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Acute Toxicity and *In Vivo* Hepatoprotective And Nephroprotective Inethanol Extract Of*gmelina Arborea* and *Grewia Umbellifera*

Sakthivel .S*, Sheik Abdulla.S**
**Research Scholar, Manonmaniam Sundaranar University, Tirunelveli, Tamil Nadu, India.*
***Department of Chemistry & Biosciences, Sastra University, Kumbakonam, Tamil Nadu, India.*
Corresponding Author: Sakthivel .S

Abstract: *The present study was carried out the effect of Gmelina arborea and Grreia umbellifera in nephroprotective and hepatoprotective of the selected plant. The plant has analyzed the primary phytochemical and Gas chromatography and mass spectroscopic to find the active components, then the plant where selected the further investigation. The selected plant have protective effect has proved the analyzed liver enzymes and kidney markers in that result are demonstrated in this paper detailed.The results of the present investigation infer that these plants (GA and GU) extractspossess potent antioxidant, Hepatoprotective and nephroprotective property, the former being probably responsiblethan the later. Thus, the extracts can be beneficial in treating liver and renal damages caused due to chemical exposure.*

Keywords*: Gmelina arborea, Grewia umbellifera, ALT,β-D Glucorinidase, β-D galactoridase, ALT, GGT.*

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I. Introduction

Plants have some medicinal properties or pharmacological effect in human body that plant are denoted as medicinal plant. Plants are used for in the form of direct or extract form because it possess the natural medicinal properties[1]. Medicinal plant are naturally synthesis the secondary metabolites like Alkaloids, Flavonoids, Tannin, Terpenoids, Glycosides, Volatile oil, etc[2]. Herbal plants produce and contain a variety of chemical substances with varied physiological effects. They are huge reservoir of various chemical substances with potential therapeutic properties[1]. Herbal plants are being increasingly utilized to treat a wide variety of clinical diseases [2]. Herbs have been used by all cultures throughout history and thus, herbal medicine is the oldest form of health care known to mankind. It was an integral part of the development of modern civilization. Many drugs commonly used today are of herbal origin. Higher plants as source of medicinal compound continue to play a dominant role in maintenance of human health since antiquities [3]. Herbal medicine is gaining popularity once again and there is an increased interest in green medicine simply because it is considered as safe. Traditionally also plants and plant extracts were used to cure many diseases and disorders. However, before usage it is of utmost important to ensure its safety. The extract may be therapeutically very efficient but if its toxicity assessment is not worked out, it will not be accepted[4]. Hence, toxicity assessment of plants with proven therapeutic use is of utmost important. Toxicity reports are needed to foretell the safety associated before the use of medical products.

Innovation of the healing powers in plants is an ancient idea. Substances or compounds derived from plants have recently become of great attention owing to their resourceful applications [5]. From time immemorial medicinal plants have been used for centuries as remedies for human diseases and offer a new source of biologically active chemical compound as antimicrobial agent. Medicinal plants are the richest bio-resources of drugs of traditional medicinal systems, modern medicines, nutraceuticals, food supplements, folk medicines, pharmaceuticals, intermediate and chemical entitled for synthetic drugs (Hammer et al., 1999). It has been estimated that 14-28% of higher plant species are used medicinally and that 74% of pharmacologically active plant derived components were discovered after following up on ethno medicinal use of the plants[6].

The primary benefit of using plant derived-medicine is that they are relatively safer than synthetic alternatives, offering profound therapeutic benefits and affordable treatment [4]. However, it must be noted that not all medicinal plants are safe for consumption in the crude form.

II. Plant Description

A.Description of *Gmelina arborea*

Plant available in Assam, West Bengal, Southern Bihar, Odisha and southern India.In this plant fast growing tree in different environmental location, mostly found in the rain or moist forest, it grow moderate to large up to 30 mille meters, outer bark has been yellow colour and white inside.*Gmelina arborea* wood is pale yellow to cream-coloured or pinkish-buff when fresh, turning yellowish brown on exposure and is soft to moderately hard, light to moderately heavy, lustrous when fresh, usually straight to irregular or rarely wavy grained and medium course textured. Flowering takes place during February to April when the tree is more or less leafless whereas fruiting starts from May onwards up to June. The fruit is up to 2.5 cm long, smooth, dark green, turning yellow when ripe and has a fruity smell.This tree is commonly planted as a garden and an avenue tree; growing in villages along agricultural land and on village community lands and wastelands. It is light demander, tolerant of excessive drought, but moderately frost hardy. It has good capacity to recover from frost injury. Gamhar trees coppices very well with vigorous growth. Saplings and young plants need protection from deer and cattle.

B. Description of plant

Fig 1 *Grewia umbellifera*

Fig 2 *Gmelina arborea*

Table 1 Taxonomy of *Grewia umbellifera*

Kingdom	Planate
Damain	Eukaryotic
Division	Vascular plants
Class	Dicotyledonous flowering plant
Order	Malvales
Family	MAlvaceae
Genus	Grewia
Species	**Grewia umbellifera**
commonly known as	Ghat crossberry
Kannada:	Bilisuri
Malayalam:	Bhasmavalli, kokkivalli

Table 2 Taxonomy of *Gmelina arborea*

Kingdom	Planate
(Unranked)	Angiosperms
(Unranked)	Eudicots
(Unranked)	Asterids
Family	Lamiaceae
Genus	Gmelina
Species	Grewia umbellifera
Tamil Name	Kumutai, Kumpal,
Hindi	Bhadraparni
Malayalam	Kumizh

III. Material And Methods

A. COLLECTION AND IDENTIFICATION OF PLANTS

The bark of GA and GU were collected from south India, Kanyakumari district during the month of January and Febuary. The plant was identified by S. Balasubramanium, ABS Botanical Garden – Salem.

B. PREPARATION OF EXTRACTS

The freshly collected barks were dried in shade, then coarsely powdered. For extraction of crude phytochemical, 25 g of powdered bark material was kept in closed conical flask with 20 mL various solvents like petroleum ether, benzene, chloroform, ethanol, acetone, ethyl acetate and distilled water in a shaker at room temperature for 24 h. After incubation, the extracts were filtered and the extracts were collected and stored in the refrigerator at 4° C for further studies. All the extracts were subjected to preliminary phytochemical screening as per the guidelines.

IV. Plant Sample Extraction For GC - MS Analysis

10 gm of powder of barks of *Gmelina arborea* and *Grewia umbelliferea* was soaked in 20ml of Absolute alcohol overnight and then filtered through a Whatman ® No. 41 filter paper (pore size 20-25 m) along with 2 gm of sodium sulphate to remove the sediments and traces of water in the filtrate. Before filtering, the filter paper along with sodium sulphate was wetted with absolute alcohol. The filtrate is then concentrated by bubbling nitrogen gas into the solution and was concentrated to 1 ml. The extract contains both polar and non-polar phytocomponents.

V. Gc-Ms Analysis

GC/MS analysis of this extract was carried out using a Perkin Elmer GC Claurus 500 system and Gas Chromatograph interfaced to a Mass Spectrometer (GC/MS) equipped with an Elite-1 fused silica capillary column (30 m × 0.25 mm ID ×1 Mdf composed of 100% Dimethyl poly siloxane). For GC/MS analysis, an electron ionization system with ionization energy of 70 eV was used. Helium gas (99.999%) was used as the carrier gas at a constant flow rate of 1 ml/min and an injection volume of 2 l was employed (split ratio of 10:1). Injector temperature 250°C, Ion-source temperature 280°C. The oven temperature was programmed from 110°C (isothermal for 2 min.), with an increase of 10°C/min, to 200°C, then 5°C/min to 280°C, ending with a 9 min isothermal at 280°C. Mass spectra were taken at 70 eV; a scan interval of 0.5 seconds and fragments from 45 to 450 Da. Total GC running time was 36 minutes. The relative percentage amount of each constituent was calculated by comparing its average peak area to the total areas. Software adopted to handle mass spectra and chromatograms was a TurboMass Ver5.2.0.

VI. Experimental Design

The rats were divided into following six groups of three rats each. Group I Albino rats pretreated with 100 mgof *Gmelina arborea* bark extracts per kg of body weight, Group II Albino rats pretreated with 200 mgof *Gmelina arborea* bark extracts per kg of body weight, Group III Albino rats pretreated with 300 mgof *Gmelina arborea* bark extracts per kg of body weight, Group IV Albino rats pretreated with 100 mgof *Grewia umbellifera* bark extracts per kg of body weight,Group V Albino rats pretreated with 200 mgof *Grewia umbellifera* bark extracts per kg of body weight, Group VI Albino rats pretreated with 300 mgof *Grewia umbellifera* bark extracts per kg of body weight.

VII. Acute Toxicity Studies

Healthy male rats, weighing 180-220g, were randomly divided into six groups of five animals each. They were deprived of pellet diet, but not water *ad libitum*, 15 hours prior to the administration of the test suspension. The control group received water containing 15% dimethylsulfoxide (DMSO) (vehicle) administered intraperitonially. The ethanol extract of *Gmelina arborea* and *Grewia umbellifera*barks suspended in 15% DMSO was administered orally at doses of 100, 200 and 300 mg/kg of body weight. The rats were observed for morbidity and mortality once a day, for 14 days, with pellet diet and water *ad libitum*, and their body weights were recorded. The number of survivors after the 14-day period was noted. The animals were then sacrificed and submitted to microscopic analysis.

