Exp. Theo. NANOTECHNOLOGY 10 (2026) 207-218 https://doi.org/10.56053/10.S.207

Synthesis radioprotective role of nanomaoist roses particles in preventing liver and kidney damage and cancer risk in gamma-irradiated mice

Ali Kh. Shihab[1], *Asia H. Al-Mashhadani*[1,*], *Rizk Mostafa Shalaby*[2]

[1]Department of Physics, College of Science, University of Baghdad, Baghdad, Iraq
[2]Physics Department, Faculty of Science, Mansoura University, Egypt
[*]) Email: asia.hammad@sc.uobaghdad.edu.iq

Received 17/11/2025, *Received in revised form* 15/12/2025, *Accepted* 28/12/2025, *Published* 15/2/2026

Nanoparticles own particular homes inclusive of high cell penetration and sturdy interplay with free radicals, making them promising agents for stopping molecular harm those results in most cancers. Their use opens new horizons in reducing carcinogenic chance by way of enhancing cell protection and mitigating oxidative strain prompted by way of harmful factors. Gamma ray exposure results in major health problems, such as significant oxidative stress and cancer risk in living tissues and cellular damage. The possible radioprotective benefits of nano Maoist Roses Particles (NMRP) against gamma radiation-induced hazards are investigated in this work. First Gamma-irradiated deionized water is examine using *2,2-diphenyl-1-picrylhydrazyl* (DPPH) and UV-VIS spectrometer to determine the free radicals in irradiated water. The n the NMRP is added to water before exposed to gamma rays, again the free radicals are determine for five concentrations. The results of this work show the free radicals scavenger ability of NMRP increases with increases the concentration of NMRP from 35.4% at 0.00005 g/ml to 100% at 0.00025 g/ml of NMRP concentration. Natural antioxidants such phenolic compounds, flavonoids, and anthocyanins, which are abundant in Maoist Rosas, may be essential in scavenging free radicals generated by ionizing radiation. In this work, NMRP is applied to biological tissues (kidney and liver of mice) exposed to gamma rays, and the DNA integrity, histological alterations, and indicators of oxidative stress are assessed. Pre-treatment with NMRP significantly decreased tissue damage, according to the data, suggesting that it has intriguing potential as a natural radioprotective agent. The importance of plant-derived chemicals in reducing radiation risks in environmental and medicinal contexts is demonstrated by this study.

Keywords: Kidney and liver; Antioxidant; Nanoparticles.

1. INTRODUCTION

Nanotechnology is a multidisciplinary technology subject that has been a key transformative research field all through this century. The integration of concepts from physics, biology, chemistry, medication, pharmacy, and materials science allows nanotechnology to deliver progressive solutions to lengthy-status challenges throughout numerous domain names. The core generation involves the manipulation of materials at the nanoscale—typically between 1 and 100 nm—where they exhibit distinctive physicochemical properties that do not appear in their bulk or macroscopic forms [1]. Nanoparticles combine three fundamental homes—an increased surface vicinity, chemical quantum-scale physics, and better response efficiency effects—to alter their interaction ability with biological systems and environmental elements [2]. These techniques are used to produce several nanos with a series of sizes and functional properties. Even though gold and silver are used in traditional nanopathy (disease conditions caused by or related to nanomaterials), with their potent anti-free radical properties, their chemical assembly may use hazardous materials, and this raises questions about how they are biologically diverse in living organisms [3].

Natural nanomaterials provide protective benefits, especially for tissue protection and radiation conservation, and are environmentally friendly alternatives for drug agents. The energy is transported through the room through electromagnetic waves, which are extremely dangerous to all organisms. The ion radiation risk from nuclear power plants, medical procedures, and environmental sources can cause cellular degeneration, oxidative stress, and DNA damage. The effect on cells ranges from mild inflammation to severe disease conditions, including cancer and cell death. Therefore, the development of effective radioprotective medicines is necessary for environmental protection with clinical safety as well as environmental protection [4]. Due to the dissolution of oxidative stress, gamma radiation exposure causes a great risk to living tissue and can lead to acute and chronic tissue damage by damaging DNA and cellular homeostasis. Nano natural product-based techniques with synthetic in the pursuit of effective radioprotective agents are currently assessed due to their increased power and safety [5].

