Determination of Hepatoprotective Activity of Methanolic Extract of *Ipomea reniformis*

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**Abstract**

**Objectives:** The main objectives of the study were to evaluate investigation of hepatoprotective activity of methanolic extract of *Ipomea reniformis* (MEIR) in experimentally induced hepatotoxicity in rats.

**Methods:** Hepatoprotective activity of MEIR was studied against Paracetamol (3 g/kg p.o.) and ethanol (4 g/kg p.o.) induced hepatotoxicity in rats. Silymarin (100mg/kg p.o.) was used as a standard reference in this study. Parameters evaluated in the study of Serum biomarkers Serum glutamate oxaloacetic transaminase (SGOT), Serum glutamate pyruvate transaminase (SGPT), Bilirubin (total & direct) and Total protein and Tissue antioxidant levels Glutathione, Lipid peroxidation (LPO) and histopathological changes of livers were assessed in the above mentioned models.

**Results & Conclusion:** When compared to PCM and ETH toxicant groups to normal group there were increased in wet liver weight and wet liver volume, (SGOT), Serum glutamate pyruvate transaminase (SGPT), Bilirubin (total & direct) and Glutathione and Total protein levels were markedly reduced. Treated groups showed significant decreased wet liver weight and wet liver volume, SGOT, SGPT, DB, TB, LPO, and increased in GSH, TP levels were markedly increased in Silymarin, MEIR low dose (200 mg/kg p.o.) and MEIR high dose (500 mg/kg p.o.). Histopathological changes Steatosis, Necrosis etc., were partly or completely prevented in animals treated with the MEIR.

Based on improvement in serum marker enzyme levels, physical parameters, Antioxidant parameters, and histopathological studies, it is concluded that the MEIR possesses hepatoprotective activity.

**Keywords:** Hepatoprotective, *Ipomea reniformis*, Paracetamol, Ethanol.

**INTRODUCTION**

Liver is the key organ regulating homeostasis in the body. It is involved with almost all the biochemical pathways related to growth, fight against disease, nutrient supply energy provision and reproduction [1]. The liver is expected to perform physiological functions but also to protect against the hazards of harmful drugs and chemicals.

Liver diseases are largest health problem worldwide and are mainly caused by toxic chemicals, excessive consumption of alcohol, infections and autoimmune disorders. Excessive production of reactive oxygen species (ROS) plays an important role in the pathogenesis and progression of various disease involving different organs such as liver [2].

Alcohol and Paracetamol are known to cause liver damage due to production of excessive reactive free radicals which alter the constitution of hepatocytes there by affect the physiological functions carried out by the liver. Ethanol gets converted into acetaldehyde by alcohol dehydrogenase which further gets metabolised in mitochondria to acetate by acetaldehyde dehydrogenase. Along with the formation of highly reactive oxygen and hydroxy ethyl radical, this covalently modifies the proteins, DNA and lipids of hepatocytes [3]. In the absence of a reliable liver protective drug in modern medicine there are a number of conventional medicinal preparations in ayurveda used for the treatment of liver disorders [4]. In the absence of a reliable liver protective drug in modern medicine there are a number of conventional medicinal preparations in ayurveda used for the treatment of liver disorders [5]. Herbal medicines have recently attracted much attention as alternative medicines useful for treating or preventing life style related disorders and relatively very little knowledge is available about their mode of action. There has been a growing interest in the analysis of plant products which have stimulated intense research on their potential health benefits. Hence, searching the safe and potent remedies from the herbal origin for the treatment of hepatic disorders has become most fascinating and desired area of research for the pharmacologists. According to the literature survey some medicinal plants such as *Spirulina maxima* [6] *Eclipta alb* [7] *Boehmeria nivea* [8] *Cichorium intybus* [9] *Aegel marmelos* [10] etc, which are traditionally used in the management of liver disorders and reported to possess measurable hepatoprotective effect against various experimental animal models. However, still more numbers of medicinal plants are needed to be screened for their hepatoprotective efficacy. *Ipomea reniformis* chois (Convolvulaceae) is a perennial, much branched herb (creepers). It is widely distributed all over India. It is also known as *Merremia emarginata*. It is reported to have many important medicinal properties. In the Indigenous system of Medicine, *Ipomea reniformis* has been claimed to be useful for cough, headache, neuralgia, rheumatism, diuretic, inflammation, troubles of nose, fever due to enlargement of liver and also in kidney diseases. Powder of leaves is used as a snuff during epileptic seizures, Juice acts as purgative and the root is having diuretic, laxative, and applied in the disease of the eyes and gums. The Methanolic extract of this plant has proven to have anti-inflammatory [11], antidiabetic [12], antioxidant and antiobesity [13] activities while Methanolic extract of this plant has proven to have nephroprotective activity [14].
Methanol extract of this plant might be used for anti oxidant and antiobesity activities with minimal toxicity [15]. Literature reviews indicated that there is no scientific report on liver protective property of the title plant till date. Hence, the present investigation is aimed to assess protective role of I. reniformis whole plant extract against paracetamol and alcohol induced liver damage in rats.