VIII. *In Vivo* Hepatoprotective And Nephroprotective

The animals were divided into 5 groups of three rats each. Group I animals served as normal control and received distilled water for seven days. Group II animals orally received paracetamol (30 mg/kg body weight) for seven days. Group III animals received 30 mg/kg body weight of paracetamol orally along with 200 mg/kg body weight of ethanol extract of *Gmelina arborea* for seven days. Group IV animals received 30 mg/kg body weight of paracetamol orally along with 200 mg/kg body weight of ethanol extract of *Grewia umbellifera* for seven days orally. Group V animals received 30 mg/kg body weight of standard drug silymarin along with 30 mg/kg body weight of paracetamol for seven days. On the 8th day, all the animals were put under light ether anesthesia and blood was collected from the retro-orbital sinus using a heparinized capillary tube. The blood was allowed to clot and the separated serum was obtained by centrifugation at 4000 rpm for 15 min. The separated serum was used for the estimation of AST, ALT, ACP, ALP, GGT, LDH, Total protein, Bilirubin, Total cholesterol, Triglycerides, Albumin, SOD, GPX, GST, GRD, CAT, LPO, Total ATPase, Na+/K+-ATPase, Mg2+-ATPase, Ca2+-ATPase, Isocitrate dhase, - keto glutarate dhase, β–D Glucorinidase, β–D galactoridase, Hemoglobin, PCV, MCV, MCH, MCHC, PLC, Granolocytes, Total leucocyte count, Urea, Creatinine, Uric acid, Phosphorous, Magnesium, Chloride, Sodium.

Statistical Analysis:
The values were expressed as mean ± SEM. The statistical analysis was carried out by one way analysis of variance (ANOVA) followed by Dunnet's 't' - test. P values <0.05 were considered significant.

IX. Analysis Of Biochemicals

In this study was estimated the liver enymes like AST,ALT,ACP,GGT (Orolowski and Meister (1963)),LDH (King 1965),Total Portein(Lowry's method), Bilurbin(Malloy and Evelyn), Albumin(Doumas, 1971), Total Cholesterol(zak's method), Triglycerides, SOD(Kakkar, 1984), GPx(Rotruck,1973), GST (Jackoby and Habig 1980),GRD (Beutler 1984), CAT(Sinha,1972), LPO (Ohkawa et,1979), Total ATPs(Evans ,1969), Sodium(Bonting,1970), Potassium(Bonting , 1970)., Megnisum**(**Ohnishi,1982), Calcium(Hjerten and Pan,1983), Isocitrate dhase(Fatania,1993), α-keto glutarate dhase (Fatania,1993), β-D Glucorinidase, β-D galactoridase, Urea(Varley, 1976), Creatinine(Owen, 1954), Uric acid(Henry caraway's method), and Phosphorous(Fiske and Subbarow method). The results are noted.

X. Haematological Studies

Haemoglobin (Hb)

Haemoglobin was estimated by Oxyhaemoglobin method **(Bell *et. al*., 1945)**. Briefly, 20 mg-diluted blood was mixed with 5 ml of 0.004% of ammonia solution. The development of reddish pink colour was measured at 625 nm.

Red Cell Count

Red cell count was determined by visual Haemocytomrtcr method **(Eric Ponder *et al*., 1934)**. Briefly the anti-coagulated blood was diluted with Hayem's fluid and filled up to the mark in the RBC pipette and mixed well for 3 minis. The Neubnuer's chamber was charged after discarding 1 or 2 drops of the mixture from the RBC pipette. The cells were allowed to settle down for 2 mins, and the RBCs were counted under low power in the four large corner squares.

Packed Cell Volume (PCV)

It was estimated by **Wintrobe's method (1929)**. Briefly, the anti-coagulated blood was filled into a Wintrobe's tube up to 10 cm and centrifuged at 2000-3000 rpm for 30 minutes. After centrifugation, layers were separated, as uppermost layer of plasma, thin white layer of platelets, greenish pink layer of leucocytes, lower most the layer of RBCs and grey white layer of leucocytes and platelets interposed between plasma above and packed RBCs, below which is called buffy coat. The lowermost height of column layer of RBC was noted and expressed as percentage.

Mean Corpuscular Volume (MCV)
MCV is calculated using the equation = PCV in L/L RBC count/ L
Mean Corpuscular Haemoglobin (MCH)
MCH is calculated using the equation = Hb /L RBC count/L
Mean Corpuscular Haemoglobin Concentration (MCHC)
MCHC is calculated using the equation = Hb/dl PCV in L/L
Total White Cell and Platelet Count (TWCC) and (PLC)

TWCC and PLC were determined by visual Hr.amocytometer method **(Eric Ponder *et al*., 1934)**. Briefly, the anti-coagulated blood was diluted with diluting fluid and filled up to the marking in the WBC pipette and mixed well for three minutes. The Neubauer's chamber was charged after discarding 1 or 2 drops of the mixture from the WBC pipette. The cells were allowed to settle down for 2 minutes, and the WBCs and PLCs were counted under low power in the four large comer squares.

XI. Histopathological Studies

Tissue samples obtained upon autopsy were preserved in 10% formal insolution for a minimum of one hour. Dehydration of the fixed tissue done by three changes with (80%, 90% and absolute) is opropyl alcohol in between one hour interval. Clearing of tissue was done by 2 changes of xylene in between one hour interval. This Processed tissue was oriented so that sections were cut in the desired plan of tissue. Two L shaped metal molds were laid on metal plate so as to enclose a rectangular or square space. This was then partly filled with melted paraffin and the tissue was placed in it in the desired plan or position. The container was then filled with melted paraffin and allowed to cool until reasonably firm so that set block of paraffin with the tissue can be removed from the molds. The block was then trimmed to a suitable size and kept for cooling at 0^oC. A section of the paraffin embedded tissue was done using a micro to me adjusting to 5µm thickness. The sections were cleared from wax by immersing in xylene for 3 minutes. The sections were stained with Haematoxylin stain for 20 minutes, washed in running tap water for 20 minutes. Then stained with Eosin stain for 15 sec-12 minutes and mounted in D.S.X. (Dibuxylphthalase in xylene) and viewed under microscope to evaluate the changes.
Liver and Kidney tissues were dissected out, washed in saline and preserved in 10 % formalin for histological studies and part of them were homogenized with suitable buffer for biochemical parameter analysis.

XII. Results And Discussion

Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum AST and ALT in normal and experimental rats

The Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* on serum AST and ALT in normal and experimental rats. In hepatotoxin induced rats the levels of serum AST were significantly increased (89.22±1.59) when compared to normal control rats (61.14±1.24). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significant decrease (64.49±1.03) in the levels of serum AST. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significant decrease (67.28±1.36) in the levels of serum AST. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (62.66±1.41).

In hepatotoxin induced rats the levels of serum ALT were significantly increased (49.36±1.08) when compared to normal control rats (27.86±0.92). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significant decrease (29.18±0.97) in the levels of serum ALT. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significant decrease (33.10±0.89) in the levels of serum ALT. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (28.17±0.93).

Groups	AST (IU/L)	ALT (IU/L)
Group-I (Normal control)	61.14±1.24	27.86±0.92
Group-II (Hepatotoxin Induced)	89.22±1.59	49.36±1.08
Group-III (Hepatotoxin + Plant extract* (200mg/kg BW)	64.49±1.03	29.18±0.97
Group-IV (Hepatotoxin + Plant extract (200mg/kg BW)**	67.28±1.36	33.10±0.89
Group-V (Standard drug)	62.66±1.41	28.17±0.93

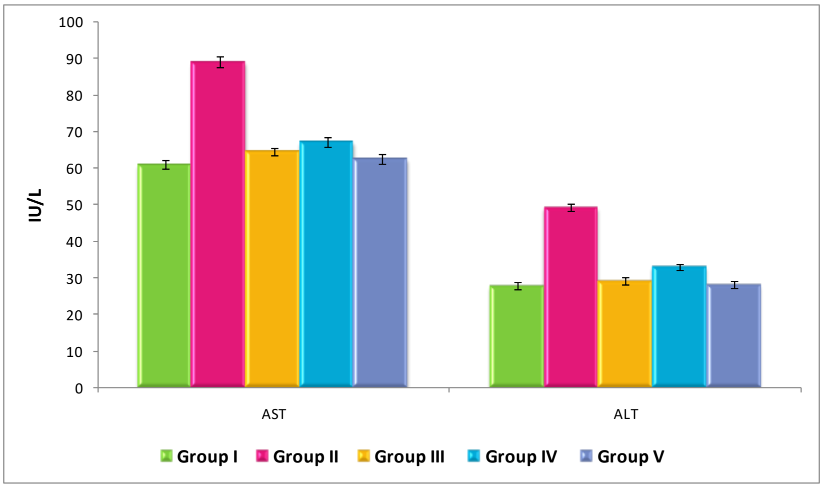


Fig 3 *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum ACP and ALP in normal and experimental rats*

The Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* on serum ACP and ALP in normal and experimental rats. In hepatotoxin induced rats the levels of serum ACP were significantly increased (79.38±1.09) when compared to normal control rats (50.75±1.32). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significant decrease (56.17±1.55) in the levels of serum ACP. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significant decrease (58.64±1.87) in the levels of serum ACP. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (54.37±1.10). In hepatotoxin induced rats the levels of serum ALP were significantly increased (138.47±1.63) when compared to normal control rats (79.30±1.03). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significant decrease (85.92±1.26) in the levels of serum ALP. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significant decrease (89.21±1.92) in the levels of serum ALP. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (83.19±1.23).