Strong antioxidants and free radical-removing properties are shown by natural plant particles, enriched in bioactive substances such as flavonoids and phenolic acids. These substances are desirable radio-reproduced alternatives when reducing oxidative damage and promoting cellular repair processes. For example, research has shown that particles from plants such as Edhatoda Vasika and Sentle Asiatica, mostly due to gamma radiation injury caused by their antioxidant properties, shield DNA and cell membranes. Similarly, it has been shown that nano artists, such as silver, gold, serum oxide screen, and other tissues, reduced other tissues' gamma radiation risk by reducing free radicals and reducing inflammation [6, 7]. The flowering plant pink maoist, also known as "China rose," has many bioactive compounds in the petals, including flavonoids and phenolic acids, known for antioxidant and tissue root properties. Nevertheless, pink maoist for radioprotection still has much to learn about the combination of petal particles and nanotechnology. Nanoformulation can improve bioavailability and efficiency of plant particles and provide better protection against radiation-induced damage [8].

The use of Nano Rosa Maoist to protect biological tissues from gamma-ray radiation is not yet a matter of scientific studies reviewed by any colleague. However, a lot of research has used natural particles—such as the combination of nanotechnology to protect against curcumin [9], olive leaves [10], and al-Hana [11]. The aim of the present study is to evaluate the radioprotective efficacy of nano-formulated Maoist Rosa particles (NMRP) in opposition to gamma radiation-brought-on oxidative pressure (by reducing the number of free radicals) and tissue harm. This is achieved through (i) determining its antioxidant and loose radical scavenging potential using DPPH and UV–Vis spectroscopic assays and (ii) assessing its protective results in vivo on liver and kidney tissues of irradiated mice. The basic objective is to establish NMRP as a secure, primarily plant-based nanoformulation with ability applications in mitigating radiation-prompted cellular and tissue damage through the law of oxidative stress, irritation, and preservation of tissue integrity.

2. EXPERIMENTAL

2.1 Materials

The study utilized two primary materials. Deionized water (DIW) is sourced from the medical laboratories at the University of Baghdad/Iraq. The cesium-137 (Cs-137) gamma radiation source is obtained from the Nuclear Laboratory in the Department of Physics, College of Science, and University of Baghdad, Iraq. Maoist roses for the experiments are collected from local nurseries and horticultural centers in Baghdad. Additionally, the free radical compound 2,2-diphenyl-1-picrylhydrazyl (DPPH) is purchased from Sigma-Aldrich (Germany) through the United Tetra Group for Medical and Scientific Supplies in Jordan.

2.2 Methods

DIW is chosen as a model system to investigate the removal of radioactive contamination and the scavenging of free radicals because water constitutes approximately 70% of the human body. Exposure to ionizing radiation, such as gamma rays, generates free radicals through interactions with impurity-free DIW. To replicate this, DIW samples are irradiated using a cesium-137 (Cs-137) gamma radiation source. For NMRP synthesis, 1 g of Maoist Rosa particles is dissolved in 100 mL of DIW in a 200-mL volumetric flask. The solution is stirred physically at 50°C for 40 min using a stirrer. After stirring, the solution is filtered using filter paper, resulting in the formation of hydrous NMRP.
The properties of the used mice are as follows:

- Species: Albino mice (Mus musculus).
- Age and Weight: 9–11 weeks; 20–24 g.
- Source: National Center to Control and Pharmaceutical Research, Iraq.
- Housing: Biotechnology Research Center, Al-Nahrain University.
- Route of Administration: Subcutaneous injection of nanoparticles at the dorsal region.
- Irradiation: Whole-body gamma exposure (Cs-137, 2 Sv, 662 keV).

These mice are divided into four groups; each group contains 5 mice: Group A (control), Group B (nano-treated only), Group C (irradiated only), and Group D (nano + irradiated). Mice in Groups B and D received intraperitoneal injections of the nanoparticles at the defined dose every two days, for two doses. Group D and Group C are then exposed to gamma radiation at 2 mSv (whole-body exposure). One week post-irradiation, animals are sacrificed humanely, and liver and kidney tissues are collected for histological examination. Control and nano-only groups provided baseline comparisons to assess both the safety of the nanoparticles and their radioprotective potential.

3. RESULTS AND DISCUSSION

3.1 UV–vis absorption spectrum of irradiated water with NMRP

Either untreated DIW or treated DIW made up the solution, and each had varying NMRP concentrations between 0.00005 and 0.00025 g/mL. To evaluate their effects on free radical inhibition, these solutions are mixed with an ethanolic DPPH solution at a certain ratio. The NMRP water suspensions' capacity to scavenge free radicals is measured using the DPPH test to assess their antioxidant activity. A well-known standard free radical that is frequently used as a baseline to assess antioxidant activity is DPPH. To examine the optical characteristics of NMRP and verify the effective production of the nanoparticles, UV-vis spectroscopy is utilized. The $\pi \rightarrow \pi^*$ electronic transitions in aromatic rings are responsible for the noticeable absorption peak in the UV–vis spectrum that is seen at about 277 nm. The presence of flavonoids and phenolic chemicals, which are recognized for their antioxidant qualities, is shown by this peak.

