

## Comparative Efficacy of Seed Extract of *Tamarindus indica* and Vitamin E on the Liver Weight of Long Evan's Rats Intoxicated with Paracetamol

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### Abstract

**Background:** *Tamarindus indica* is an antioxidant rich plant. It has therapeutic interest in drugs and xenobiotics induced liver damage. **Objective:** This study was aimed to explore the effectiveness of ethanolic extract of seed of *Tamarindus indica* on liver weight when liver is intoxicated with paracetamol and to compare it with the effects of Vitamin E, a known hepatoprotectant. **Materials and method:** A total of twenty four Long Evan's rats were collected and divided into four groups. Each group having six rats ( $n=6$ ). Control group received normal diet ad libitum, only paracetamol group received paracetamol (1500 mg/kg) for 12 days and rest two groups received paracetamol (1500 mg/kg) along with ethanolic extract of seed of *Tamarindus indica* (1250 mg/kg) and vitamin E (500 mg/kg) for 12 days respectively. On 13th day, all rats were sacrificed. Then livers were collected and weighed by an electronic balance. **Results:** In this study, the mean ( $\pm$ SD) liver weight was  $4.08\pm 0.23$  in control group,  $6.27\pm 0.68$  in only paracetamol treated group,  $5.22\pm 0.72$  and  $4.57\pm 0.86$  in paracetamol along with seed extract of *Tamarindus indica* and vitamin E treated group respectively. **Conclusion:** The present study showed that mean ( $\pm$ SD) weight of liver increased with paracetamol and decreased with seed extract of *Tamarindus indica* which is similar to the effects of vitamin E.

**Keywords:** *Tamarindus indica*; Vitamin E; Paracetamol; Liver weight.

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### Introduction

Liver is the organ of pre-eminent importance. Liver disease accounts for approximately 2 million deaths per year worldwide, 1 million due to cirrhosis and 1 million due to viral hepatitis and hepatocellular carcinoma.<sup>1</sup> Various drugs and

chemicals like methyl dopa, halothane, paracetamol, carbon tetrachloride, ethanol, thiacetamide, etc. can also be injurious to liver cell.<sup>2</sup> Rimonabant, propylthiouracil, corticosteroid are used to treat liver disease and

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cause serious side effects such as insomnia, vomiting, constipation and depression.<sup>3</sup> Due to inaccessibility of treatment and numerous side effects, people in developing countries are increasingly embracing the use of medicinal plants to treat liver pathologies.<sup>4</sup>

*Tamarindus indica*, a largely growing tree, belongs to the family Caesalpiniaceae. It serves as a proverbial herbal medicine in each and every part of the world. Its fruit, leaves, seeds, stem, bark have been used as traditional medicine. Tamarind possesses antibacterial, antidiabetic, antifungal, anti-inflammatory, antimalarial, antioxidant and hepatoprotective activities.<sup>5</sup> Studies have shown that *Tamarindus indica* contains flavonoid, ascorbic acid and beta-carotene.<sup>6</sup> These compounds are responsible for reducing liver weight which is increased by hepatotoxic agents.<sup>7,8</sup> Hepatoprotective effect of vitamin E is proved for a long time. Several studies were done on hepatoprotection caused by plant extracts and their effects were compared with this known hepatoprotective agent.<sup>9,10</sup> The present study was chosen to measure the effect of ethanolic extract of seed of *Tamarindus indica* on liver weight where liver was intoxicated with paracetamol, an over the counter (OTC) drug and thus to evaluate hepatoprotection and compare it with that of vitamin E.

## Materials and Method

### (a) Drugs and Chemicals

Paracetamol powder was obtained from Kumudini Pharmaceuticals Ltd., Bangladesh. Propylene glycol was used as solvent for paracetamol powder. Vitamin E solution was collected from Drug International Ltd., Bangladesh.

### (b) Collection of Plant Materials

The seeds of *Tamarindus indica* were collected from Sirajgonj and identified by plant taxonomy unit of Bangladesh National Herbarium with accession no. DACB-35524, which was deposited to the Herbarium.

### (c) Preparation of Plant Extracts

The seeds were shade dried and pulverized into fine particles by electric grinder machine. The powder was kept in an airtight plastic container. Then they were immersed in 95% ethanol. The extract so obtained was condensed at 40-50°C until a paste was formed in a vacuum rotatory evaporator. Extract paste was freeze dried. Then they were kept in the refrigerator for further use.

### (d) Animals

A total of twenty four Long Evan's rats (150-180gm) were used for this study. The rats were collected from ICDDR'B. They were kept in a well ventilated room in the animal house of Dhaka Medical College. A 12 hour light/12 hour dark cycle was maintained. They were allowed free access to food and water ad libitum. Ethical clearance for the use of animals was obtained from the committee constituted for the purpose.

### (e) Grouping of Animals

Twenty four rats were organized into four groups randomly. Each group consisted of six rats (n=6). Control group received normal diet ad libitum. Only Paracetamol group received paracetamol (1500mg/kg) for 12 days and another two groups received paracetamol (1500mg/kg) along with ethanolic extract of seed of *Tamarindus indica* (1250mg/kg) and vitamin E (500mg/kg) for 12 days respectively.