TABLE 4

Groups	ACP (IU/L)	ALP (IU/L)
Group-I (Normal control)	50.75±1.32	79.30±1.03
Group-II (Hepatotoxin Induced)	79.38±1.09	138.47±1.63
Group-III (Hepatotoxin + Plant extract* (200mg/kg BW)	56.17±1.55	85.92±1.26
Group-IV (Hepatotoxin + Plant extract (200mg/kg BW)**	58.64±1.87	89.21±1.92
Group-V (Standard drug)	54.37±1.10	83.19±1.23

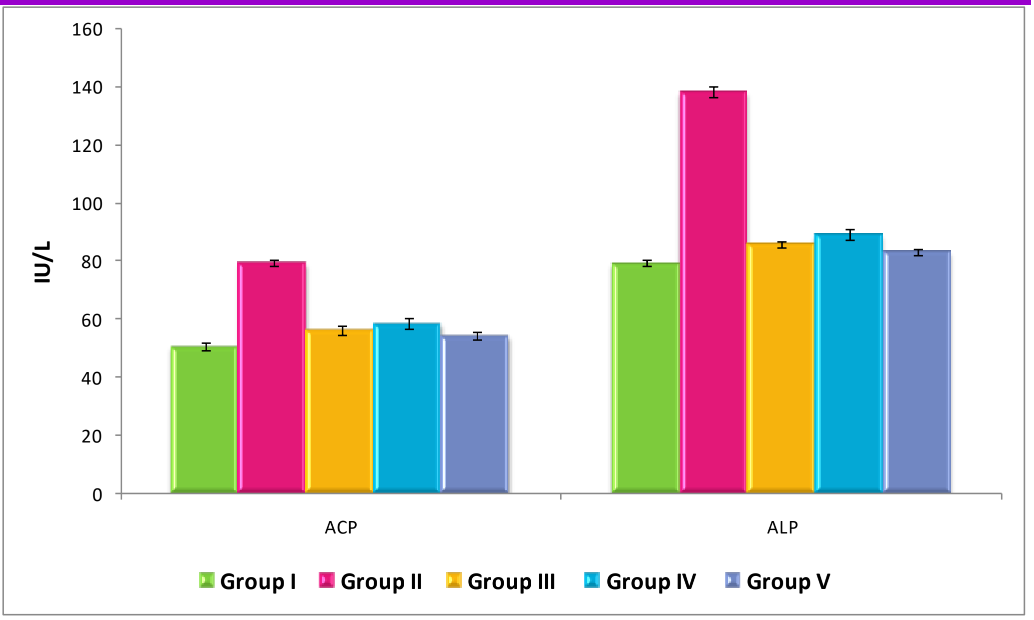


Fig 4 *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum GGT and LDH in normal and experimental rats*

The Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* on serum GGT and LDH in normal and experimental rats. In hepatotoxin induced rats the levels of serum GGT were significantly increased (66.49±1.21) when compared to normal control rats (47.32±0.97). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significant decrease (52.41±1.17) in the levels of serum GGT. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significant decrease (55.93±1.19) in the levels of serum GGT. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (49.16±0.95). In hepatotoxin induced rats the levels of serum LDH were significantly increased (187.62±1.93) when compared to normal control rats (110.27±1.56). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significant decrease (125.49±1.99) in the levels of serum LDH. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significant decrease (129.87±1.88) in the levels of serum LDH. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (121.31±1.93).

TABLE 5

Groups	GGT (IU/L)	LDH (IU/L)
Group-I (Normal control)	47.32±0.97	110.27±1.56
Group-II (Hepatotoxin Induced)	66.49±1.21	187.62±1.93
Group-III (Hepatotoxin + Plant extract* (200mg/kg BW)	52.41±1.17	125.49±1.99
Group-IV (Hepatotoxin + Plant extract (200mg/kg BW)**	55.93±1.19	129.87±1.88
Group-V (Standard drug)	49.16±0.95	121.31±1.93

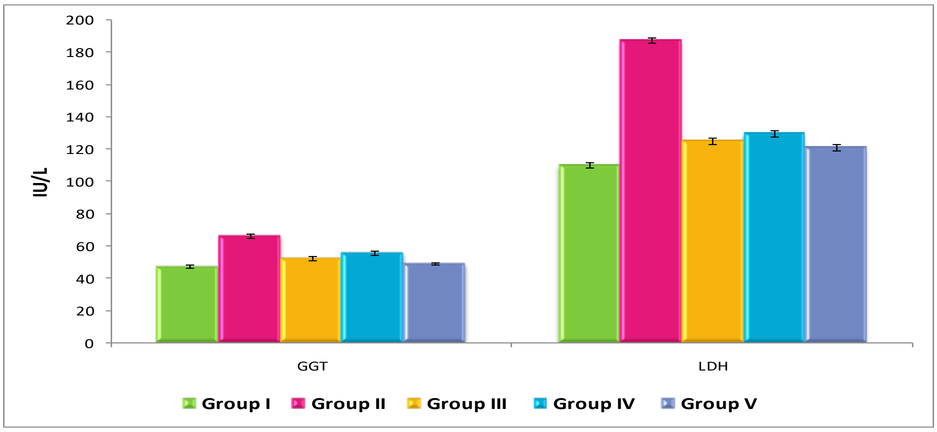


Fig 5 *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum total protein and bilirubin in normal and experimental rats*

The Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* on serum Total protein and bilirubin in normal and experimental rats. In hepatotoxin induced rats the levels of serum Total protein were significantly decreased (9.08±1.09) when compared to normal control rats (16.36±0.69). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (15.25±1.12) in the levels of serum Total protein. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (14.56±1.03) in the levels of serum Total protein. Among these two plants, the effect of *Gmelina arboreato* hepatotoxin induced rats showed a better effect than that of *Grewia umbelliferawhich* is very close to the effect of standard drug (15.92±1.15). In hepatotoxin induced rats the levels of serum bilirubin were significantly increased (18.92±1.21) when compared to normal control rats (10.61±0.65). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significant decrease (11.93±1.08) in the levels of serum bilirubin. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significant decrease (12.41±0.98) in the levels of serum bilirubin. Among these two plants, the effect of *Gmelina arboreato* hepatotoxin induced rats showed a better effect than that of *Grewia umbelliferawhich* is very close to the effect of standard drug (11.39±0.93).

TABLE 6

Groups	Total Protein (mg/dl)	Bilirubin (mg/dl)
Group-I (Normal control)	16.36±0.69	10.61±0.65
Group-II (Hepatotoxin Induced)	9.08±1.09	18.92±1.21
Group-III (Hepatotoxin + Plant extract* (200mg/kg BW)	15.25±1.12	11.93±1.08
Group-IV (Hepatotoxin + Plant extract (200mg/kg BW)**	14.56±1.03	12.41±0.98
Group-V (Standard drug)	15.92±1.15	11.39±0.93

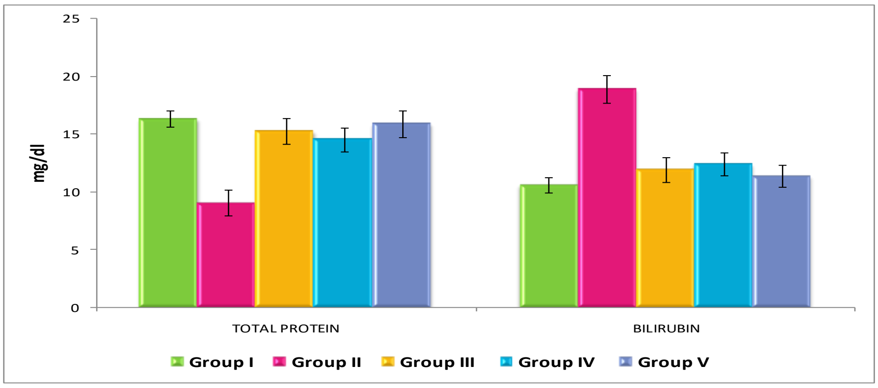


Fig 6

Table 7 Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* ontotal cholesterol, triglycerides and albumin of liver tissues in normal and experimental rats

Groups	Total cholesterol (mg/g)	Triglycerides (mg/g)	Albumin (mg/g)
Group-I (Normal control)	110.92±3.14	86.13±2.46	173.83±3.65
Group-II (Hepatotoxin Induced)	271.65±2.89	65.41±1.92	328.51±3.85
Group-III (Hepatotoxin + Plant extract* (200mg/kg BW)	115.83±2.56	82.94±1.83	183.62±2.37
Group-IV (Hepatotoxin + Plant extract (200mg/kg BW)**	119.32±1.71	80.12±1.60	188.13±2.49
Group-V (Standard drug)	112.44±2.03	84.39±1.90	180.61±2.84

Values are expressed as mean ± SEfor 3 animals in each group
(*Ethanol extract of barks of *Gmelina arborea* **Ethanol extract of barks of *Grewia umbellifera*)

Table 7 & Figure 7 shows the Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* on tissueTotal cholesterol, triglycerides and albumin in normal and experimental rats. In hepatotoxin induced rats the levels of tissue Total cholesterol were significantly increased (271.65±2.89) when compared to normal control rats (110.92±3.14). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantdecrease (115.83±2.56) in the levels of tissue Total cholesterol. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantdecrease (119.32±1.71) in the levels of tissue Total cholesterol. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (112.44±2.03).In hepatotoxin induced rats the levels of tissue triglycerides were significantly decreased (65.41±1.92) when compared to normal control rats (86.13±2.46). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (82.94±1.83) in the levels of tissue triglycerides. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (80.12±1.60) in the levels of tissue triglycerides. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (84.39±1.90). In hepatotoxin induced rats the levels of tissue albumin were significantly increased (328.51±3.85) when compared to normal control rats (173.83±3.65). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantdecrease (183.62±2.37) in the levels of tissue albumin. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantdecrease (188.13±2.49) in the levels of tissue albumin. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (180.61±2.84).