The consistent presence of this peak throughout NMRP concentrations ranging from 0.00005 to 0.00025 g/mL indicates uniform dispersion of nanoparticles and robust colloidal stability. Moreover, the lack of additional peaks or broad shifts at higher wavelengths suggests a limited particle size distribution and minimal nanoparticle agglomeration. The observed absorption characteristics corroborate the presence of bioactive components capable of scavenging radicals, hence augmenting the antioxidant and radioprotective properties of the particles. Overall, the evidence from the UV-vis spectrum confirms the phytochemical integrity and successful synthesis of NMRP, demonstrating that it is a nanomaterial suitable for biomedical applications.

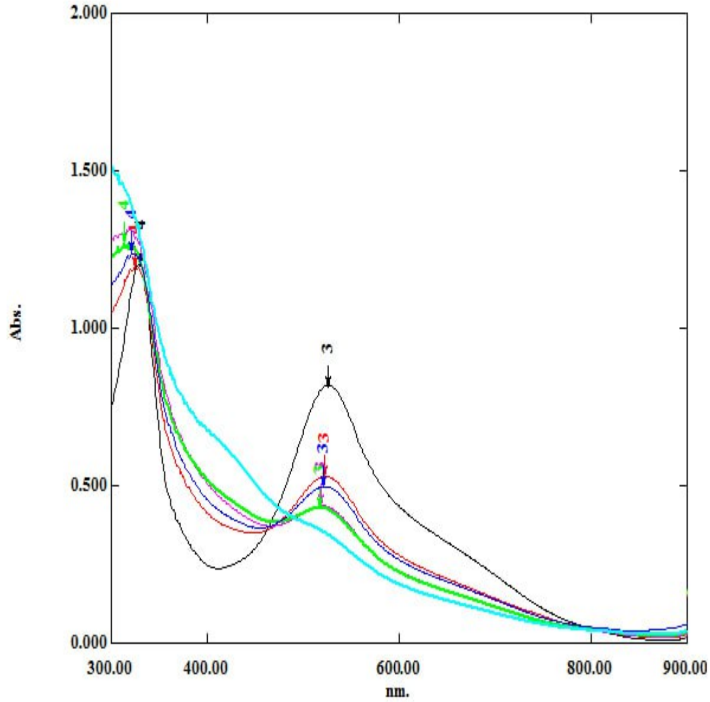

Figure 1 Peak absorbance of nano Maoist *Rosa* particles at various concentration (0.00005, 0.00010, 0.00015, 0.00020 and 0.00025 g/mL).

Table 1 The absorbance, concentration, and % inhibition of the nano Maoist *Rosa* particles at various concentration using DPPH assay.

Sample Condition	Concentration ($\times10^{-3}$ mg/ml)	Absorbance	Inhibition%
Irradiated	0.05	0.528	35.4
Irradiated	0.10	0.434	46.9
Irradiated	0.15	0.425	48.0
Irradiated	0.20	0.346	57.6
Irradiated	0.25	---	100
Irradiation, Before adding nanoparticles	—	0.817	—

Figure 1 illustrates the free radical scavenging efficiency in DIW exposed to gamma radiation. The black curve represents the absorbance spectrum of irradiated DIW with DPPH. After adding the NMRP to the irradiated DIW, the absorbance peak decreased, indicating that the free radical scavenging efficiency decreased [13]. The percentage of free radicals is decreases with increasing the concentration of nanoparticles as shown in Figure 2.

