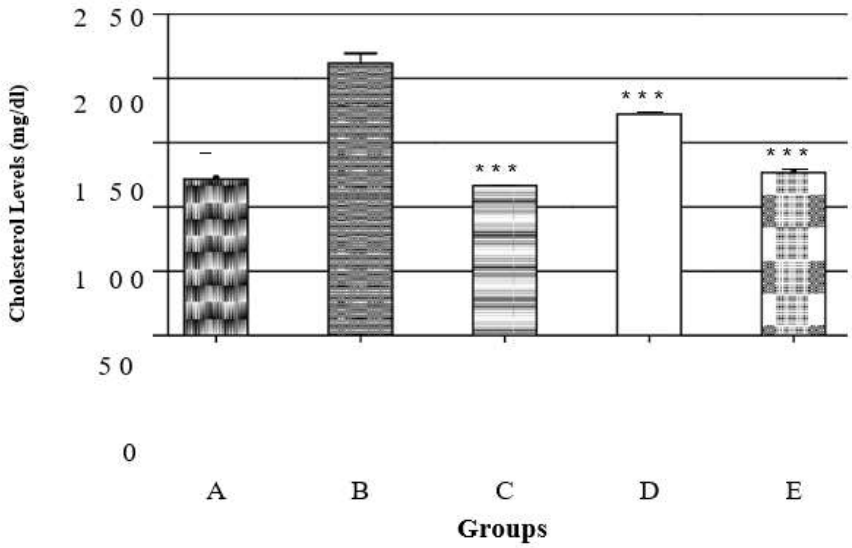
A: Normal Control (1 ml vehicle)
B: Paracetamol (2 gm/kg p.o.)
C: Paracetamol + Silymarin (2 gm/kg p.o. + 100 mg/kg p.o)
D: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 200 mg/kg p.o)
E: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 400 mg/kg p.o)

Figure 10: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in paracetamol induced hepatotoxicity



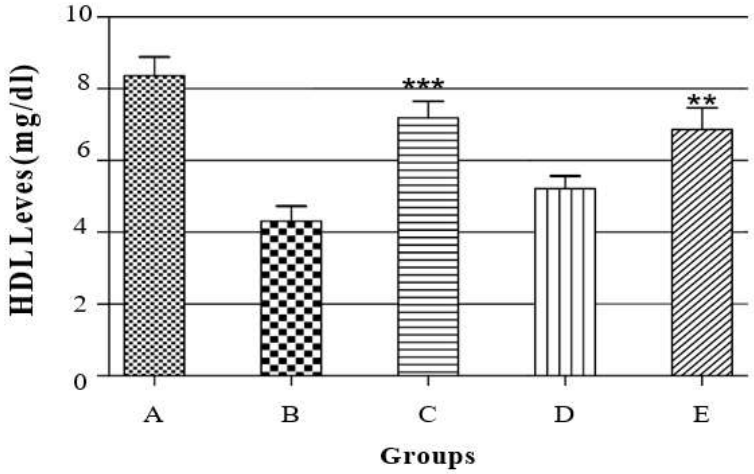
A: Normal Control (1 ml vehicle)
B: Paracetamol (2 gm/kg p.o.)
C: Paracetamol + Silymarin (2 gm/kg p.o. + 100 mg/kg p.o)
D: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 200 mg/kg p.o)
E: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 400 mg/kg p.o)

Figure 11: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in paracetamol induced hepatotoxicity



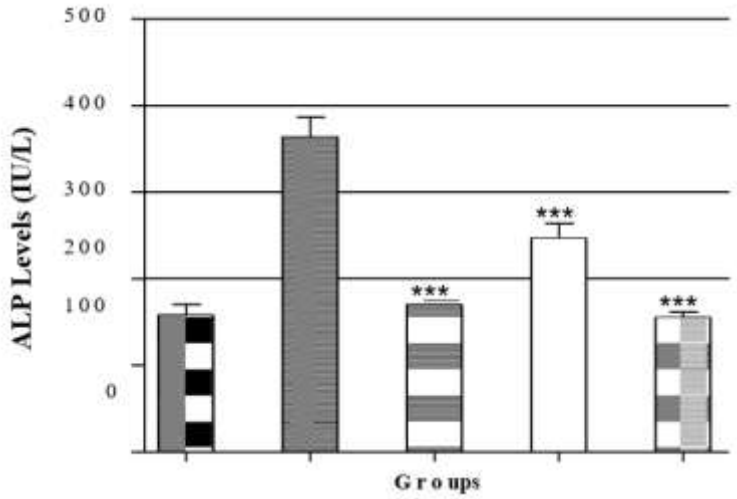
A: Normal Control (1 ml vehicle)
B: Paracetamol (2 gm/kg p.o.)
C: Paracetamol + Silymarin (2 gm/kg p.o. + 100 mg/kg p.o)
D: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 200 mg/kg p.o)
E: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 400 mg/kg p.o)

