



EFFECT OF *OPUNTIA ELATIOR* ON ALTERATIONS IN GLUTAMATE PYRUVATE TRANSAMINASE ACTIVITY INDUCED BY GAMMA RADIATION IN SWISS ALBINO MICE

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ABSTRACT

Objectives: Radiotherapy has side effects on the health by affecting body systems and also by increasing susceptibility to some diseases. Glutamate pyruvate transaminase activity increases in the kidney of irradiated mice after irradiation. *Opuntia elatior*, an edible herb, is tested in this study for its ameliorating effects on radiation induced alterations in mice kidney GPT activity.

Methods: Effect of *O. elatior* stem extract (OEE) was observed on the GPT activity in kidney of Swiss albino mice irradiated to a dose of 6 Gy of gamma radiation, 10 mg/kg body weight dose of OEE and both the treatments to record Glutamate pyruvate transaminase (GPT) activity alterations in mouse kidney. The animals were sacrificed at days 1, 3, 5, 10, 15, and 30 post-irradiation. Glutamate pyruvate transaminase activity was measured quantitatively by the altered method of *Henery et al.*, 1974.

Results: The GPT activity was normal in the mice without any treatment and increased in the irradiated group, lowered in only plant extract-treated group found increase in GPT activity after irradiation was decreased OEE pretreatment in the in OEE with irradiated group, normal GPT activity was achieved till day 30 after-treatment. Therefore, *O. elatior* controlled radiation-induced alterations in GPT activity.

Conclusion: OEE reduced the radiation induced toxicity. Products of plant origin usually do not cause their ill effects on body's physiological processes; OEE is found useful in managing GPT activity. As OEE is an edible plant, it is easy to use as a cure and it is also found to regulate Glutamate pyruvate transaminase activity in kidneys of mice.

Keywords: *Opuntia elatior* extract, Gamma irradiation, Glutamate pyruvate transaminase activity, Kidney, Mouse.

1. INTRODUCTION

Along with the increasing uses of radioactivity, harmful effect of radioactive substances and rays produced during this process became more familiar. Simultaneously their disadvantages were also observed. "In the middle of 20th century, search to prevent and treat harmful effects of various types of radiations started. The chemically synthesized radio protectors like amino thiols bear high toxicity than other chemical protectors (Weiss & Landauer, 2003; Rades *et al.*, 2004)^{1,2}. Earlier studies concentrated on sulfhydryl compounds and other chemical products but these compounds also have toxicity at the effective dose. (Jagetiya and Baliga, 2005; Weiss and Landauer, 2009)^{3,4}. Therefore, various plant products were tested for their radio protective activity. They scavenge free radicals acclimatizing the antioxidant defense mechanism by control of the genes which are accountable for antioxidant properties (Jagetiya, 2007)⁵. Search deviated to the natural substances like plants and their products. In the nineties and after that extensive screening was done to obtain effective and nontoxic (less toxic) radioprotectors.

As there is massive diversity of flora, there are chances of evolving effective radioprotective agents from these bioactive compounds. Vicenin, Oreintin, Kaempferol, Quercetin, Myricetin, Rutin etc. are plant products that are proven radioprotectors. (Yasushi *et al.*, 2018)⁶. Oral dose of methanolic extract of *Leptopus cordifolium* leaves (150 and 250 mg/kg dose) significantly cured GPT enzyme activity which is modified in allaxon induced diabetic mice. (Rahman *et al.*, 2021)⁷. It has been reported that certain species of *Opuntia* have polyphenolic products which are potent radio protectors in mice/rats. The chemical analysis of the *Opuntia* fruit showed the presence of carbohydrates, phenolics, betalains and flavonoids etc. GOT enzyme activity in kidney was protected by *Opuntia elatior* extracts in ethanol and acetone both, against gamma radiation in GPT activity in kidney of Swiss albino mice (Poonia & Sharma, 2020)⁸. One more sps of *Opuntia* was analyzed by Dabadi *et al.*, (2021) that is *Opuntia humifusa* for its Phytochemical and pharmacological aspects also support this study.⁹ Sharada and Acharya (2022) reviewed *Opuntia elatior* Mill. – For its Phytochemistry and pharmacological properties *Opuntia elatior* Mill.¹⁰ Phytochemicals and Pharmacological Activities were studied in *Opuntia ficus-indica* Fruit by Luis Giraldo-Silva *et al.*, (2023)¹¹.