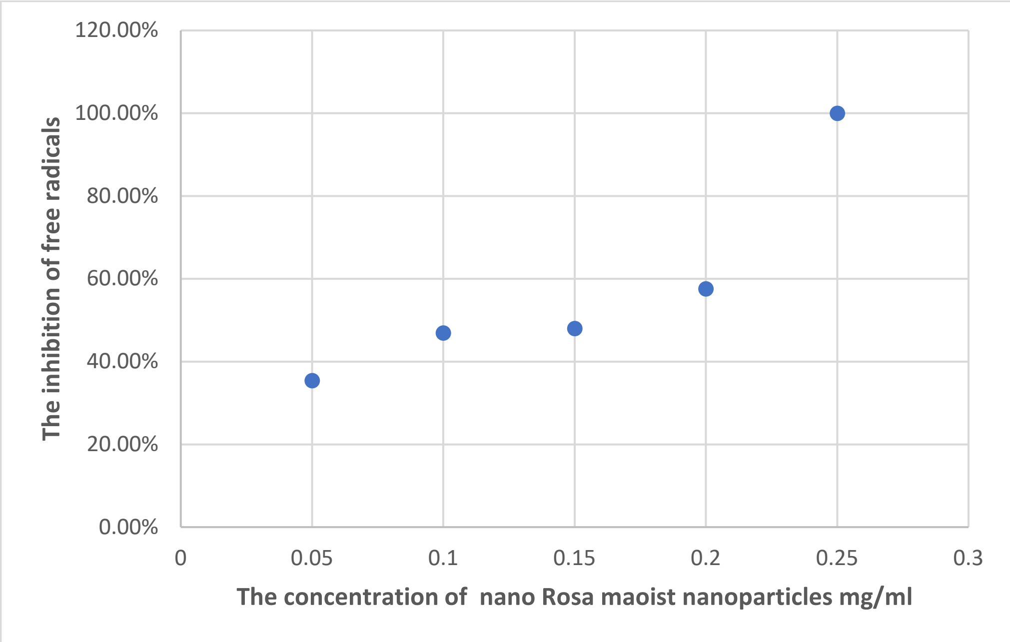

Figure 2 Percentage inhibitions of free radicals as a function of nano Maoist Rosa particles concentrations. The graph illustrates the dose-dependent antioxidant activity of the particles, showing a steady increase in inhibition percentage with increasing concentrations of nano-cinnamon, reaching a maximum of 60.9% at 2.5×10^{-3} g/l.

3.2 In vivo results
3.2.1 Kidney tissue

Figure 3 illustrates normal kidney tissue showing well-organized glomeruli and intact renal tubules without inflammation or degeneration. This healthy structure serves as the baseline reference for evaluating pathological changes in other experimental groups. The renal tissue in Figure 4 also shows normal glomeruli and tubules, closely resembling the control institution. The absence of atypical functions indicates that NMRP by myself does no longer induce any nephrotoxic effects, highlighting its biocompatibility and protection on the tested dose. Severe pathological alterations are obtrusive following gamma irradiation as shown in Figure 5. These consist of perivascular cuffing of inflammatory cells (mainly neutrophils), congestion of blood vessels, and necrosis of renal tubular epithelial cells. Such harm reflects oxidative pressure, inflammation, and structural breakdown caused by ionizing radiation, regular with radiation nephropathy. The histological appearance in Figure 6is largely preserved, with everyday glomerular tufts and renal tubules evident. The absence of excessive inflammatory infiltration and necrosis, in assessment to the irradiated group, demonstrates that NMRP affords huge protection towards radiation-triggered renal damage. The results strongly endorse that its antioxidant and free radical scavenging residences successfully mitigate tissue damage.

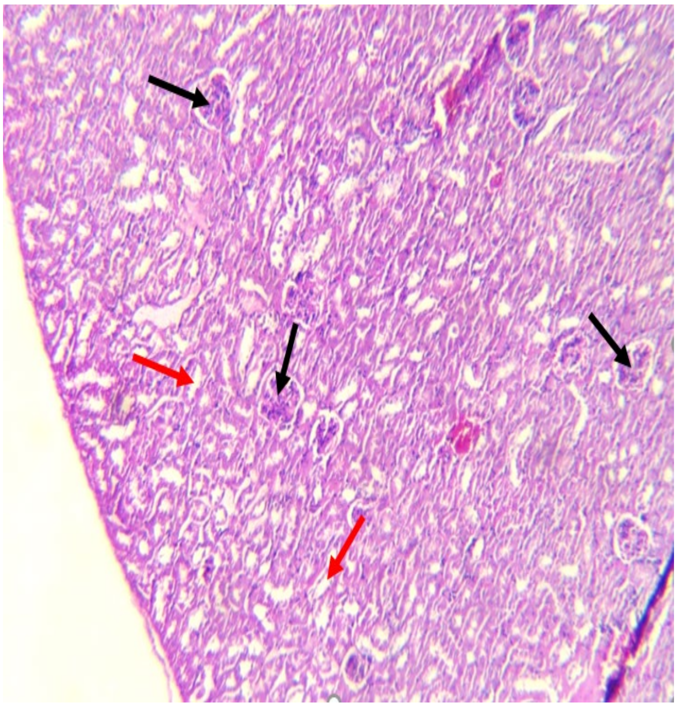

Figure 3 Histological section of kidney from control group shows normal glomerular tufts (black arrow) and renal tubules (red arrow) (H and E; 100×).