**MATERIALS AND METHODS**

**Solvents required for Methanolic Extract of Ipomoea reniformis**

Methanol, Hexane

**Apparatus and Diagnostic kits used for Dissertation work:**

Cooling centrifuge, Homogenizer, Incubator.

**METHODOLOGY**

**Methanolic extraction of Ipomoea reniformis**

The whole plant was washed with distilled water and shade dried for two weeks. After drying, the dried plant material was powdered with mechanical grinder and passes the powder with sieve no. 22 to get uniform particle size. The powder is packed in Soxhlet apparatus for defatting with n-hexane for 3 days. The plant powder (marc) was air dried after defatting. Again it is packed in Soxhlet apparatus for methanol extraction for 18hrs until to get clear solution in syphon tube.

**Pharmacological Evaluation**

**Preparation of dose**

Weighed quantity of Methanolic extract of Ipomoea reniformis (MEIR) was suspended in water using 0.5% carboxy methyl cellulose and administered orally to experimental animals. Suspension of MEIR was prepared freshly. The MEIR was administrated at doses of 200 mg/kg (L.D) and 400 mg/kg (H.D) for each animal as per previous study [6].The experiments were conducted 1 h after the oral administration. In Multiple dose study the animals daily received the suitable oral dose of the MEIR for a period of 14 days. The parameters were assessed on the 14th day after the administration of particular day dose.

**Paracetamol induced hepatotoxicity**

**Experimental design**

Animal: Wistar rat, Weight: 150 - 250 g
No. of animals in each group (n): 6

**Treatment schedule**

Thirty animals were randomly divided equally into six groups of six animals each.

**Group 1:** (Control) received 0.5% CMC for 14 days.

**Group 2:** (PCM-induced control) received Paracetamol (3 g/kg p.o.) suspended with 0.5%CMC orally for 7 days.

**Group 3:** (Drug control) received MEIR (400 mg/kg p.o.) for 14 days.

**Group 4:** (Low dose) received MEIR (200 mg/kg/day p.o.) and 99.9% ethanol (4 g/kg) with corn oil (10 ml/kg/day) p.o. for 14 days.

**Group 5:** (High dose) received MEIR (400 mg/kg/day p.o.) and 99.9% ethanol (4 g/kg) with corn oil (10 ml/kg/day) for 14 days.

**Group 6:** (Silymarin control) received silymarin (100 mg/kg/day p.o.) and 99.9%ethanol (4 g/kg) with corn oil (10 ml/kg/day) for 14 days.

After 14 days of treatment with MEIR, 15th day blood is collected from retro orbital plexus puncture and rats were sacrificed and liver was collected immediately perfused with Phosphate Buffer Solution. Serum was separated by centrifugation. The collected Serum glutamate oxaloacetic transaminase (SGOT), Serum glutamate pyruvate transaminase (SGPT), direct bilirubin (DB), total bilirubin (TB), total proteins were assayed. In tissue homogenate lipid per-oxidation, glutathione, were assayed and then histopathological studies also carried out.

**Ethanol induced hepatotoxicity**

**Experimental design**

Animal: Wistar rat, Weight: 150 - 250 g
No. of animals in each group (n): 6

**Treatment schedule**

Thirty animals were randomly divided equally into six groups of six animals each.