2. METHODS

Mus musculus norvegicus, commonly called Swiss albino mouse, were taken from colony developed in the laboratory, in University of Rajasthan, Jaipur's zoology department. They were maintained under standard conditions of food and water and weighing 25±2 gram, their age was between 6 to 8 weeks. Institutional animal ethics committee approved it. (CPCSEA registration no. 1678/Go/Re/S/12/CPCSEA dated 16.06.2017).

2.1 Irradiation Source

Irradiated of the animals was done at Cancer treatment Centre, SMS Medical College and Hospital, Jaipur with Co⁶⁰ teletherapy unit. The animals were housed in well ventilated boxes of 30 X 30 X 5 cm size to expose them whole bodily. The source surface distance was 80 cm and dose rate was 1.47 Gy/min.

2.2 Plant material Source

Smriti Van Jaipur was source of O.E. stems. They were collected and identified by experts in Department of Botany, University of Rajasthan, Jaipur. (RUBL no. 211574).

2.3 Plant extract preparation

O. elatior stems were shade dried after peeling and cutting and powdered. Its extract was prepared by soxhleting stem powder in Ethanol and Acetone separately at 68°C and 40°C in Soxhlet apparatus for 36 h each. Different doses of each extract were fed to the groups of mice as per experimental plan. On the basis of survival assay, 10 mg/kg body weight dose per mice was selected for both the extracts.

2.4 Design of experiment

Four groups of selected healthy, adult mice were made and treated as below.

- I: Mice without any treatment.
- II: Only OEE (10 mg/kg body weight).
- III: OEE (10 mg/kg body weight) before exposure to 6 Gy Co⁶⁰ gamma radiation.
- IV: Only 6 Gy Co⁶⁰ gamma radiations.

Mortality behavior, body weight, in the mice was observed. The animals were sacrificed at 1,3,5,10,15,30 days after treatment.

2.5 Autopsy

Six animals at 1,3,5,10, 15, and 30 days after irradiation were sacrificed and Glutamate pyruvate dehydrogenase activity was estimated quantitatively in the kidneys.

2.5 Estimation of Glutamate pyruvate transaminase activity

GPT activity was measured in kidney by using Modified method of Thefeld *et al.*, (1974)¹², Wallnofer *et al.*,(1974)¹³, Bergmeyer *et al.*,(1974)¹⁴. The kit was obtained from Transasia Biomedicals Ltd.,Baddi,Dist. Solan,HR.

3. RESULTS

GPT/ALT (Glutamate pyruvate transaminase / Alanine transaminase)

3.1 Acetone extract treated animals

No change in the GPT/ALT activity was observed in the untreated control mice. GPT activity decreased significantly till 30 days after treatment only OEE in acetone (49.55 to 34.05 micro gram/gram). Irradiated group (with 6 Gy gamma rays) had significant increase till 30th post irradiation day (61.56 to 71.85 microgram/gram). Mice, which were pretreated with OEE before irradiation (with 6Gy gamma rays), GPT activity was significantly decreased at 30th day post treatment (66.08 to 48.24 microgram/gram) as compared to day 1.