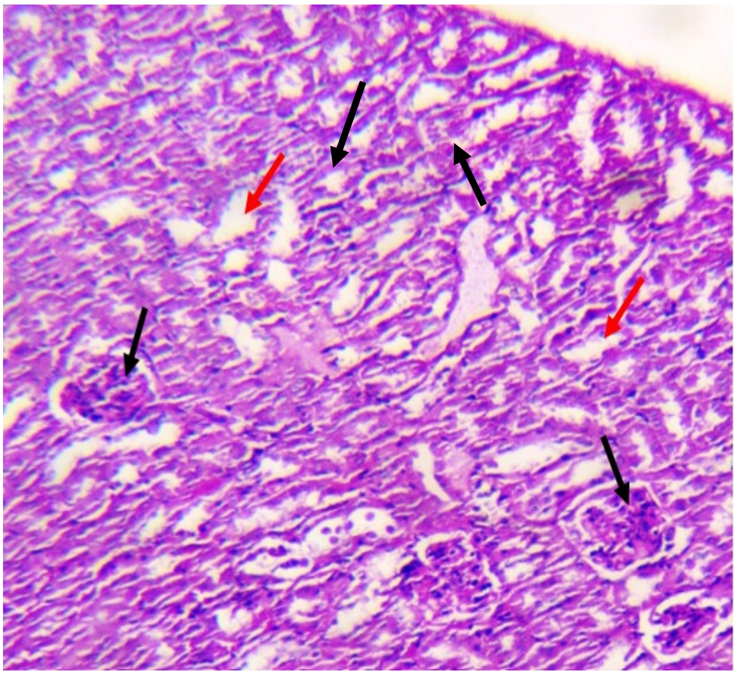

Figure 4 Histological section of kidney from nano injection group shows normal glomerular tuft (black arrow) and renal tubules (red arrow) (H and E; 200×).

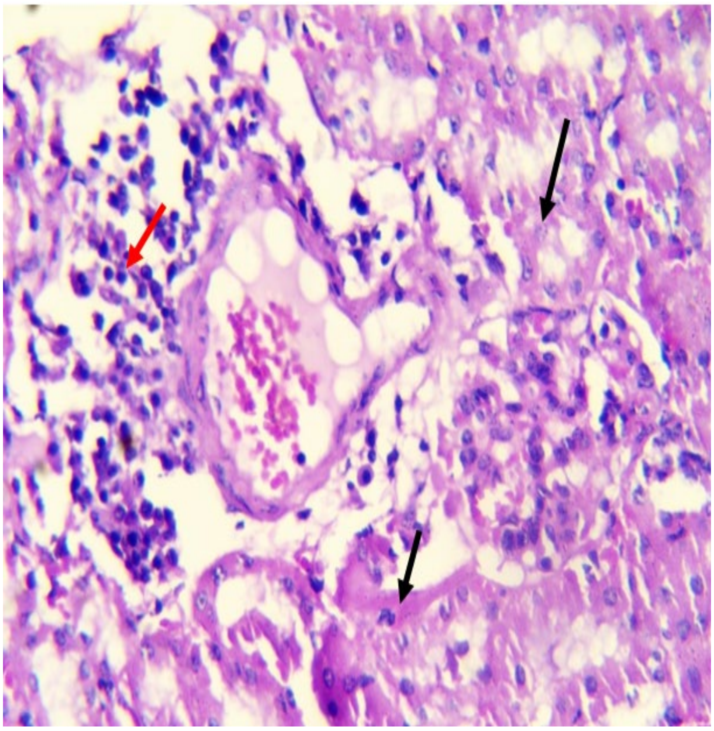

Figure 5 Histological section of kidney from irradiated group E shows perivascular cuffing of inflammatory cells mainly neutrophils (red arrow), degeneration and necrosis of the epithelial cells of some renal tubules (H and E; 400×).