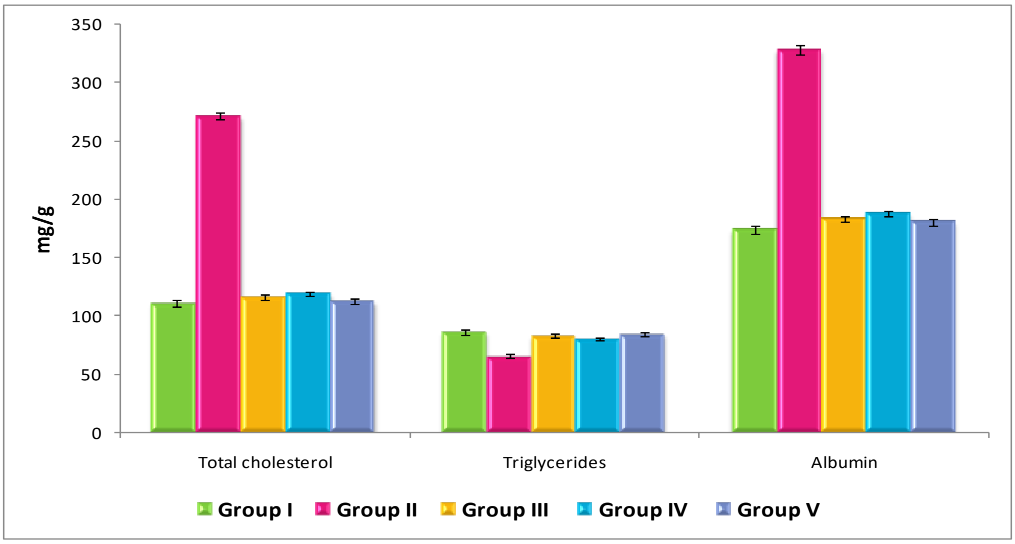


***Figure 7** Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on total cholesterol, triglycerides and albumin of liver tissues in normal and experimental rats*

Table 8 Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* onserum antioxidants and lipid peroxidation parameters in normal and experimental rats

Groups	SOD	GPX	GST	GRD	CAT	LPO
Group-I (Normal control)	6.65±0.52	5.35±0.29	5.89±0.34	3.85±0.29	4.02±0.38	3.37±0.3
Group-II (Hepatotoxin Induced)	3.09±0.21	2.48±0.23	3.75±0.25	1.48±0.19	1.12±0.16	8.12±0.55
Group-III (Hepatotoxin + Plant extract* (200mg/kg BW)	6.43±0.49	5.15±0.36	5.71±0.29	3.80±0.26	3.80±0.29	3.62±0.41
Group-IV (Hepatotoxin + Plant extract** (200mg/kg BW)	6.19±0.41	5.03±0.31	5.67±0.33	3.76±0.28	3.72±0.27	3.68±0.43
Group-V (Standard drug)	6.57±0.5	5.22±0.37	5.78±0.27	3.83±0.25	3.98±0.31	3.50±0.47

Values are expressed as mean ± SEfor 3 animals in each group
(*Ethanol extract of barks of *Gmelina arborea* **Ethanol extract of barks of *Grewia umbellifera*)

Figure 8 *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum antioxidants and lipid peroxidation parameters (SOD, CAT and LPO) in normal and experimental rats*

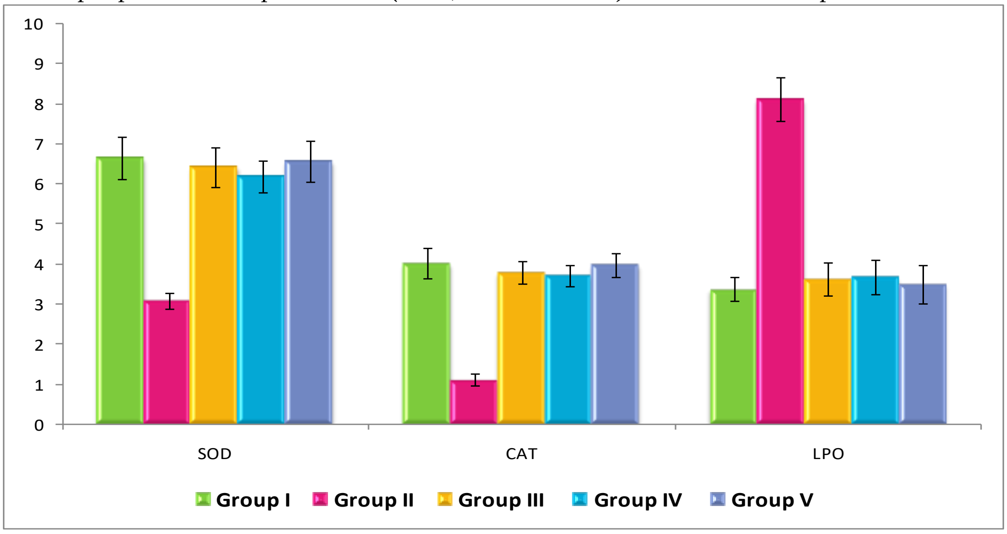


Figure 8A *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum antioxidants and lipid peroxidation parameters (GPX, GST and GRD) in normal and experimental rats*

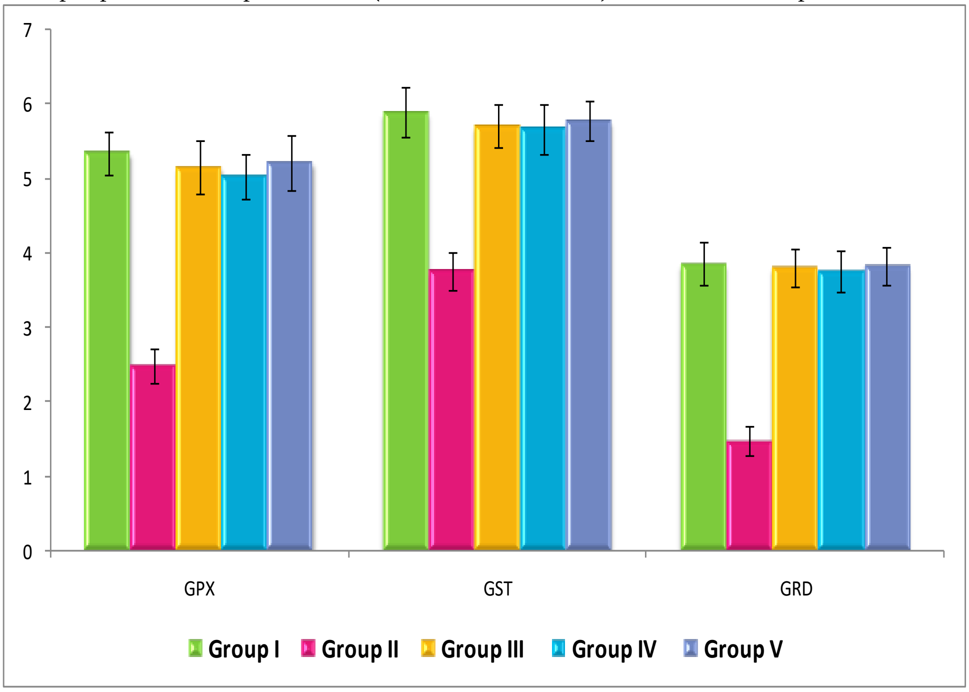


Table 8& Figure 8,8A shows the Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera*on SOD, GPX, GST, GRD, CATand LPOin normal and experimental rats. In hepatotoxin induced rats the levels of SOD were significantly decreased (3.09±0.21) when compared to normal control rats (6.65±0.52). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (6.43±0.49) in the levels of SOD. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (6.19±0.41) in the levels of SOD. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (6.57±0.5).

In hepatotoxin induced rats the levels of GPX were significantly decreased (2.48±0.23) when compared to normal control rats (5.35±0.29). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (5.15±0.36) in the levels of GPX. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (5.03±0.31) in the levels of GPX. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (5.22±0.37).

In hepatotoxin induced rats the levels of GST were significantly decreased (3.75±0.25) when compared to normal control rats (5.89±0.34). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (5.71±0.29) in the levels of GST. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (5.67±0.33) in the levels of GST. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (5.78±0.27).

In hepatotoxin induced rats the levels of GRD were significantly decreased (1.48±0.19) when compared to normal control rats (3.85±0.29). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (3.80±0.26) in the levels of GRD. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (3.76±0.28) in the levels of GRD. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (3.83±0.25).

In hepatotoxin induced rats the levels of CAT were significantly decreased (1.12±0.16) when compared to normal control rats (4.02±0.38). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (3.80±0.29) in the levels of CAT. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (3.72±0.27) in the levels of CAT. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (3.98±0.31).

In hepatotoxin induced rats the levels of LPO were significantly increased (8.12±0.55) when compared to normal control rats (3.37±0.3). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantdecrease (3.62±0.41) in the levels of LPO. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantdecrease (3.68±0.43) in the levels of LPO. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (3.50±0.47).

Table 9 Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* onserum mitochondrial enzyme parameters in normal and experimental rats

Groups	Total ATPase	Na^+/K^+-ATPase	Mg^{2+}-ATPase	Ca^{2+}-ATPase
Group-I (Normal control)	4.81±0.07	1.69±0.02	0.69±0.02	2.19±0.09
Group-II (Hepatotoxin Induced)	2.73±0.05	0.87±0.02	0.31±0.01	0.82±0.02
Group-III (Hepatotoxin + Plant extract* (200mg/kg BW)	4.58±0.08	1.49±0.03	0.59±0.02	1.89±0.07
Group-IV (Hepatotoxin + Plant extract** (200mg/kg BW)	4.51±0.06	1.42±0.02	0.55±0.03	1.82±0.09
Group-V (Standard drug)	4.67±0.07	1.53±0.04	0.62±0.03	1.96±0.08

Values are expressed as mean ± SEfor 3 animals in each group
(*Ethanol extract of barks of *Gmelina arborea* **Ethanol extract of barks of *Grewia umbellifera*)

Figure 9 *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum mitochondrial enzyme parameters (Total ATPase and Ca^{2+}-ATPase) in normal and experimental rats*

