



EVALUATION OF LIVER FUNCTIONS WITH *MORINGA OLEIFERA* LEAF EXTRACT IN CADMIUM INDUCED ADULT WISTAR ALBINO RATS

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ABSTRACT: Cadmium (Cd) is one of the naturally occurring metallic toxicants, affecting various organs. Liver is one of the organs affected by Cd toxicity (acute & chronic exposure). Disruption of the cellular antioxidant system, generation of reactive oxygen species & oxidative stress, etc., are one of the few mechanisms by which cadmium affects the liver. Herbal plants, like, *Moringa oleifera*, whose health & nutritional benefits like, antioxidant, anti-inflammatory properties, etc., are well documented in a number of scientific literatures, have been used to combat toxicity of these materials. The present study was done to find out the effect of aqueous leaf extract of *Moringa oleifera* on liver functions in cadmium exposed adult wistar rats. Male wistar albino rats were divided into four groups & group I was taken as the control. Pre-treatment with *Moringa* leaf extract in cadmium exposed rats showed a significant decrease in the levels of AST (aspartate aminotransferase) & ALT (alanine aminotransferase) as compared to the cadmium alone treated rats. Therefore, the present study suggests that pre-treatment with *Moringa oleifera* leaf extract alters the levels of the liver enzymes & hence can improve the liver functions in cadmium chloride induced rats. However, further studies have to be done to find out the detailed mechanisms of this beneficial effect of *Moringa* on the liver functions.

Keywords: Cadmium, *Moringa oleifera*, liver, AST, ALT.

INTRODUCTION

Cadmium is a transitional metal [1] with varying degrees of solubility, absorption & toxicity [2]. It binds to various biological components, like, proteins & non-protein sulfhydryl groups, macromolecules, metallothionein, etc., [3]. Cadmium toxicity, often leads to various clinical conditions, like, renal & hepatic dysfunctions, bone diseases [4], osteomalacia & osteoporosis, hypertension, arteriosclerosis, anaemia, cancer, etc., [5-7]. The liver injury is a form of acute toxicity of cadmium [8]. *Moringa oleifera* is the most widely distributed species of the Moringaceae family throughout the World, especially in Asian countries, having a remarkable range of pharmacological properties in addition to significant nutritional value & hence have been scientifically evaluated for its possible medicinal applications [9].

Review of literature

Exposure to cadmium occurs in human-beings mainly by two routes, inhalation & ingestion. Absorption of cadmium also occurs through skin but it is relatively insignificant [8]. Cadmium induces peroxidation, caused by the release of free oxygen radicals [10] which cause the stimulation & also destruction of sensitive macromolecules & tissues [11]. Liver diseases, a public health problem, remain a major global concern even today, as it still has extremely poor prognosis & a high mortality rate, despite remarkable advances in the field of modern medicine [12]. The liver, which is also affected by cadmium toxicity, is mostly damaged by apoptosis & necrosis [13]. Various studies to find out new effective medicines, without side effects, for treating liver diseases are still on-going. Natural remedies, mainly from traditional plants are found to be both effective & safe alternatives for the treatment of hepatotoxicity. Extracts from plant sources have also been investigated for hepato-protective & antioxidant effects against liver damage [14, 15]. *Moringa oleifera* is one of the herbal plants with a wide range of medicinal applicability.

The leaves are a source of protein, β -carotene, vitamins (A, B, C, E, riboflavin), nicotinic acid, folic acid, pyridoxine, amino acids, minerals, various phenolic [16,17], with a known powerful antioxidant property [18]. Previous studies in male rats have demonstrated the hepato-protective effects of extracts from different parts of *Moringa oleifera* against liver damage [19, 20]. But, the anti-hepatotoxic nature of *Moringa oleifera* leaves against cadmium induced liver injury in rats has not yet been demonstrated.

Therefore, the present study was designed to determine the effect of leaf extract of *Moringaoleifera* on liver damage caused by cadmium toxicity, by measuring the levels of AST (aspartate aminotransferase) & ALT (alanine aminotransferase), in the experimental animals.

MATERIALS AND METHODS

The chemicals used for the biochemical assay were obtained from Durga Laboratories, Mangalore, Karnataka, India. The study was conducted in the year (2011-2012). All experimental procedures & maintenance of the animals were confined to the strict guidelines of the Institutional Ethics Committee and to that of Federal laws for the use of animals, in the experiment.

Plant materials

Samples of *Moringa oleifera* leaves were collected from the plantations in & around Mangalore, Karnataka, India. They were also identified & authenticated by a plant taxonomist.

Preparation of extract

The leaves of the plant were cleaned thoroughly. They were then dried in room temperature & crushed into coarse powder. About 20 g of powder was taken & soaked separately in 100 ml of water & chloroform by keeping it in a Shaker for 3 days. It was filtered through cheese cloth and reduced to 10% of its original volume (organic solvent). Then, using a rotary evaporator, the filtrate was concentrated in vacuum, while aqueous extract was dried using water bath. The extract preparation was carried out in Yenepoya Medical College, Yenepoya University, Mangalore, Karnataka, India [21].