**Group 1:** (Control) received 0.5% CMC for 14 days.

**Group 2:** (Ethanol control) received 99.9% ethanol 4g/kg with corn oil (10 ml/kg/day) p.o. for 14 days.

**Group 3:** (Drug control) received MEIR (400 mg/kg/day p.o.)

**Group 4:** (Low dose) received MEIR (200 mg/kg/day p.o.) and 99.9% ethanol (4 g/kg) with corn oil (10 ml/kg/day) for 14 days.

**Group 5:** (High dose) received MEIR (400 mg/kg/day p.o.) and 99.9% ethanol (4 g/kg) with corn oil (10 ml/kg/day) for 14 days.

**Group 6:** (Silymarin control) received silymarin (100 mg/kg/day p.o.) and 99.9%ethanol (4 g/kg) with corn oil (10 ml/kg/day) for 14 days.

After 14 days of treatment with MEIR, 15th day blood is collected from retro orbital plexus puncture and rats were sacrificed and liver was collected immediately perfused with Phosphate Buffer Solution. Serum was separated by centrifugation. Serum is collected and assayed for Serum glutamate oxaloacetic transaminase (SGOT), Serum glutamate pyruvate transaminase (SGPT), direct bilirubin, total bilirubin, total proteins were assayed. The tissue homogenate lipid peroxidation, glutathione were assayed and then histopathological studies also carried out.

**Parameters evaluated in the study**

**Determination of wet liver weight**

Livers isolated from the animals were washed with alcohol, dried with filter paper strips, weighed on an electronic balance and were expressed with respect to their bodyweight i.e.gm/100 gm

**Determination of wet liver volume:**

After recording the liver weights weighing, the livers were individually dropped into measuring cylinder containing a fixed volume of distilled water and the volume displaced was recorded and expressed as ml/100g body weight.
The results section includes studies on acute toxicity and hepatoprotective activity of a compound. Each animal received a single dose of the compound (MEIR, 2000 mg/kg) by oral administration. No mortality was observed over a 14-day period. Dilutions of the maximum tolerable dose were used for further studies.

Hepatoprotective activity of MESUOL against paracetamol-induced hepatotoxicity was studied. The compound showed protective effects on physical parameters and serum biochemical parameters.

### Table 1: Effect of MEIR on Wet liver weight and Wet liver volume in Paracetamol-induced hepatotoxic rats.

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Wet liver weight (gm/100gm)</th>
<th>Wet liver volume (ml/100gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Normal</td>
<td>3.6±0.084</td>
<td>3.5±0.095</td>
</tr>
<tr>
<td>B</td>
<td>Paracetamol</td>
<td>4.6±0.083***a</td>
<td>4.67±0.092***a</td>
</tr>
<tr>
<td>C</td>
<td>MEIR alone</td>
<td>3.7±0.068***b</td>
<td>3.83±0.15***b</td>
</tr>
<tr>
<td>D</td>
<td>MEIR (LD)+Paracetamol</td>
<td>3.9±0.055**b</td>
<td>4.07±0.069***b</td>
</tr>
<tr>
<td>E</td>
<td>MEIR (HD)+Paracetamol</td>
<td>3.8±0.057***b</td>
<td>3.91±0.070***b</td>
</tr>
<tr>
<td>F</td>
<td>Silymarin</td>
<td>3.7±0.057***b</td>
<td>3.82±0.097***b</td>
</tr>
</tbody>
</table>