3.2 Ethanol extract treated animals

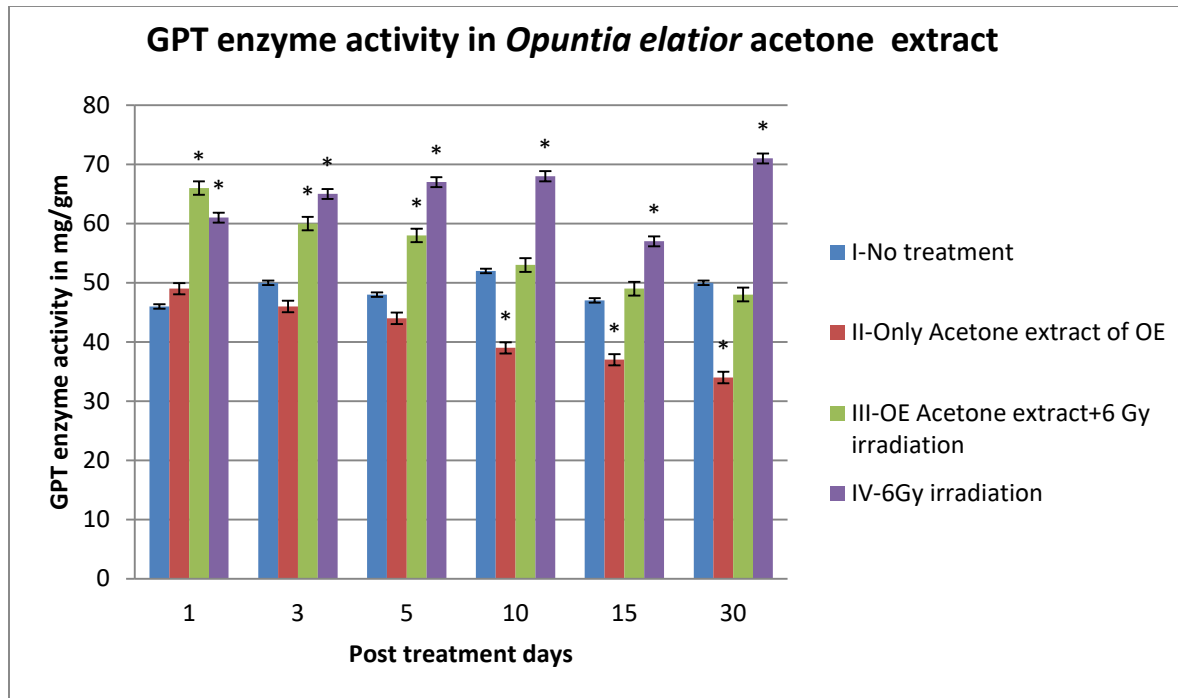
Constantly normal GPT activity was observed in the untreated control group from day 1 to 30. Only ethanolic extract of OEE generated significant increase in GPT activity by day 30 (40.05 to 46.50 microgram/gram). The mice irradiated with 6 Gy gamma rays only showed 63.48 to 70.81 microgram/gram GPT activity by 30th day post treatment. Those animals which were pretreated with OE ethanolic extract before irradiation to GPT activity was maximum on 5th day (60.74 microgram/gram) and then decreased till 30th day finally reducing to normal levels.

3.3 Two way anova (Two factor, 1. Treatment 2. Day)

Acetone extract, treatment and day wise changes were found less significant when anova was applied. In ethanol extract same scenario was observed.