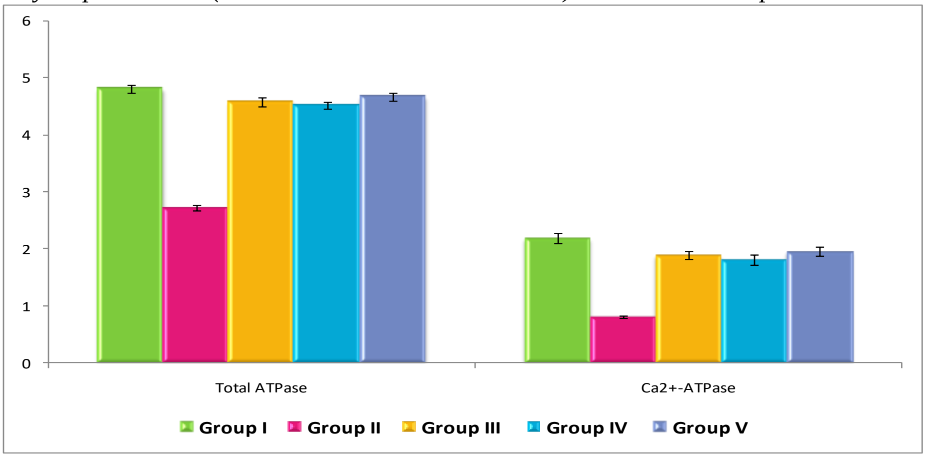


Figure 9A *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum mitochondrial enzyme parameters (Na^{+}/K^{+}-ATPase and Mg^{2+}-ATPase) in normal and experimental rats*

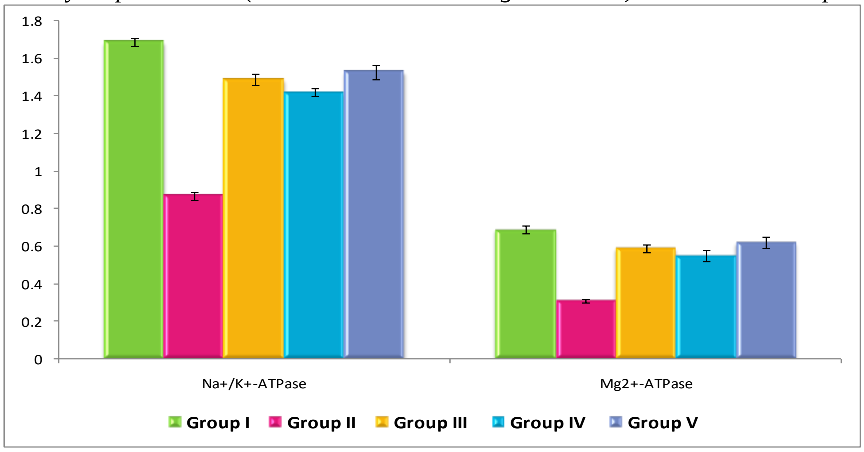


Table 9& Figure 9,9A shows the Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera*on Total ATPase, Na^{+}/K^{+}-ATPase, Mg^{2+}-ATPase and Ca^{2+}-ATPasein normal and experimental rats. In hepatotoxin induced rats the levels of Total ATPase were significantly decreased (2.73±0.05) when compared to normal control rats (4.81±0.07). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (4.58±0.08) in the levels of Total ATPase. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (4.51±0.06) in the levels of Total ATPase. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (4.67±0.07). In hepatotoxin induced rats the levels of Na^{+}/K^{+}-ATPase were significantly decreased (0.87±0.02) when compared to normal control rats (1.69±0.02). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (1.49±0.03) in the levels of Na^{+}/K^{+}-ATPase. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (1.42±0.02) in the levels of Na^{+}/K^{+}-ATPase. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (1.53±0.04). In hepatotoxin induced rats the levels of Mg^{2+}-ATPase were significantly decreased (0.31±0.01) when compared to normal control rats (0.69±0.02). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (0.59±0.02) in the levels of Mg^{2+}-ATPase. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (0.55±0.03) in the levels of Mg^{2+}-ATPase. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (0.62±0.03). In hepatotoxin induced rats the levels of Ca^{2+}-ATPase were significantly decreased (0.82±0.02) when compared to normal control rats (2.19±0.09). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (1.89±0.07) in the levels of Ca^{2+}-ATPase. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (1.82±0.09) in the levels of Ca^{2+}-ATPase. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (1.96±0.08).

Table 10 Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* onserum carbohydrate metabolic enzyme parameters in normal and experimental rats

Groups	Isocitrate dhase	α-keto glutarate dhase	β-D Glucorinidase	β-D galactoridase
Group-I (Normal control)	136.61±3.42	112.39±2.91	11.51±0.26	14.69±0.21
Group-II (Hepatotoxin Induced)	89.38±2.18	71.52±2.21	27.39±0.32	33.06±0.35
Group-III (Hepatotoxin + Plant extract* (200mg/kg BW)	128.64±2.49	107.82±2.54	13.87±0.25	16.12±0.27
Group-IV (Hepatotoxin + Plant extract** (200mg/kg BW)	120.95±2.78	104.21±2.13	15.42±0.22	18.53±0.29
Group-V (Standard drug)	132.81±2.88	111.61±2.67	12.92±0.21	15.54±0.23

Values are expressed as mean ± SEfor 3 animals in each group
(*Ethanol extract of barks of *Gmelina arborea* **Ethanol extract of barks of *Grewia umbellifera*)

Figure 10 *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum carbohydrate metabolic enzyme parameters (Isocitrate dhase and α-keto glutarate dhase) in normal and experimental rats*

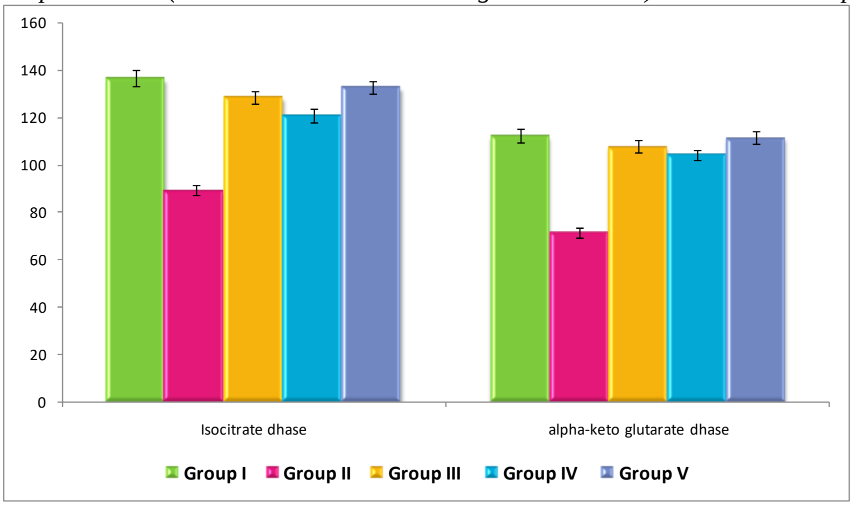


Figure 10A *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum carbohydrate metabolic enzyme parameters (β-D Glucorinidase and β-D galactoridase) in normal and experimental rats*

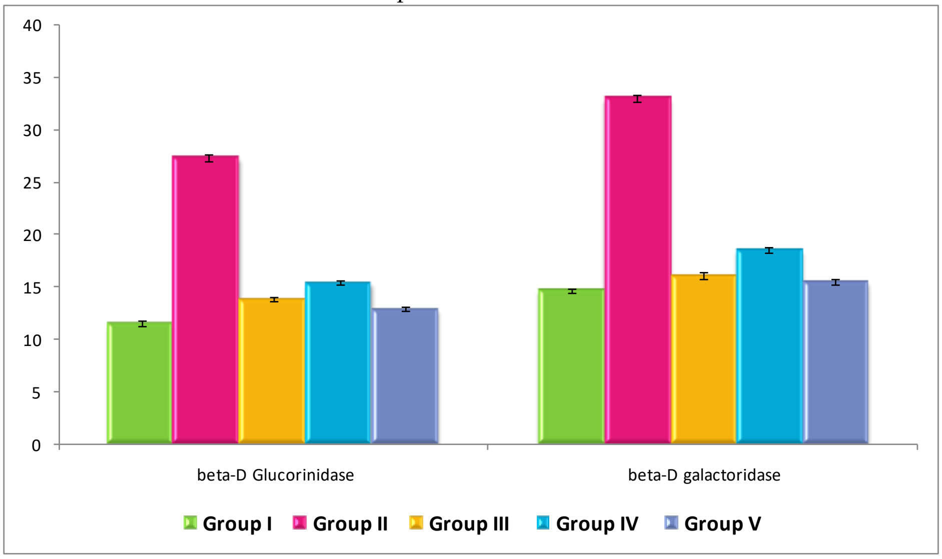


Table 10& Figure 10, 10A shows the Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera*on Isocitrate dhase, α-keto glutarate dhase, β-D Glucorinidase, β-D galactoridasein normal and experimental rats. In hepatotoxin induced rats the levels of Isocitrate dhase were significantly decreased (89.38±2.18) when compared to normal control rats (136.61±3.42). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (128.64±2.49) in the levels of Isocitrate dhase. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (120.95±2.78) in the levels of Isocitrate dhase. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (132.81±2.88).

In hepatotoxin induced rats the levels of α-keto glutarate dhase were significantly decreased (71.52±2.21) when compared to normal control rats (112.39±2.91). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantincrease (107.82±2.54) in the levels of α-keto glutarate dhase. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantincrease (104.21±2.13) in the levels of α-keto glutarate dhase. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (111.61±2.67).

In hepatotoxin induced rats the levels of β-D Glucorinidase were significantly increased (27.39±0.32) when compared to normal control rats (11.51±0.26). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantdecrease (13.87±0.25) in the levels of β-D Glucorinidase. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantdecrease (15.42±0.22) in the levels of β-D Glucorinidase. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (12.92±0.21). In hepatotoxin induced rats the levels of β-D galactoridase were significantly increased (33.06±0.35) when compared to normal control rats (14.69±0.21). Oral administration of *Gmelina arborea* to hepatotoxin induced rats showed a significantdecrease (16.12±0.27) in the levels of β-D galactoridase. Also the oral administration of *Grewia umbellifera* to hepatotoxin induced rats showed a significantdecrease (18.53±0.29) in the levels of β-D galactoridase. Among these two plants, the effect of *Gmelina arborea*to hepatotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (15.54±0.23).