Figure 12: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in paracetamol induced hepatotoxicity



A: Normal Control (1 ml vehicle)
B: Paracetamol (2 gm/kg p.o.)
C: Paracetamol + Silymarin (2 gm/kg p.o. + 100 mg/kg p.o)
D: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 200 mg/kg p.o)
E: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 400 mg/kg p.o)

Figure 13: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in paracetamol induced hepatotoxicity



A: Normal Control (1 ml vehicle)
B: Paracetamol (2 gm/kg p.o.)
C: Paracetamol + Silymarin (2 gm/kg p.o. + 100 mg/kg p.o)
D: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 200 mg/kg p.o)
E: Paracetamol + 70% Ethanolic extract (2 gm/kg p.o. + 400 mg/kg p.o)

Figure 14: Effects of 70% ethanolic extract of Celastrus paniculatus on hepatic enzymes in paracetamol induced hepatotoxicity

Histopathological Studies in CCl_4 induced hepatotoxicity

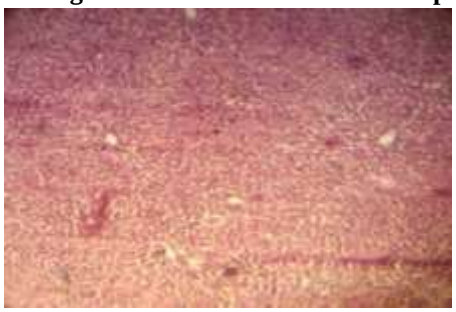


Figure 15: Architecture Normal Liver

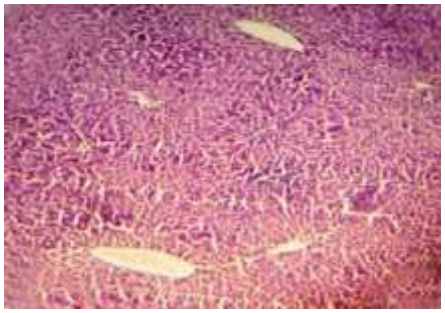


Figure 16: CCl_4 Treated Liver

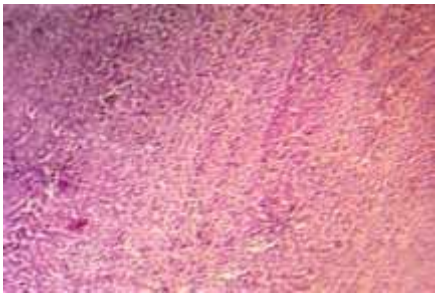


Figure 17: Liver architecture of CCl_4 + 100 mg/kg of Silymarin treatment

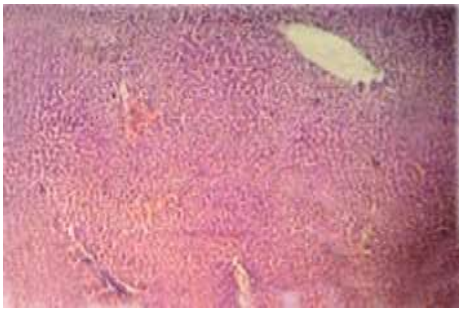


Figure 18: Liver architecture of CCl_4 +200 mg/kg 70% ethanolic extract of Celestrus Paniculatus leaves treatment

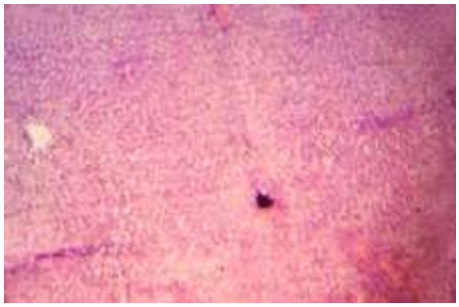


Figure 19: Liver architecture of CCl_4 +400 mg/kg of 70% ethanolic extract of Celastrus paniculatus leaves treatment