### Table 2: Effect of MEIR on SGOT, SGPT, Total bilirubin, Direct bilirubin, and Total protein levels in Paracetamol-induced hepatotoxic rats.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SGOT levels (U/L)</th>
<th>SGPT levels (U/L)</th>
<th>Total bilirubin (mg/dl)</th>
<th>Direct bilirubin (mg/dl)</th>
<th>Total protein (gm/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>140.5±5.92</td>
<td>93.93±2.97</td>
<td>0.25±0.019</td>
<td>0.29±0.058</td>
<td>9.53±0.122</td>
</tr>
<tr>
<td>Paracetamol</td>
<td>273.2±9.68***a</td>
<td>134.3±9.35***a</td>
<td>0.78±0.02***a</td>
<td>0.78±0.007***a</td>
<td>3.91±0.057***a</td>
</tr>
<tr>
<td>MEIR alone</td>
<td>130.5±9.67***b</td>
<td>93.10±6.76***b</td>
<td>0.35±0.016***b</td>
<td>0.26±0.009***b</td>
<td>9.42±0.14***b</td>
</tr>
<tr>
<td>MEIR (LD)+Paracetamol</td>
<td>240.2±7.87**b</td>
<td>100.2±8.72**b</td>
<td>0.64±0.049**b</td>
<td>0.63±0.068**b</td>
<td>7.86±0.250**b</td>
</tr>
<tr>
<td>MEIR (HD)+Paracetamol</td>
<td>174.7±6.30***b</td>
<td>87.15±6.30***b</td>
<td>0.37±0.018***b</td>
<td>0.33±0.022***b</td>
<td>7.75±0.194***b</td>
</tr>
<tr>
<td>Silymarin</td>
<td>161.2±3.88***b</td>
<td>76.23±6.20***b</td>
<td>0.35±0.039***b</td>
<td>0.27±0.032***b</td>
<td>9.13±0.036***b</td>
</tr>
</tbody>
</table>

### Table 3: Effect of MEIR on Glutathione and LPO in Paracetamol-induced hepatotoxic rats.

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Glutathione</th>
<th>LPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Normal</td>
<td>0.27±0.0007</td>
<td>43.75±7.089</td>
</tr>
<tr>
<td>B</td>
<td>Paracetamol</td>
<td>0.07±0.001***a</td>
<td>248.0±38.13***a</td>
</tr>
<tr>
<td>C</td>
<td>MEIR alone</td>
<td>0.17±0.008***b</td>
<td>71.69±7.645***b</td>
</tr>
<tr>
<td>D</td>
<td>MEIR (LD)+Paracetamol</td>
<td>0.16±0.007**b</td>
<td>183.0±14.25**b</td>
</tr>
<tr>
<td>E</td>
<td>MEIR (HD)+Paracetamol</td>
<td>0.25±0.009**b</td>
<td>75.53±14.33**b</td>
</tr>
<tr>
<td>F</td>
<td>Silymarin</td>
<td>0.24±0.011***b</td>
<td>70.97±13.24**b</td>
</tr>
</tbody>
</table>
Figure 1: Effect of MEIR on (A) Wet Liver Weight (B) Wet Liver Volume (C) SGOT (D) SGPT levels in Paracetamol induced Hepatotoxic rats.

Figure 2: Effect of MEIR on D.bilirubin (DB), T.proten (TP) levels in Paracetamol induced Hepatotoxic rats.

Figure 3: Effect of MEIR on LPO and Glutathione in Paracetamol induced Hepatotoxic rats.
Ethyl alcohol Induced Model

Physical parameters:

Wet liver weight and Wet liver volume:
Control group (Ethyl alcohol) treatment in rats resulted in enlargement of liver which was evident by increase in the wet liver weight and volume. The groups treated with MEIR 200 mg/kg showed better restoration. Silymarin 100 mg/kg and MEIR 400 mg/kg showed significant restoration of wet liver weight and wet liver volume nearer to normal.

Biochemical Parameters:

Rats treated with Control group (ethyl alcohol) developed a significant hepatic damage observed as elevated serum levels of hepatospecific enzymes like SGPT, SGOT, Bilirubin and Total Proteins, when compared to normal control. Pretreatment with MEIR 200mg/kg showed better protection. Silymarin (100 mg/kg) and MEIR 400 mg/kg showed good protection against paracetamol induced toxicity to liver. Significant reduction in elevated serum enzyme levels with MEIR treated animals compared to toxic control animals.

Total bilirubin and direct bilirubin:

Elevation of total bilirubin and direct bilirubin levels after administration of control group (ethyl alcohol) indicates hepatotoxicity. Pretreatment with MEIR at 400 mg/kg moderately reduced levels of total bilirubin. Pretreatment with Silymarin (100 mg/kg) and MEIR at (200 mg/kg) significantly reduced levels of total bilirubin when compared to toxic control group indicating Hepatoprotective effect.