NEPHROPROTECTIVE ACTIVITYof ethanol extract of barks of *GMELINAARBOREA*AND *GREWIAUMBELLIFERA*

Table 11 Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* onserum hematological parameters in normal and experimental rats

Groups	**Hemoglobin**	**PCV (%)**	**MCV (fl)**	**MCH (pg)**	**MCHC (%)**	**PLC (103/μl)**	**Granolocytes (%)**	**Total leucocyte count (103/μl)**
Group-I (Normal control)	13.32±1.04	38.62±0.75	59.04±1.75	15.34±0.69	32.16±0.25	27.14±0.64	15.91±0.21	6.69±0.32
Group-II (Nephrotoxin Induced)	8.15±0.91	21.47±1.13	68.52±0.81	18.67±0.52	25.46±0.49	9.36±0.47	9.19±0.19	2.06±0.12
Group-III (Nephrotoxin + Plant extract* (200mg/kg BW)	12.32±0.73	33.54±0.86	61.36±0.53	16.73±0.12	29.87±0.56	26.69±0.39	14.72±0.15	6.11±0.27
Group-IV (Nephrotoxin + Plant extract** (200mg/kg BW)	11.16±0.67	31.49±0.64	63.92±0.72	17.18±0.82	27.64±0.32	24.67±0.51	13.87±0.17	5.83±0.25
Group-V (Standard drug)	12.78±0.81	35.73±0.92	60.16±0.49	16.03±0.96	32.78±0.14	28.69±0.62	15.17±0.15	6.58±0.22

Values are expressed as mean ± SEfor 3 animals in each group
(*Ethanol extract of barks of *Gmelina arborea* **Ethanol extract of barks of *Grewia umbellifera*)

Figure 11 *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum hematological parameters (Hemoglobin and Total leucocyte count) in normal and experimental rats*

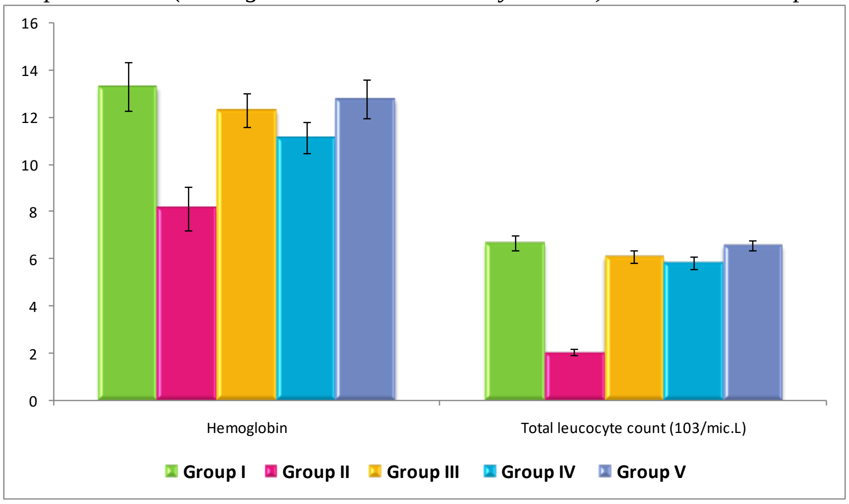


Figure 11A *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum hematological parameters (PLC and Granolocytes)in normal and experimental rats*

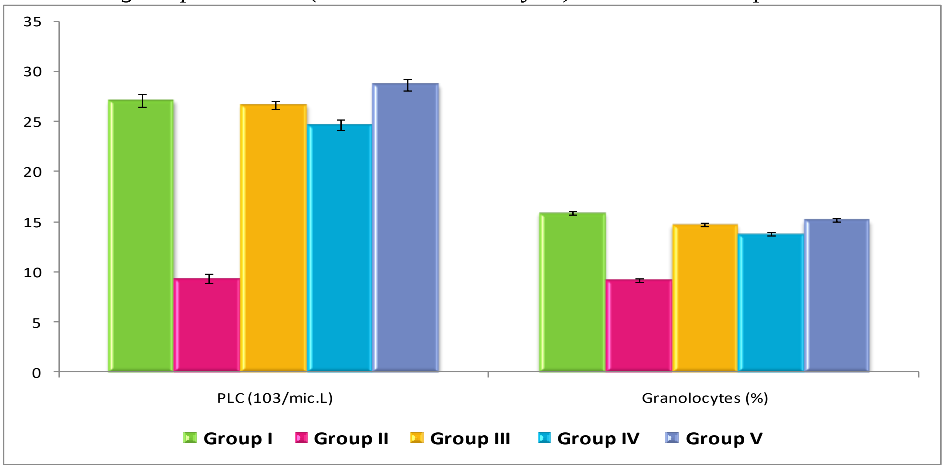


Figure 11B *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum hematological parameters (PCV and MCV)in normal and experimental rats*

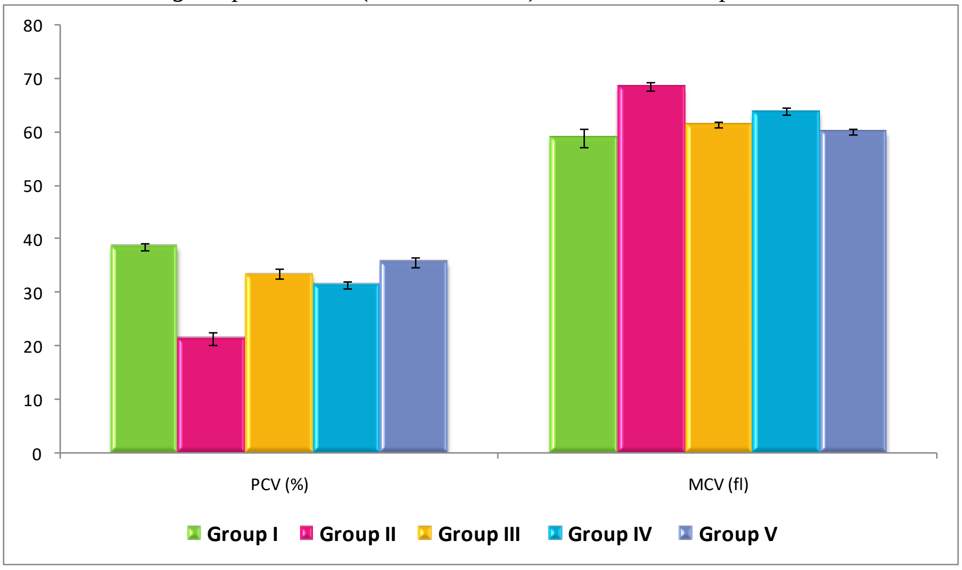


Figure 11C *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum hematological parameters (MCH and MCHC)in normal and experimental rats*

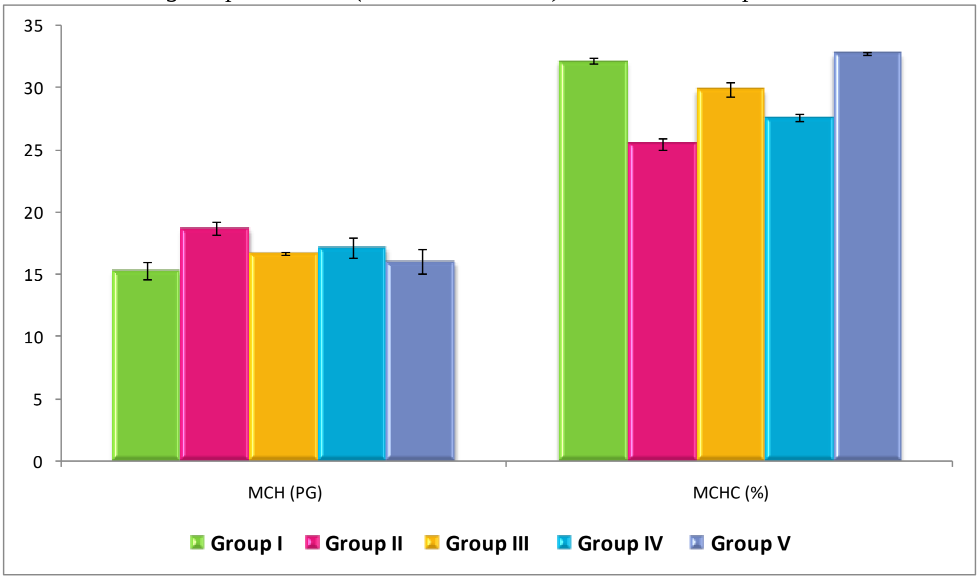


Table 11& Figure 11,11A,11B,11C shows the Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera*on Hemoglobin, PCV, MCV, MCH, MCHC, PLC, Granolocytes and Total leucocyte countin normal and experimental rats. In nephrotoxin induced rats the levels of Hemoglobin were significantly decreased (8.15±0.91) when compared to normal control rats (13.32±1.04). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantincrease (12.32±0.73) in the levels of Hemoglobin. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantincrease (11.16±0.67) in the levels of Hemoglobin. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (12.78±0.81).

In nephrotoxin induced rats the levels of PCV were significantly decreased (21.47±1.13) when compared to normal control rats (38.62±0.75). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantincrease (33.54±0.86) in the levels of PCV. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantincrease (31.49±0.64) in the levels of PCV. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (35.73±0.92).

In nephrotoxin induced rats the levels of MCV were significantly increased (68.52±0.81) when compared to normal control rats (59.04±1.75). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantdecrease (61.36±0.53) in the levels of MCV. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantdecrease (63.92±0.72) in the levels of MCV. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (60.16±0.49).

In nephrotoxin induced rats the levels of MCH were significantly increased (18.67±0.52) when compared to normal control rats (15.34±0.69). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantdecrease (16.73±0.12) in the levels of MCH. Also the oral administration of *Grewia umbellifera*to nephrotoxin induced rats showed a significantdecrease (17.18±0.82) in the levels of MCH. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (16.03±0.96).