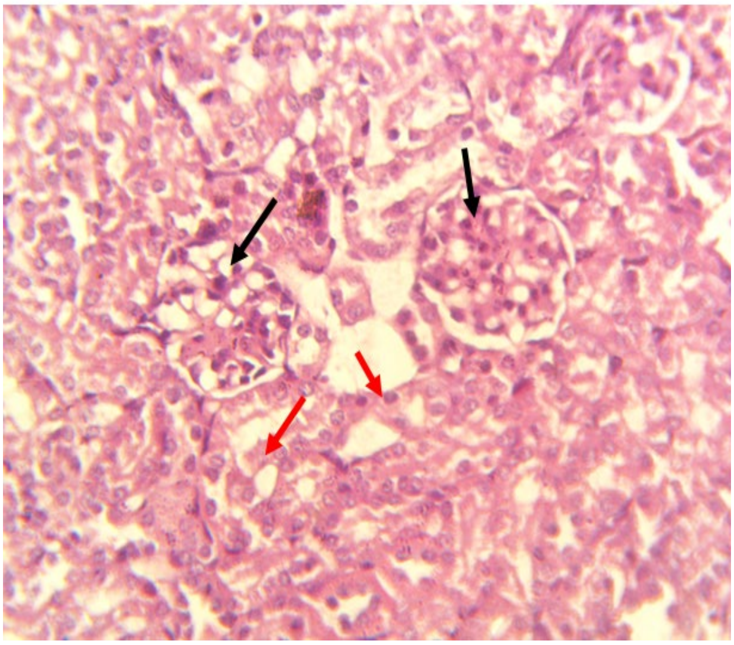

Figure 6 Histological section of kidney from nano injection and irradiated group shows normal glomerular tuft (black arrow) and renal tubules (red arrow) (H and E; 400×).

3.2.2 Liver

Figure 7 indicates the histopathological assay of liver tissue inside the manage organization. The section demonstrates a normal principal vein, intact hepatic cords, clean sinusoids, and preserved portal regions. The absence of inflammatory infiltrates or degenerative adjustments confirms that the baseline hepatic shape is intact and wholesome. This image serves because the reference point, in opposition to which pathological alterations in irradiated companies and the protecting role of NMRP can be in comparison. The parent confirms that the experimental animals did not have any pre-existing hepatic abnormalities that would be confounding. Figure 8 indicates liver tissue of the organization that worked with nano Maoist Rosa particles by itself. The hepatic structure seems to be basically equivalent to the manage institution, and sinuoids intact vital veins, structured hepatic cords, and open sinuoids. There is no histological evidence of toxicity, or unfavourable structural change. This finding is important, as it substantiates the fact that NMRP nanoparticles are biocompatible and safe over the administered dose, and do not produce deleterious output on liver histology. Therefore, one can consider NMRP as a non-poisonous herbal nano formulation, which can be used in radioprotective packages. According to figure nine, the results of liver tissue are of mice exposed to uncovered gamma radiation without any shielding. Some striking pathological characteristics are that it becomes obtrusive and involves by infiltration of inflammatory cells i.e., neutrophils around the great vein and within the portal regions. These inflammations suggest that it has acute radiation-induced hepatic injury. The hepatic cords and vascular congestion structural disorganization further puts the emphasis on the oxidative and inflammatory pressure due to the ionizing radiations. This radiation exposure is a strong indicator of the amount of radiation damage within the absence of radioprotective response, which is associated with the expected biochemical and molecular indicators of oxidative stress and tissue destruction. Figure 10 provides liver tissue of the organization that had been pre-treated with NMRP before the gamma irradiation. Its histological profile closely resembles the management and NMRP -only agencies, whereby the major veins have been preserved, hepatic cords are intact, and spaces are sinusoidal. It is interesting to note that the inflammatory infiltration and degenerative changes seen in Figure nine do not occur or occur in significantly reduced amounts. This implies that NMRP provided enormous protection against radiation-induced liver damage, likely through its unbound radical scavenging activity compromised by phenolic compounds, flavonoids and anthocyanins. The proposed radioprotective mechanism of NMRP is well supported by the histological normalization, and it shows that it can be used as a therapeutic agent.