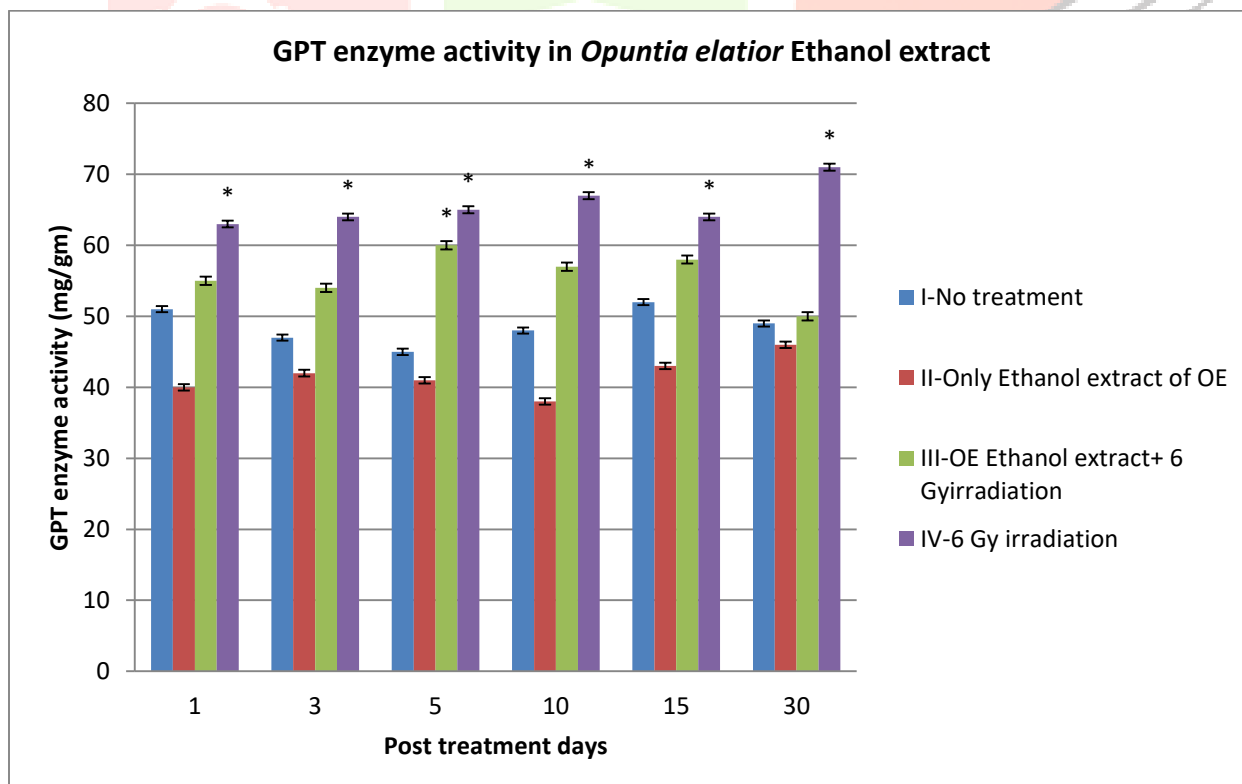
It was concluded that amongst both the types of extracts of *Opuntia elatior* cladode, (acetone and ethanol), ethanol extract has given better result to protect, GPT activity against exposure to gamma radiation.

Figure A: Variations in the Glutamate-pyruvate transaminase (microgm/gm)/Alanine transaminase activity in kidney of Co⁶⁰ gamma ray exposed mouse with and without *Opuntia elatior* (Acetone extract) pretreatment



Data represented by Mean±SE (Six mice per group). n=6, P<0.05 (Data with superscript* were significant and data without superscript* were non significant).

Fig. B: Variations in the Glutamate-pyruvate transaminase (microgm/gm)/Alanine transaminase activity in kidney of Co⁶⁰ gamma ray exposed mouse with and without *Opuntia elatior* (Ethanol extract) pretreatment.



Data represented by Mean±SE (Six mice per group). n=6, P<0.05(Data with superscript* were significant and data without superscript* were non significant).

4. DISCUSSION

Kidneys have important role in the excretion of nitrogenous waste such as urea, creatinine and uric acid. They help in regulation of extracellular fluid volume, osmolarity, electrolyte balance and production of hormones. The functional unit of the kidney is called nephron, which consists of the glomerulus, proximal convoluted tubule, distal convoluted tubule and collecting ducts. Kidneys excrete approx 85% of urea and the rest is excreted through the digestive tracts. If the kidneys are damaged, urea accumulates in blood. GOT and GPT are toxicity indicators which increase significantly after whole body irradiation. Sublethal dose (6Gy) of gamma radiation whole body increased GPT activity in mouse kidneys. Mice without any treatment were used as control. In the mice treated with plant extract along with irradiation, the kidney displayed relatively well preserved anatomical features without degenerative alterations but in some cases showed slightly altered anatomical characters.

Upto 6 Gy gamma rays whole body irradiation are approximately sublethal dose to these mice. Irradiation to this dose induces secretion of some enzymes for example AST, ALT (GPT), ALP, LDH from the cytoplasm at a rapid rate after cellular disruption and plasma membrane rupture (Pradeep *et al.*, 2008)¹⁵. Mansour *et al.*, (2018)¹⁶ found regular morphology of kidney tissue, proximal and distal tubules and other structures. They also observed that rats treated with gamma rays revealed atrophied glomeruli. The cuboidal epithelial cells of proximal and distal renal tubules had nuclear alteration along with pyknosis and karyolysis with hyalurization of some tubules.

