ISSN NO. 2320-5407

Journal homepage:http://www.journalijar.com

INTERNATIONAL JOURNAL OF ADVANCED RESEARCH

RESEARCH ARTICLE

Effect of *Moringaoleifera* leaf extract on cadmium induced renal toxicity in adult Wistar Albino rats

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Manuscript Info

Manuscript History:

Received: 14 June 2013
Final Accepted: 24 June 2013
Published Online: July 2013

Key words:
Cadmium,
Moringaoleifera,
kidney, urea, creatinine.

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Abstract

Cadmium (Cd), a transitional metal, is an important industrial & environmental toxicant, adversely affecting various organs like liver, lungs, pancreas, testis, kidneys, etc., It has been found to cause a definitive oxidative stress on the kidneys of studied rats. *Moringaoleifera*, a perennial softwood herbal plant, having anti-oxidant, anti- inflammatory properties, etc., which has been advocated for centuries for its nutritional, medicinal & industrial uses, is most oftenlyused to combat toxicity of these materials.The present study was designed to find out the effect of aqueous leaf extract of *Moringaoleifera*on kidney functions in cadmium exposed adult wistar rats. Four groups were allotted, with group I being the control. Pre-treatment with *Moringaoleifera*leaf extract in cadmium exposed rats showed a significant decrease in the levels of serum urea&serum creatinine levels as compared to the cadmium alone treated rats. Therefore, the present study suggests that pre-treatment with *Moringaoleifera*leaf extract improves the kidney functions which were affected by the toxic effect of cadmium. However, further investigations are needed to know the detailed mechanisms triggering these effects.

1. Introduction

The process of industrialization has resulted in an increase in the concentration of hazardous materials that are leading to environmental toxicity. Cadmium - a metal, which is one of these environmental pollutants, accumulates mainly in the kidney, the primary site of its toxicity(Singh et al., 2010). Herbal supplements are a natural & very effective method to combat toxicity of these hazardous materials. One such important herb is *Moringaoleifera*, which has nutritional, pharmacological &antioxidant properties with a wide range of health benefits& hence extracts from various parts of this plant have been used in traditional & folk medicine to treat a wide variety of conditions(Sharma & Singh, 2010).

1.1Review of literature

Cadmiumis a nephrotoxic heavy metal with a long biological half-life of about (15-30) years & is known to accumulate in humans(Singh et al., 2010). Nephrotoxicity can be defined as renal dysfunction that arises as a direct result on exposure to external agents like drugs, environmental chemicals, etc.,(Kore et al., 2011).Serum creatinine (a blood measurement) is an important indicator of renal health(http://www.medicinenet.com/creatinine blood test/article.htm).It is chiefly filtered out of the blood by the kidneys. Therefore, measuring serum creatinine levels is a simple & the most common test used as an indicator of renal function (Taylor & Horward, 1989).Urea which is a water soluble substanceis an end product of protein metabolism& is carried away by the blood stream. Increase in the levels of blood urea has been observed during a variety of renal disorders(Meyer & Hostetter,

2007).Thus, the increased concentrations of serum urea & creatinine could be used as indicators of nephrotoxicity (Pagana, 1998).According to Agency for Toxic Substance &Disease Registry (ASTDR) survey, cadmium has been listed as number seven in its top twenty list of hazardous materials(ASTDR draft, 1989).The risk of human exposure to cadmium is constantly increased as it is not degraded in the environment & hence enters into the food chain(ASTDR draft, 2005). Though cadmium exposure in humans occurs by absorption through the skin, inhalation & ingestion are the two main routes(Mead, 2010).Cadmium toxicity is associated with several clinical complications, like, hepatic dysfunctions, bone diseases, renal dysfunctions, etc.,(Jarup et al., 2000).Though previous study has shown that chronic cadmium exposure causes irreversible kidney damage&renal tubular dysfunction,the mechanism is still not clear(Horiguchi et al., 2006).Apoptosis of the proximal tubular cells induced by cadmiummay be connected with oxidative stress as cadmium has been found to increase cellular reactive oxygen species (ROS)&lipid peroxidation levels& also alter glutathione peroxidase (GSH) levels in many cell types(Oh & Lim, 2006).*Moringaoleifera*, a miracle tree, grown widely in various parts of the world, is known to possess various medicinal properties likeanti-pyretic, anti-inflammatory, anti-cancer, anti-ulcer, etc., The antioxidant &/or free radical scavenging property of*Moringaoleifera*may be due to the presence of phenolic compounds(Paliwal et al., 2011). Extracts from different parts of this plant have been extensively used over the years for treating inflammation**,** cardiovascular malfunctions, haematological, hepatic & renal diseases, etc.,(Goyal et al., 2007, Mahajan& Mehta, 2008, Mazumder et al., 1999). Researches have shown the various dose dependent effects of leaf extracts of *Moringaoleifera* on kidneys in rats(Josephine et al., 2012). But, the effect of *Moringaoleifera*leaf extract oncadmium induced kidney damage in rats has not yet been studied.

Therefore, the present study was undertaken to determine the effectsof Moringa*oleifera*leaf extract on kidney damage caused by cadmium toxicity, by measuring the blood urea &creatinine levels in rats.