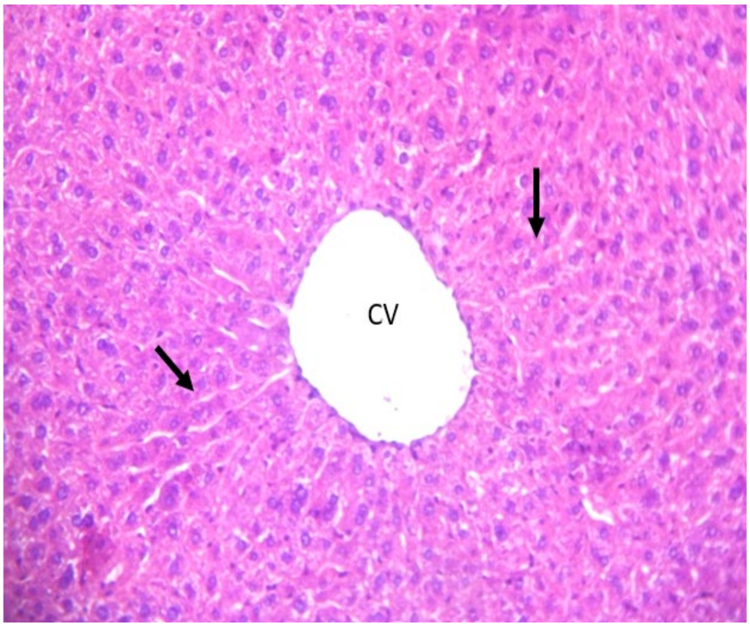

Figure 7 Histopathological section of liver from group (control group) shows normal livers section, normal central vein (cv), sinusoids and hepatic cords (arrow) (H and E; 400×).

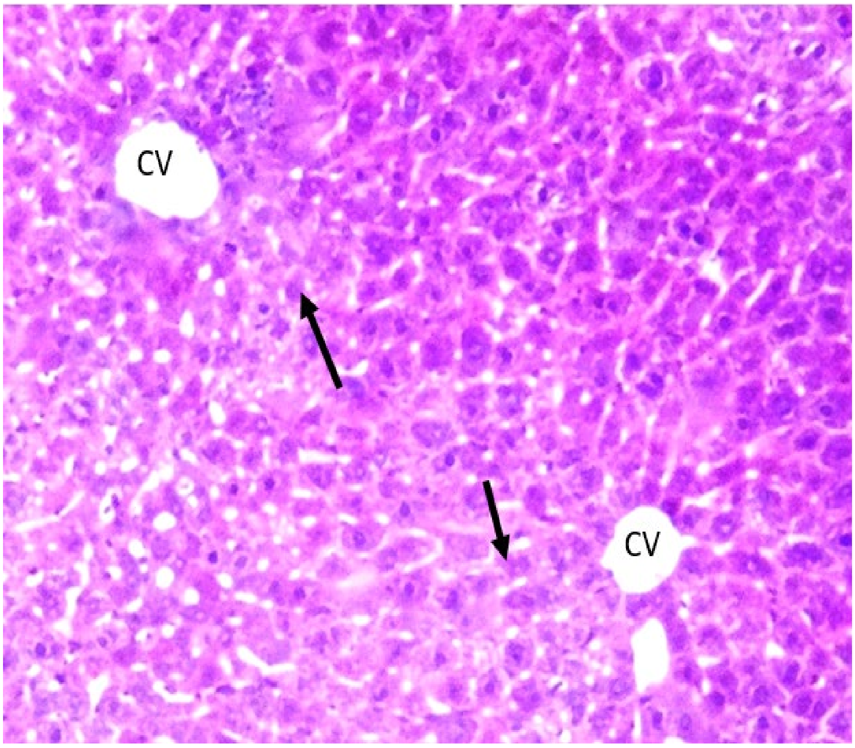

Figure 8 Histopathological section of liver from nano injection group shows normal livers section, normal central vein (cv), sinusoids and hepatic cords (arrow) (H and E; 400×).

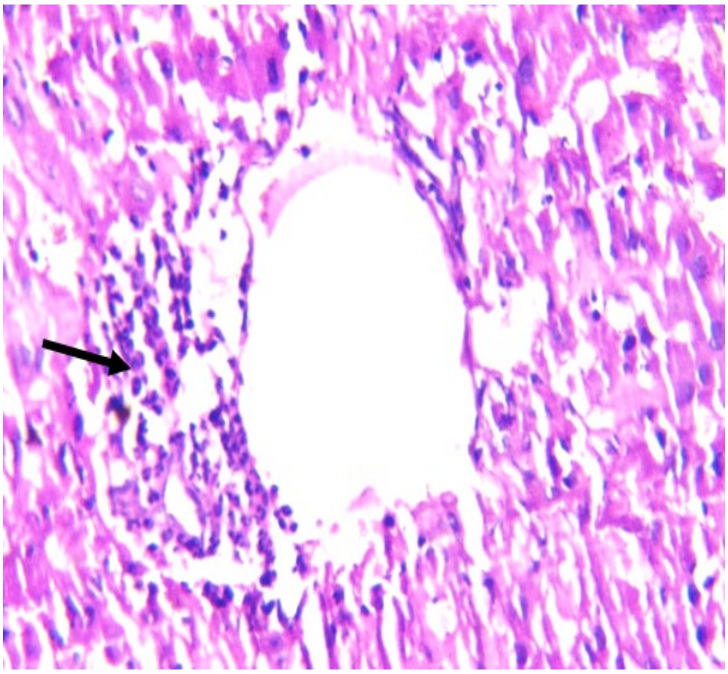

Figure 9 Histopathological section of liver from gamma irradiated group shows infiltration of inflammatory cells mainly neutrophils (arrow) adjacent to the central vein (H and E; 400×).