In nephrotoxin induced rats the levels of MCHC were significantly decreased (25.46±0.49) when compared to normal control rats (32.16±0.25). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantincrease (29.87±0.56) in the levels of MCHC. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantincrease (27.64±0.32) in the levels of MCHC. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (32.78±0.14).

In nephrotoxin induced rats the levels of PLC were significantly decreased (9.36±0.47) when compared to normal control rats (27.14±0.64). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantincrease (26.69±0.39) in the levels of PLC. Also the oral administration of *Grewia* *umbellifera* to nephrotoxin induced rats showed a significantincrease (24.67±0.51) in the levels of PLC. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (28.69±0.62).

In nephrotoxin induced rats the levels of Granolocytes were significantly decreased (9.19±0.19) when compared to normal control rats (15.91±0.21). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantincrease (14.72±0.15) in the levels of Granolocytes. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantincrease (13.87±0.17) in the levels of Granolocytes. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (15.17±0.15).

In nephrotoxin induced rats the levels of Total leucocyte count were significantly decreased (2.06±0.12) when compared to normal control rats (6.69±0.32). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantincrease (6.11±0.27) in the levels of Total leucocyte count. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantincrease (5.83±0.25) in the levels of Total leucocyte count. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (6.58±0.22).

Table 12 Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera* onserum biochemical parameters in normal and experimental rats

Groups	Urea (mg/dl)	Creatinine (mg/dl)	Uric Acid (mg/dl)	Phosphorous(mml/l)	Magnesium(mml/l)	Sodium(mEq/L)	Chloride(mEq/L)
Group-I (Normal control)	55.59±2.01	0.97±0.08	3.56±0.26	3.68±0.31	1.59±0.27	148.19±5.53	97.17±4.87
Group-II (Nephrotoxin Induced)	96.21±3.12	1.86±0.15	4.95±0.22	4.89±0.39	3.13±0.38	101.64±4.84	73.61±4.23
Group-III (Nephrotoxin + Plant extract* (200mg/kg BW)	59.34±2.59	1.12±0.11	3.71±0.19	3.76±0.35	1.73±0.19	139.83±5.19	92.53±4.52
Group-IV (Nephrotoxin + Plant extract** (200mg/kg BW)	61.13±2.72	1.17±0.13	3.76±0.20	3.82±0.38	1.79±0.20	135.26±5.68	90.19±4.71
Group-V (Standard drug)	57.12±2.52	1.06±0.09	3.68±0.23	3.73±0.37	1.65±0.18	141.37±5.47	94.92±4.93

Values are expressed as mean ± SEfor 3 animals in each group
(*Ethanol extract of barks of *Gmelina arborea* **Ethanol extract of barks of *Grewia umbellifera*)

***Figure 12A** Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum biochemical parameter Urea in normal and experimental rats*

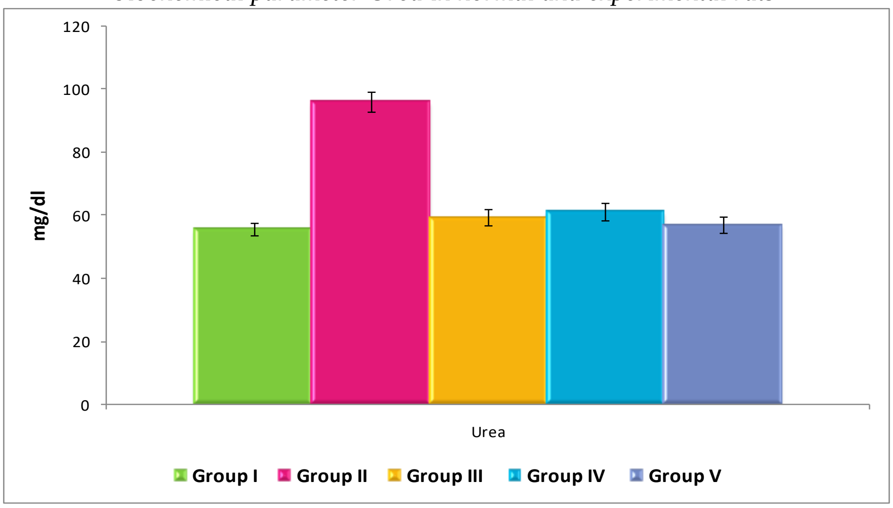


***Figure 12B** Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum biochemical parameter Creatinine and Uric acid in normal and experimental rats*

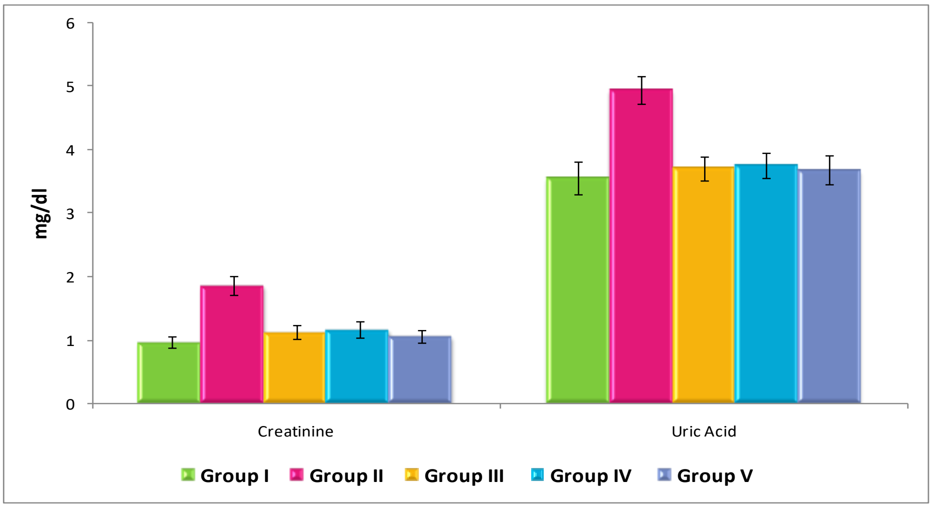


Figure 12C *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum biochemical parameters (Phosphorus and Magnesium) in normal and experimental rats*

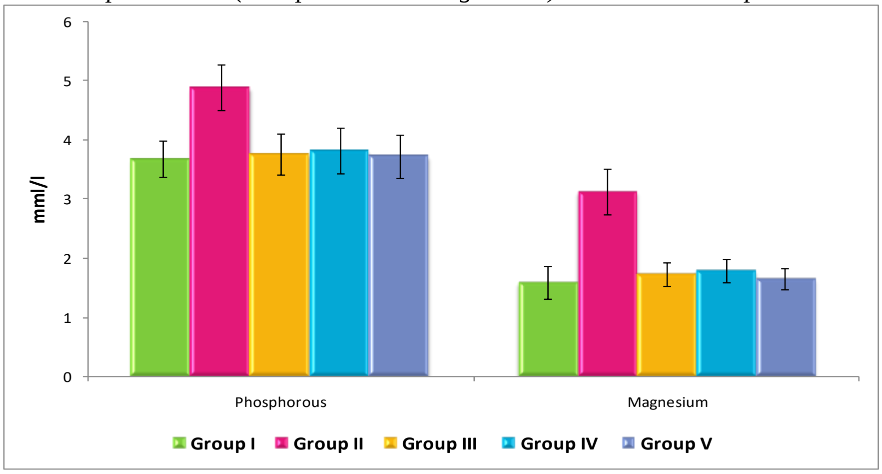


Figure 12D *Effect of ethanol extract of barks of Gmelina arborea and Grewia umbellifera on serum biochemical parameters (Sodium and Chloride) in normal and experimental rats*

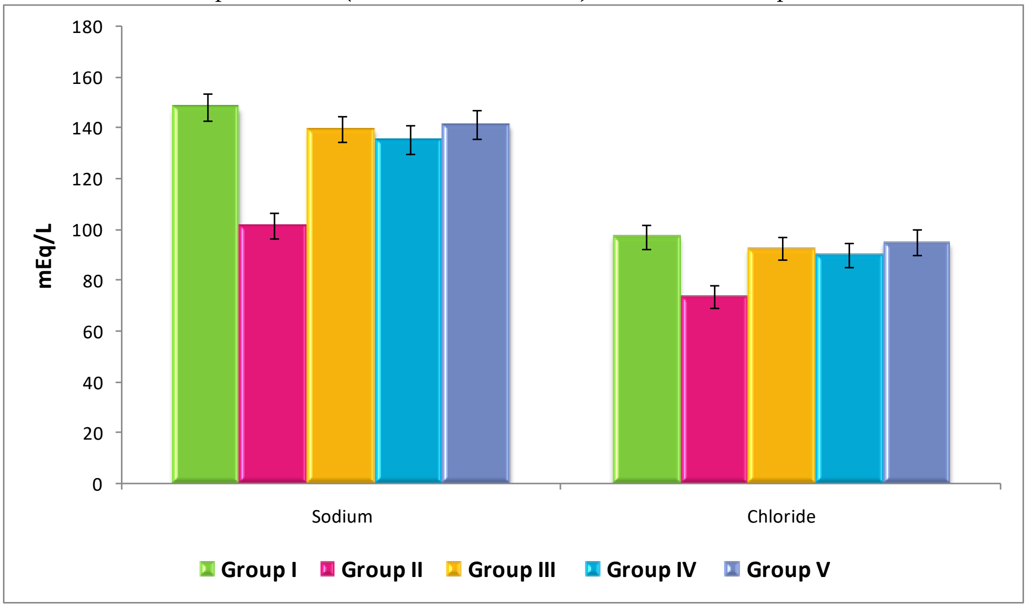
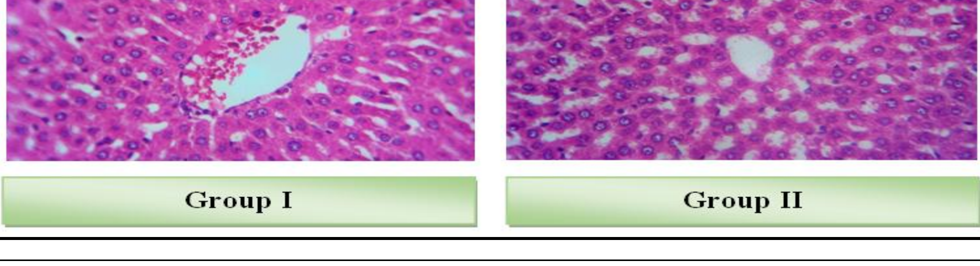


Table 12& Figure 12, 12A,12B,12C,12D shows the Effect of ethanol extract of barks of *Gmelina arborea* and *Grewia umbellifera*on Urea, Creatinine, Uric acid, Phosphorous, Magnesium, Sodium and Chloride in normal and experimental rats. In nephrotoxin induced rats the levels of Urea were significantly increased (96.21±3.12) when compared to normal control rats (55.59±2.01). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantdecrease (59.34±2.59) in the levels of Urea. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantdecrease (61.13±2.72) in the levels of Urea. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (57.12±2.52).