2. Materials & Methods

The study was conducted in the year (2011-2012). For the biochemical assay, the chemicals were obtained from Durga Laboratories, Mangalore, Karnataka, India. Strict guidelines of the Institutional Ethics Committee and Federal laws for the use of animals were followed for all the experimental procedures &also for the maintenance of the animals.

2.1 Plant materials

This was an experimental study that usedsamples of *Moringaoleifera*leaves, which were collected from the plantations in Mangalore, Karnataka, India. The plant was also identified & authenticated by a plant taxonomistwho confirmed the kingdom, family &species of the *Moringaoleifera*.

2.2 Preparation of extract

The leaves of the plant were cleaned thoroughly, dried in room temperature & then crushed into coarse powder. About 20 g of powder was taken. It was soaked separately in 100 ml of water & chloroform by keeping it in a Shaker for 3 days & then filtered through cheese cloth &reduced to 10% of its original volume (organic solvent). After that, using a rotary evaporator, the filtrate was concentrated in vacuum &using water bath, the aqueous extract was dried. The preparation of the extract was carried out in Yenepoya Medical College, Yenepoya University, Mangalore, Karnataka, India(Mukherjee, 2002).

2.3 Experimental animals

Adult male *Wistar Albino* rats, of (180-200) g weights were taken into this study. They 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). All the experimental animals taken in this study were housed in the Institutional Experimental Animal Laboratory &were having free access to food (standard diet) & water. The duration of the study was for ten days.

2.4 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 &then broadly divided into four (4) groups. Each group consisted of six (6) animals. The study was designed as follows:

Group i - control group, received normal saline only.

Group ii - experimental control group, pre- treated (oral) with *Moringaoleifera*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 *Moringaoleifera*leaf extract (100 mg/kg/bw) for 10 days, followed by cadmium chloride (10 mg/kg/bw) given orally for one day.

2.5 Biochemical estimation
Using 23 G needles, 2 ml of blood was collected directly via cardiac puncture, under aseptic precautions. To evaluate the kidney functions, serum urea &creatinine levels were estimated using standard assay kits following diacetyl-monoxime& alkaline-picrate methods respectively(Saka et al., 2012).

2.6 Statistical analysis
The data were expressed as means ±SD from 6 animals per group. Statistical significance between the groups taken into the study was analysed by using the student't' test. $p<0.05$ was taken as significant.

3. Result

Table 1: Effect of aqueous leaf extract of Moringaoleiferaon blood urea &creatininelevels in cadmium induced Albino Wistar rats (values are expressed as Mean ± SD)

Groups	Animals	Urea (mg/dl)	Creatnine (mg/dl)
i	6	17.79±0.51	0.57±0.02
ii	6	16.69±0.51***	0. 46±0.01***
iii	6	19.67±0.53 ***	0.76±0.02 ***
iv	6	17.9 ± 0.59 ***	0.62± 0.015***

Urea: Gr.ivsGr.ii, Gr.iii, Gr.iivsGr.iii, Gr.iv, Gr.iiivsGr.iv - ***p< 0.0001
Creatinine: Gr.ivsGr.ii, Gr. iii ,Gr.iivsGr.iii, Gr.iv, Gr.iiivsGr.iv - ***p <0.0001

The results depicted in Table 1 shows a significant increase (p< 0.0001) in the levels of serum urea (19.67 ±0.53) &creatinine (0.76±0.02) after cadmium exposure as compared to the normal (urea-17.79±0.51, creatinine-0.57±0.02) & experimental control (urea-16.69±0.51, creatinine-0.46±0.01) groups.But the group which received pre-treatment with *Moringaoleifera*leaf aqueous extract before cadmium exposure, showed a significant decrease(p< 0.0001) in the levels of urea (17.9±0.59) &creatinine (0.62± 0.015) as compared to the group which was exposed to cadmium.

4.Discussion

Our body is always exposed to toxic compounds from various environmental pollutants. The toxicity induced by these metallic toxicants is occasionally responsible for renal complications. Exposure to cadmium can lead to the absorption of this metal in large quantities & produce toxic actions on the organism(Veronica et al., 2012). The present study was attempted to find out the protective effect of *Moringaoleifera* leaves on kidneys in cadmium toxicity. Our findings showed that cadmium exposure increases the serum urea &creatininelevels, indicating that cadmium has a toxic effect on the kidneys, as is in accordance with previous study(Obianime& Roberts, 2009). Pre-treatment with aqueous leaf extract of*Moringaoleifera*prior to the cadmium exposure reduced the serum urea &creatinine levels significantly. The protective effect may be due to the fact that the leaves of this plant are a good source of phenolic compounds, β carotene(Sharida et al., 2012), etc.,though the actual mechanism of action may be more complex & multifaceted. Previous study has shown a time & dose dependent relationship of *Moringaoleifera* leaf extract on kidney functions(Josephine et al., 2012). However, our study in which aqueous leaf extract of *Moringaoleifera* at a dose of 100 mg/kg body weight was given for 10 days did not show any increase in the levels of serum urea &creatinine. This might be due to the change in duration & dosage pattern of the aqueous leaf extract of *Moringaoleifera*.

5. Conclusion

Therefore, the results of the present study reveal that the aqueous leaf extract of *Moringaoleifera*could act against cadmium induced kidney injury in rats. Further research should be done to investigate the complex& multifaceted mechanisms triggering these protective effects.

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