Total protein:

Control group treatment has considerably reduced serum total protein levels. Pretreatment with MEIR 400 mg/kg moderately increased the level of total protein. Pretreatment with Silymarin (100 mg/kg) and MEIR 200 mg/kg had shown a significant increase in total protein level as compared with toxicant group.

Antioxidant parameters:

From the results it was found that rats treated with Ethyl alcohol group showed a marked decrease in activity of Glutathione when compared to normal control group. In the animals treated with MEIR at 200 mg/kg the activity of Glutathione had moderately increased when compared to toxicant group. Whereas, in animals treated with Silymarin (100 mg/kg) and MEIR (400 mg/kg) significant increase in the level of these enzymes was observed. In vivo lipid peroxidation study revealed that Ethyl alcohol treated group showed significant increase in Malondialdehyde (MDA) level when compared with normal control group. MEIR and silymarin were able to significantly prevent this raise in MDA level.

Histopathology:

Microscopic examination of normal liver, section studied shows liver parenchyma with intact architecture. The central vein, portal triad, perivenular and periportal regions found to be normal.

Microscopic examination of ETH induced liver, Section studied shows the perivenular and periportal regions show mixed inflammatory infiltrations. Some of the hepatocytes show apoptosis.

Microscopic examination of MEIR LD, MEIR HD, and Silymarin treated animal livers section studied shows liver
parenchyma with intact architecture, showing unremarkable, mild hepatocytic changes respectively.

### Table 4: Effect of MEIR on Wet liver weight and Wet liver volume in Ethyl alcohol induced hepatotoxic rats.

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Wet liver weight (gm/100gm)</th>
<th>Wet liver volume (ml/100gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Normal</td>
<td>2.92±0.02</td>
<td>2.83±0.08</td>
</tr>
<tr>
<td>B</td>
<td>Ethyl alcohol</td>
<td>4.70±0.06***</td>
<td>4.79±0.06***</td>
</tr>
<tr>
<td>C</td>
<td>MEIR alone</td>
<td>2.7±0.027**“b</td>
<td>2.8±0.028**“b</td>
</tr>
<tr>
<td>D</td>
<td>MEIR (LD)+ Ethyl alcohol</td>
<td>3.29±0.16** b</td>
<td>3.38±0.09** b</td>
</tr>
<tr>
<td></td>
<td>MEIR (HD)+ Ethyl alcohol</td>
<td>3.14±0.16*** b</td>
<td>2.94±0.05*** b</td>
</tr>
<tr>
<td>E</td>
<td>Silymarin</td>
<td>3.07±0.18*** b</td>
<td>2.84±0.03*** b</td>
</tr>
</tbody>
</table>

### Table 5: Effect of MEIR on SGOT, SGPT, T.bilirubin, D.bilirubin and T.Protien levels in Ethyl alcohol induced Hepatotoxic Rats.

<table>
<thead>
<tr>
<th>Treatment</th>
<th>SGOT levels (U/L)</th>
<th>SGPT levels (U/L)</th>
<th>Total bilirubin (mg/dl)</th>
<th>Direct bilirubin (mg/dl)</th>
<th>Total protein (gm/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>90.46±5.85</td>
<td>56.28±8.06</td>
<td>0.311±0.030</td>
<td>0.29±0.026</td>
<td>9.53±0.12</td>
</tr>
<tr>
<td>Ethyl alcohol</td>
<td>137.0±11.28***a</td>
<td>115.9±9.05***a</td>
<td>0.82±0.043***a</td>
<td>0.89±0.031***a</td>
<td>3.91±0.057***a</td>
</tr>
<tr>
<td>MEIR alone</td>
<td>130.5±9.67”b</td>
<td>93.10±6.76”b</td>
<td>0.34±0.016”b</td>
<td>0.26±0.008”b</td>
<td>9.42±0.14”b</td>
</tr>
<tr>
<td>MEIR (LD)+EA</td>
<td>128.2±9.90**b</td>
<td>67.3±12.00”b</td>
<td>0.62±0.057”b</td>
<td>0.65±0.082”b</td>
<td>7.86±0.259”b</td>
</tr>
<tr>
<td>MEIR (HD)+EA</td>
<td>70.98±10.6**b</td>
<td>51.8±8.007”b</td>
<td>0.44±0.029”b</td>
<td>0.38±0.034”b</td>
<td>7.75±0.194”b</td>
</tr>
<tr>
<td>Silymarin</td>
<td>82.98±5.88***b</td>
<td>57.7±6.43***b</td>
<td>0.38±0.014***b</td>
<td>0.30±0.028***b</td>
<td>9.13±0.036***b</td>
</tr>
</tbody>
</table>