Experimental animals

Adult male *Wistar Albino* rats, weighing between (180-200) g were obtained from the animal house of Kasturba Medical College (KMC), Manipal University (MU), Mangalore, Karnataka, India. The ethical approval was taken from its Institutional Animal Ethical Committee (IAEC). The experimental animals were housed in the Institutional Experimental Animal Laboratory. They were having free access to food (standard diet) & water. The duration of administration was ten days.

Experimental design

Moringaoleifera leaf extract (aqueous) was used. A total of twenty four (24) adult male *Wistar Albino* rats of (180-200) g were taken into the study. They were then broadly divided into four (4) groups, with six (6) animals in each group, as follows:

Group i - control group, received normal saline only.

Group ii - experimental control group, pre- treated (oral) with *Moringa oleifera* leaf extract, (100 mg/kg/bw) for 10 days.

Group iii - received a single oral dose of cadmium chloride (10 mg/kg/bw).

Group iv - pre - treated with *M. oleifera* leaf extract (100 mg/kg/bw) for 10 days, followed by cadmium chloride (10 mg/kg/bw) given orally for one day.

Biochemical estimation

Using 23 G needles, 2 ml of blood was collected directly via cardiac puncture, under aseptic precautions. To study the liver functions, SGOT (serum glutamic oxaloacetic transaminase) /AST (aspartate aminotransferase) & SGPT (serum glutamic pyruvic transaminase) /ALT (alanine amino transferase) levels in the serum were assayed using spectrophotometer [22].

Statistical analysis

The data were expressed as means \pm SD from 6 animals per group. The differences between the groups were compared for statistical significance by using the student 't' test. $p < 0.05$ was taken as significant.

RESULT

Table 1, shows the effect of *Moringa oleifera* leaf extract on AST & ALT levels in cadmium induced *Wistar Albino* rats as compared to the other groups. The AST & ALT levels in the control group are 42.46 ± 0.65 & 39.25 ± 0.85 respectively. The AST & ALT levels were significantly increased ($p < 0.0001$) in group ii (75.39 ± 0.63 , 59.81 ± 0.55) & group iii (138.28 ± 1.28 , 121.98 ± 0.57) as compared to group i, whereas group iv showed a significant decrease ($p < 0.0001$) in AST (110.13 ± 0.38) & ALT (72.54 ± 0.56) levels, as compared to cadmium alone exposed group.

Table 1: Effect of aqueous leaf extract of *Moringaoleifera* on AST & ALT in cadmium induced Albino Wistar rats (values are expressed as Mean \pm SD)

Groups	Number of animals (n)	AST (IU/L)	ALT (IU/L)
i	6	42.46 \pm 0.65	39.25 \pm 0.85
ii	6	75.39 \pm 0.63 ***	59.81 \pm 0.55***
iii	6	138.28 \pm 1.28***	121.98 \pm 0.57***
iv	6	110.13 \pm 0.38***	72.54 \pm 0.56***

AST: Gr.i vs Gr.ii, Gr.iii, Gr.iv, Gr.ii vs Gr.iii, Gr.iv, Gr.iii vs Gr.iv - ***p< 0.0001

ALT: Gr.i vs Gr.ii, Gr. iii ,Gr.iv, Gr.ii vs Gr.iii, Gr.iv, Gr.iii vs Gr.iv -***p <0.0001

DISCUSSION

Exposure to cadmium is well known to induce a variety of toxicity symptoms. In the present study, elevation in the levels of plasma AST & ALT indicates liver damage [23]. Generally, the liver is one of the critical target organs of cadmium toxicity. Cadmium induced necrosis in the liver can cause release of abnormal quantities of L-ALT & L-AST into the blood [24]. A significant decrease in the plasma levels of AST & ALT activities in the animals pre-treated with *Moringa oleifera* leaf extract prior to the administration of cadmium probably is an indication of protective effect of *Moringa oleifera* on liver damage induced by cadmium [24]. However, our study also showed an increase in the plasma AST & ALT levels in the *Moringa oleifera* alone treated group, which reveals that the leaf extract of this plant has a toxic effect on the liver by itself, as in accordance with the previous studies [25].

CONCLUSION

Though the leaf extract of this plant induced a negative effect on the liver, the present study showed that it has the potential to reduce cadmium induced liver toxicity. The greater potency of *Moringa oleifera* leaf extract against cadmium could be due to the antioxidant/ chelating property [26]. Thus our study recommends that pre-treatment with *Moringa oleifera* leaf extract might be useful to a major extent in reducing the toxicity in the population exposed to cadmium.

Further studies are required to investigate the detailed mechanisms triggering these effects.

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