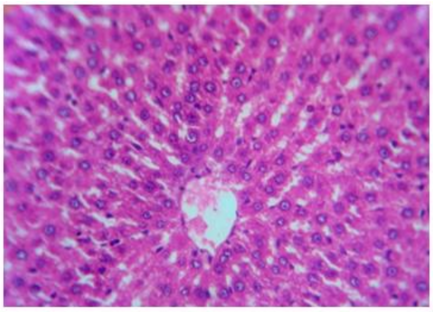
In nephrotoxin induced rats the levels of Creatinine were significantly increased (1.86±0.15) when compared to normal control rats (0.97±0.08). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantdecrease (1.12±0.11) in the levels of Creatinine. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantdecrease (1.17±0.13) in the levels of Creatinine. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (1.06±0.09). In nephrotoxin induced rats the levels of Uric acid were significantly increased (4.95±0.22) when compared to normal control rats (3.56±0.26). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantdecrease (3.71±0.19) in the levels of Uric acid. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantdecrease (3.76±0.20) in the levels of Uric acid. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (3.68±0.23). In nephrotoxin induced rats the levels of Phosphorous were significantly increased (4.89±0.39) when compared to normal control rats (3.68±0.31). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantdecrease (3.76±0.35) in the levels of Phosphorous. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantdecrease (3.82±0.38) in the levels of Phosphorous. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (3.73±0.37). In nephrotoxin induced rats the levels of Magnesium were significantly increased (3.13±0.38) when compared to normal control rats (1.59±0.27). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantdecrease (1.73±0.19) in the levels of Magnesium. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantdecrease (1.79±0.20) in the levels of Magnesium. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (1.65±0.18). In nephrotoxin induced rats the levels of Sodium were significantly decreased (101.64±4.84) when compared to normal control rats (148.19±5.53). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantincrease (139.83±5.19) in the levels of Sodium. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantincrease (135.26±5.68) in the levels of Sodium. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (141.37±5.47). In nephrotoxin induced rats the levels of Chloride were significantly decreased (73.61±4.23) when compared to normal control rats (97.17±4.87). Oral administration of *Gmelina arborea* to nephrotoxin induced rats showed a significantincrease (92.53±4.52) in the levels of Chloride. Also the oral administration of *Grewia umbellifera* to nephrotoxin induced rats showed a significantincrease (90.19±4.71) in the levels of Chloride. Among these two plants, the effect of *Gmelina arborea*to nephrotoxin induced rats showed a better effect than that of *Grewia umbellifera*which is very close to the effect of standard drug (94.92±4.93).

HISTOPATHOLOGICAL STUDIES

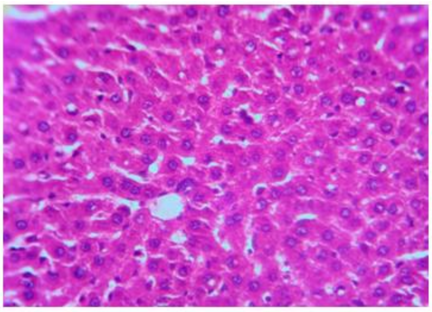
Plate 1 HISTOPATHALOGICAL STUDY OF LIVER



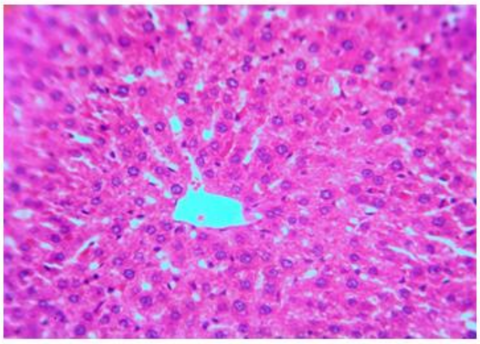
Group I | Group II



Group III

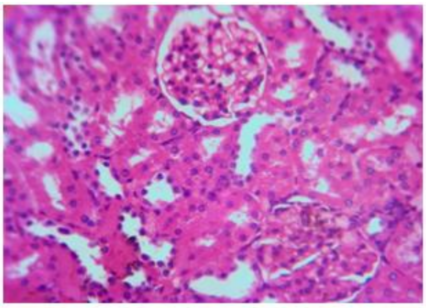


Group IV

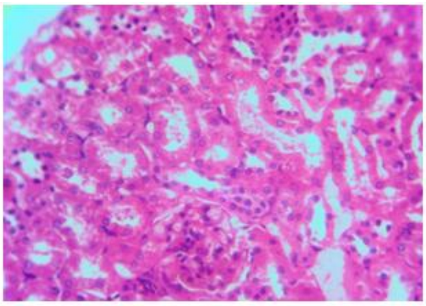


Group V

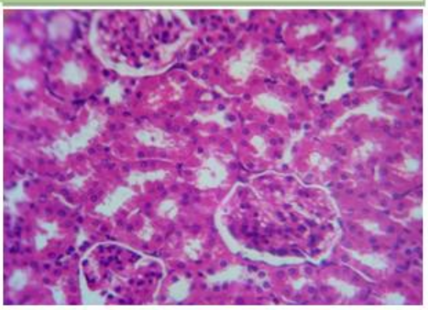
Plate 2 HISTOPATHALOGICAL STUDY OF KIDNEY



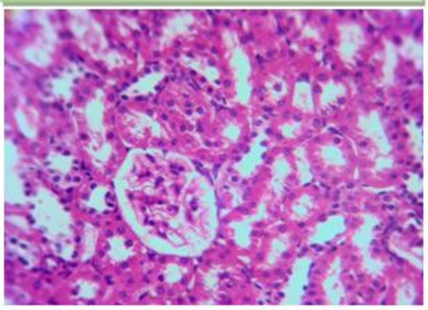
Group I



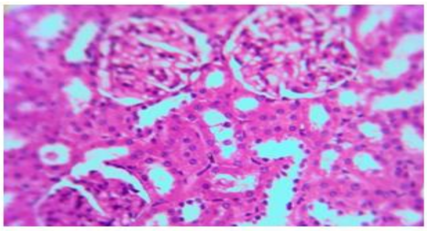
Group II



Group III



Group IV



Group V

Liver:

Group I

The histological section of rat liverstained with hematoxylin and eosin shows normal architechture with prominent central vein and the columnar hepatocytes radiating from the center towards the periphery. Nucleus properly stained and remain undisturbed.

Group II

The histological section of rat liver stained with hematoxylin and eosin shows disarrangementof normal hepatic cells with centrilobularnecrosis, hyperplasia, vascular and cellulardegeneration, polymorpho nuclear aggregation, inflammation and fattydegeneration were observed. Hyper vacuolization is very prominent.

Group III

The histological section of rat liver stained with hematoxylin and eosin shows reduction in the inflammatory cells, vascular congestion and degeneration, cellular degeneration, necrosis and vacuoles.

Group IV

The histological section of rat liver shows marked reduction in the necrosis and vacuolization. The nucleus are prominent and undisturbed. No marked hyperplasia observed. The sections clearly show regaining of normalcy in the tissue architecture.

Group IV

The histological section of rat liver shows almost normal architecture but with very negligible vacuolization and centrilobular necrosis near the central vein region.

Kidney:

Group I

The histological section of rat kidney stained with hematoxylin and eosin did not show any notablehistopathological alterations

Group II

The histological section of rat kidney stained with hematoxylin and eosin shows loss of renal tubulararchitecture with rearrangement of renal tubules and glomerulus.Kidney sections showed diffuse degenerative changes in thesections. The renal tubules showed cellular swelling invariablywith narrowing of lumen to great extent.

Group III

The histological section of rat kidney stained with hematoxylin and eosin shows focal areas of necrosiswith accumulation of proteincasts in the tubular lumen.

Group IV

The histological section of rat kidney stained with hematoxylin and eosin revealed somedegree of cellular swelling with prominent regaining of normalcy with least interstitial necrosis. Tubular regeneration is seen.

Group IV

The histological section of rat kidney stained with hematoxylin and eosin reveal normal tubules with no protein cast in their mononuclear inflammatory cell infiltration.

XII. Conclusion

The present work is a comprehensive compilation of findings in the evaluation oftraditionally known medicinal plants for their Hepatoprotective and nephroprotective activity of the two medicinal plants GA and GU.

This study can be concluded with the following points:

- The study on in vitro antioxidant activity of medicinal plants also revealed the antioxidant potential of the plants.
- Hepatoprotective activity studies of the barks of GA and GU on paracetamol induced rats showed the significant protective activity.
- The ethanol extract of GA and GU extracts showed significant nephroprotective activity.

In conclusion, the results of the present investigation infer that these plants (GA and GU) extractspossess potent antioxidant, Hepatoprotective and nephroprotective property, the former being probably responsiblethan the later. Thus, the extracts can be beneficial in treating liver and renal damages caused due to chemical exposure.

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