### Collection of Liver

After 24 hours of last treatment, all rats were sacrificed with light chloroform anesthesia. Then livers were separated and cleared with water, dried with tissue paper. They were properly weighed by an electronic balance. Then they were fixed in 10% formalin.

### Statistical Analysis

The values were expressed as mean ( $\pm$ SD). The statistical analysis was carried out by student's 't' test and  $p < 0.05$  was considering as significant.

## Results

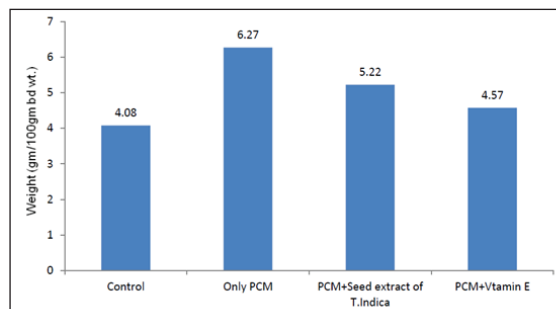
In this study, the mean ( $\pm$ SD) liver weight was  $4.08 \pm 0.23$  in control group,  $6.27 \pm 0.68$  in only paracetamol group,  $5.22 \pm 0.72$  and  $4.57 \pm 0.86$  in paracetamol along with ethanolic extract of seed of *Tamarindus indica* and vitamin E treated group respectively (Table I). In rats treated with only paracetamol, liver weight increased significantly as compared to control group. Significant decrease in liver weight was observed following administration of ethanolic extract of seed of *Tamarindus indica* and vitamin E along with paracetamol. There was no significant difference between seed extract of *T. indica* and vitamin E (Table II).

**Table I: Liver weight of rat of different groups**

Groups	Liver weight (gm/100gm body weight) Mean ( $\pm$ SD)
Control	$4.08 \pm 0.23$
Only Paracetamol (1500 mg/kg)	$6.27 \pm 0.68$
Paracetamol (1500 mg/kg) + seed extract <i>T. indica</i> (1250 mg/kg)	$5.22 \pm 0.72$
Paracetamol (1500mg/kg) + Vitamin E (500 mg/kg)	$4.57 \pm 0.86$

**Table II: Comparison of liver weight of rat of different groups**

Groups	p value	Level of significance
Control vs Only Paracetamol	$p < 0.001^{***}$	Highly significant
Control vs Paracetamol with <i>T. indica</i> seed extract	$p > 0.1$	Not significant
Control vs Paracetamol with vitamin E	$p > 0.1$	Not significant
Only Paracetamol vs Paracetamol with <i>T. indica</i> seed extract	$p < 0.05$	Significant
Only Paracetamol vs Paracetamol with vitamin E	$p < 0.01$	Significant
Paracetamol with <i>T. indica</i> seed extract vs PCM with vitamin E	$p > 0.1$	Not significant



**Fig. 1: Bar diagram showing mean ( $\pm$  SD) liver weight of different groups of rats**

## Discussion

In this study, paracetamol intoxicated group gained liver weight. Seed extract of *Tamarindus indica* reduce increased liver weight of rat which is similar to effects of vitamin E and nearer to control group. These findings are in agreement with previous works on various extracts against paracetamol toxicity.<sup>6,8</sup>

Paracetamol is the most commonly used antipyretic and analgesic. It is safe at therapeutic dose. Overdose is to be associated with inflammation marked by an increase in inflammatory cytokines, tumor necrosis factor- $\alpha$  (TNF- $\alpha$ ) and interleukin.<sup>11</sup> In liver microsomes, a small percentage of paracetamol (5-10%) is converted by cytochrome p450 into a reactive metabolite, N-acetyl-parabenzoquinone imine (NAPQI), that is related to paracetamol hepatotoxicity. If paracetamol is ingested at hepatotoxic dose, massive presence of NAPQI causes mitochondrial glutathione (GSH) depletion and the formation of protein adducts.<sup>12</sup> This event results in generation of reactive oxygen species (ROS) including  $H_2O_2$ , superoxide anion ( $O_2^-$ ), hydroxyl ( $OH^-$ ) radical that affect liver cell membrane with a consequent cellular swelling, karyolysis, vacuolization and the loss of cellular elements and cause hepatocytes necrosis.<sup>3</sup>

Tamarind seed extract rich in procyanidin prevents the activation of T & B cells in the liver, macrophages and inflammatory mediators such as TNF- $\alpha$ , IL-1 and IL-6. It significantly inhibits the burst of oxidation in the liver.<sup>13</sup> Tamarind seed extract also contains several polyphenolic compounds that provides antioxidant activity.<sup>14</sup> Therefore, it reduces inflammation of cells and fatty changes. Vitamin E acts as a hepatoprotectant due to its antioxidant property that is buried in its structure.<sup>15</sup> *Tamarindus indica* is a well known plant for its fruit and leaves. It has a significant protective effect on renal complications that are associated with hyperglycemia and boosts the immune system as well.<sup>16</sup> In this study, it is very clear that tamarind seed extract reduces swelling of liver cell and abnormal liver weight, normalizes liver architecture and causes hepatoprotection.

## Conclusion

This study shows that tamarind seed extract decreases liver swelling by its ability to decrease oxidative stress and thus reduces weight of liver. Further researches should be done for better application of tamarind seed as a liver disease therapy.

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