Histopathological changes in the kidney stained with Haematoxyline and Eosin, normal kidney structure was observed. More distortion of the glomerular apparatus was seen in the irradiated group. Plant extracts pretreated and then irradiated group had lesser alterations in the kidney tubules as compared to only irradiated group.

ALT (GPT) enzyme activities increased in only radiation (6GY) treated group as compared to the normal control (without any treatment) group at all the autopsy intervals at 1, 3, 5, 10, 15, 30 day in swiss albino mice. Recovery pattern was observed in irradiated (6Gy) with *Opuntia elatior* cladode (10mg/kg body weight) extract in acetone and ethanol, individually treated groups on all the autopsy intervals in swiss albino mice. The same recovery pattern was observed in only *Opuntia elatior* extract in acetone and ethanol treated groups on all the autopsy intervals in swiss albino mice. Although both extracts, Acetone and Ethanol of *Opuntia elatior* protected ALT/GPT, enzyme activities alteration against gamma radiation in swiss albino mice but ethanolic extract was more protective.

In experimental animals which were pretreated with OEE extracts, GPT activity reached to near normal levels faster at 30th day post-treatment. Lesser increase in GPT activity was observed in experimental groups at day 1 and at other intervals, which appears to be due to presence of several components in the plant extracts. Effect of Acetone and Ethanol, extract was different, which also appears to be due to presence of different types and concentrations of their chemical constituents.

Antioxidant activity and free radical scavenging activity of *Loranthus globosus* was detected by Rana *et al.*, (2018)¹⁷ to maintain GPT and GOT activity in serum in stress induced mice. Oxidative and hepatic toxicity was removed by extract of *Atriplex suberecta*. The serum enzyme level and bilirubin levels were also maintained by *Psidium guajava* and *Ricinus communis*. (Parvez *et al.*, 2018, Amujiri *et al.*, 2021)^{18,19}. GPT

activity in mice was also protected by *Glossogyne tenuifolia* extract.(Chen *et al.*,2022)²⁰.*Opuntia elatior* extracts,seems to have worked by removing reactive oxygen sps.(ROS) due to presence of flavanoids,phenolic contents,vitamins etc.Beta-alanin,beta-cyanine and rich quantity of sugar are also present.The defensive effect of Acetone and Ethanolic fraction of *Opuntia elatior* extract could be due to scavenging free radicals directly or by reacting with membrane phospholipid bilayers to break the chain of reactions initiated by reactive oxygen sps.The development of antioxidant systems potential might due to free radical scavenging effect of Acetone and Ethanolic extracts in *Opuntia elatior*. Gloria *et al.*,(2023)observed that *Opuntia elatior* fruit extract is a rich source of beneficial, biological compounds with strong antioxidant and cytoprotective effects against oxidative stress and mitochondrial damage generated by Diclofenac.²¹ Beatriz N. Guedes et al.2023 reviewed it in “ Biopharmaceutical applications of *Opuntia ficus-indica*: bibliometric map, bioactivities and extraction techniques”.²² Another study,clearly indicated hematinic activity of *O. elatior* fruit juice in Phenylhydrazine-induced haemolytic anaemia in rats mightbe due to presence of betalains as an active constituent and potent antioxidant agent.(Vaidehi *et al.*,2023).²³

5. CONCLUSION

Radiation exposure is deleterious for a person's health by damaging body systems and reducing immunity and may lead to death. Research on herbal products has shown good results to achieve improved quality of life and increased survival time. Radiation-induced toxicities are lowered by herbal treatment. Thus, OEE may prove to be useful to manage Glutamate pyruvate transaminase activity in the kidneys, as it is edible and nontoxic to the body systems.

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7. AUTHORS' CONTRIBUTIONS

Both, Kavita Poonia and Professor Jaimala Sharma contributed in experimental work and writing of this article both.

8. CONFLICTS OF INTEREST

No conflict of interest in this reports work.

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