### Table 6: Effect of MEIR on Glutathione and LPO in Ethyl alcohol induced hepatotoxic rats.

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
<th>Glutathione</th>
<th>LPO</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Normal</td>
<td>0.028±0.002</td>
<td>0.079±0.001</td>
</tr>
<tr>
<td>B</td>
<td>Ethyl alcohol</td>
<td>0.006±0.003***a</td>
<td>0.149±0.003***a</td>
</tr>
<tr>
<td>C</td>
<td>MEIR alone</td>
<td>0.271±0.007””b</td>
<td>0.093±0.001””b</td>
</tr>
<tr>
<td>D</td>
<td>MEIR (LD)+Ethyl alcohol</td>
<td>0.019±0.003**b</td>
<td>0.138±0.009**b</td>
</tr>
<tr>
<td>E</td>
<td>MEIR (HD)+Ethyl alcohol</td>
<td>0.025±0.005***b</td>
<td>0.125±0.004***b</td>
</tr>
<tr>
<td>F</td>
<td>Silymarin</td>
<td>0.027±0.001***b</td>
<td>0.078±0.011***b</td>
</tr>
</tbody>
</table>

Figure 5: Effect of MEIR on (A) Wet Liver Weight, (B) Wet Liver Volume, (C) SGPT, (D) SGOT levels in Ethyl alcohol induced Hepatotoxic rats.
**Figure 6**: Effect of MEIR on (E) T.Bilirubin, (F) D.Bilirubin, (G) T.Protein levels in Ethyl alcohol induced hepatotoxic rats.

**Figure 7**: Effect of MEIR on LPO and Glutathione levels in Ethyl alcohol induced hepatotoxic rats.

**Figure 8**: Histopathology of ethyl alcohol induced hepatotoxicity (A) NORMAL (B) DRUG ALONE (C) ETH ALONE 4g/kg (D) MEIR LD (E) MEIR HD (F) SILYMARIN
CONCLUSION

Hepatoprotective activity:
The hepatoprotective effect of MEIR was confirmed by the following parameters:
The isolated livers from the toxicant treated animals exhibited increase in their physical parameters like wet liver weight and wet liver volume. Indeed, animals treated MEIR showed decrease in the values of above physical parameters which is an indication of hepatoprotection.

Biochemical parameters:
In case of toxicant treated groups there will be rise in serum marker enzymes such as SGPT, SGOT, total bilirubin and decrease in the level of total protein. The same is observed in liver diseases in clinical practice and hence are having diagnostic importance in the assessment of liver function.
In the present study, treatment with MEIR significantly reduced the toxicant elevated levels of above mentioned serum marker enzymes and increase in the levels of total protein. Hence, at this point it is concluded that the MEIR possess hepatoprotective activity.

Antioxidant enzymes: In case of toxicant treated groups there will be decrease in enzyme activities such as SGPT, SGOT, total bilirubin and decrease in the level of total protein. Indeed, animals treated MEIR showed decrease in the values of above mentioned serum marker enzymes and increase in the levels of total protein. Hence, at this point it is concluded that the MEIR possess hepatoprotective activity.

Histopathological studies: In toxicant treated animals there will be severe histopathological disturbances in the cytoarchitecture of the liver. The same is observed in case of humans who are suffering from major liver disorders. In the present study animals treated with MEIR under study exhibited minimal hepatic derangements and intact cytoarchitecture of the liver was maintained, indicating hepatoprotection.

Based on improvement in serum marker enzyme levels, physical parameters, Antioxidant parameters, and histopathological studies, it is concluded that the MEIR possesses hepatoprotective activity and thus supports the traditional application of the same under the light of modern science. The whole plant extract have been reported to exhibit chemopreventive and antioxidant activity. Under the present experimental results suggest that MEIR may have future clinical application after further studies.

Acknowledgement
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REFERENCES