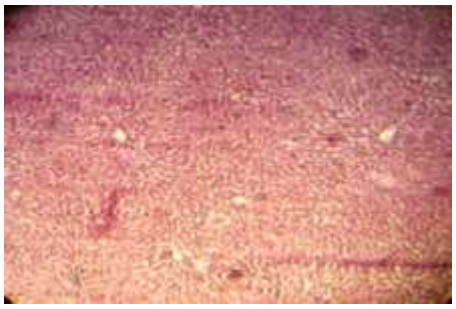


Figure 20: Architecture Normal Liver

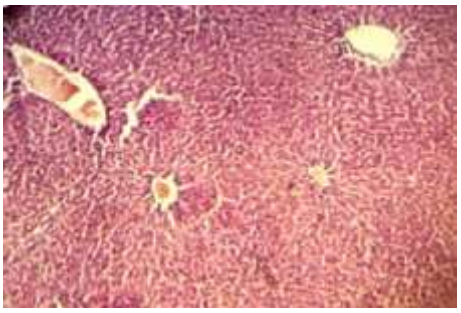


Figure 21: Paracetamol Treated Liver

Figure 22: Liver architecture of CCl_4 + 100 mg/kg of Silymarin treatment

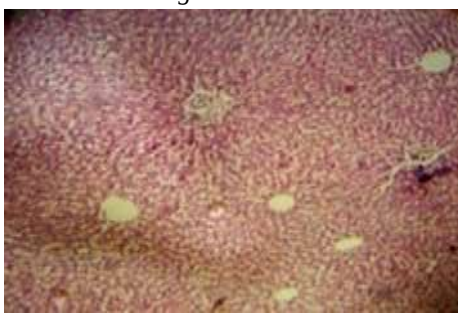


Figure 23: Liver architecture of PCM +200 mg/kg 70% ethanolic extract of Celestrus paniculatus leaves treatment

Figure 24: Liver architecture of PCM +400 mg/kg of 70% ethanolic extract of Celestrus paniculatus leaves treatment

Summary

The leaves of *Celastrus paniculatus* was subjected to preliminary phytochemical investigations and found that leaves possess carbohydrates, flavonoids, protein, saponins, tannins and cardiac glycosides. The acute toxicity studies for ethanolic, aqueous and 70% ethanolic extracts were conducted as per OECD guidelines 420. Acute toxicity studies have revealed that the ethanolic, aqueous and 70% ethanolic extracts of this plant were safe upto 2000 mg/kg. The extracts prepared by using polar solvents have demonstrated the dose dependent *in-vitro* and *in-vivo* antioxidant activity. 70% ethanolic and aqueous extracts were found to possess reducing power, superoxide anion scavenging, hydroxyl radical, DPPH radical scavenging activity. Evaluation of *in-vivo* antioxidant and hepatoprotective activities of 70% ethanolic extracts of *Celastrus paniculatus*, leaves were carried out at two doses 200 and 400mg/kg body weight.70% ethanolic extract increased the GSH and decreased lipid peroxidation levels in both CCl_4 and paracetamol models. Treatment with 70% ethanolic extract of this leaves has protected the liver from both CCl_4 and paracetamol challenge. This was demonstrated by reducing the elevated levels of biomarkers like SGPT, SGOT, ALP, Bilrubin, Cholesterol and increasing the decreased levels of HDL in both the models. In addition, histopathological observations have shown that there is an improvement in the architecture of the liver due to the treatment with 70% ethanolic extract in both models.

Conclusion

The leaves of *Celastrus paniculatus* contain saponins, tannins, flavonoids, carbohydrates, cardiac glycosides and proteins The study was taken up to evaluate 70% ethanolic and aqueous extracts of leaves of *Celastrus paniculatus* for antioxidant and hepatoprotective activities.The acute toxicity study conducted for ethanolic, aqueous and 70% ethanolic extracts indicates that there are safe up to 2000mg/kg body weight. Aqueous and 70% ethanolic extracts of leaves of *Celastrus paniculatus* has demonstrated dose dependent reducing power, superoxide anion scavenging, hydroxyl radical scavenging, and DPPH radical scavenging activities.70% of ethanolic extract of the leaves of *Celastrus paniculatus* has demonstrated dose dependent increase in the depletion tissues GSH and decrease lipid peroxidation levels by both CCl_4 and paracetamol. Treatment with 70% ethanolic extract has brought back the elevated levels of SGPT, SGOT, ALP, Total and Direct Bilrubin, Cholesterol in both CCl_4 and paracetamol induced hepatotoxicity in rats. Similarly reduced HDL levels were increased Histopathological observation revealed that treatment with 70% ethanolic extract has reversed the hepatic damage by both CCl_4 and paracetamol. The 70% ethanolic extract of leaves of *Celastrus paniculatus* possess hepatoprotective activity and this may be due to the presence of flavonoids and antioxidant principles. These results are indicating that antioxidant principles are having a role in these leaves

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