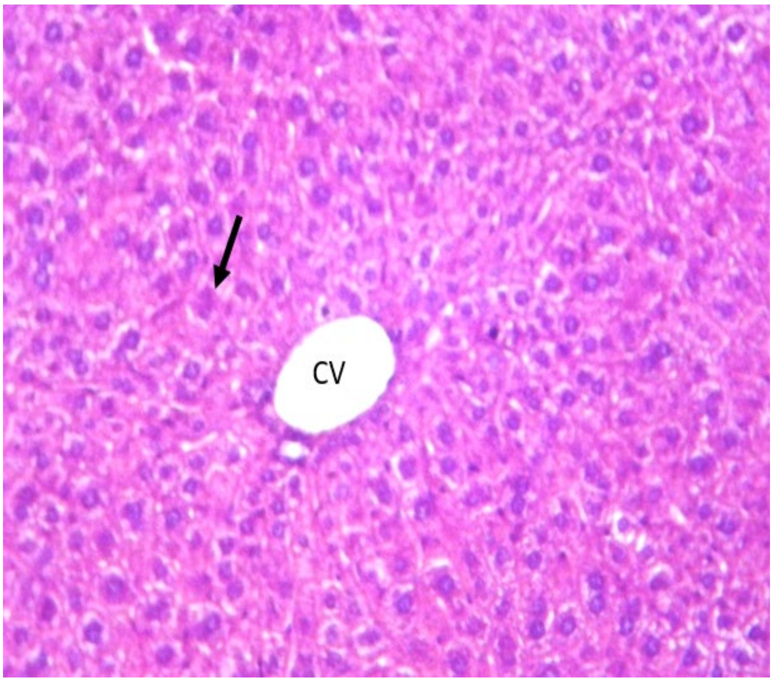

Figure 10 Histopathological section of liver from nano injection and gamma irradiated group shows normal livers section, normal central vein (cv), sinusoids and hepatic cords (arrow) (H and E; 400×).

4. CONCLUSIONS

The potent free radical–scavenging ability of NMRP is attributed to its high phenolic content, nano-formulated structure, and confirmed DPPH radical inhibition activity. The effectiveness of particles such as a natural antioxidant and radioprotective agent is further supported by a reduction in gamma-inspired tissue damage; NMRP-only groups showed normal hepatic architecture, confirming the absence of intrinsic toxicity. Finally, NMRP demonstrated significant protective benefits against tissue damage in mice due to gamma radiation. Nano Maoist Rosa particles (NMRP) showed no toxicity and preserved normal hepatic structure, while gamma radiation caused severe kidney and liver damage. Pretreatment with NMRP markedly reduced inflammation and tissue injury, confirming its strong radioprotective potential. According to these findings, NMRP can be a naturally occurring plant-based radioprotective agent. Studies show how green nanotechnology and particles from medicinal plants can safely and effectively reduce radiation-induced oxidative stress in biological and environmental applications. The viability of the production of plant-based nanomaterials was shown using an environmentally friendly, green process by successful synthesis of NMRP that avoided the use of dangerous chemical reagents.

Acknowledgments

The authors would appreciate the support of Department of Physics, College of Science, University of Baghdad, Iraq and Physics Department, Mansoura University, Egypt Faculty of Science to meet the required support of facilities in this research. Special thanks are also given to all my colleagues and everybody that helped indirectly in completion of this study.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript.

References

[1] K.A. Altammar, E.A. Al-Suhaimi, M. Bashir, Saudi J. Biol. Sci. 30 (2023) 103685 https://doi.org/10.26434/chemrxiv-2023-k704b
[2] S. da, Santos, and D. R. Izario, Experimental and Theoretical NANOTECHNOLOGY 3 (2019) 245 https://doi.org/10.56053/3.3.245
[3] A. Sani, C. Cao, D. Cui, Toxicol. Rep. 8 (2021) 1021 https://doi.org/10.3390/app11083532
[4] D.B. Devedov, R.J. Asherov, G.H. Glenko, N.O. Ferstaloya, Experimental and Theoretical NANOTECHNOLOGY 3 (2019) 253 https://doi.org/10.56053/3.3.253
[5] M. Mourad Mabrook. (2018). Experimental and Theoretical NANOTECHNOLOGY 2 103 https://doi.org/10.56053/2.2.103
[6] T. Saidani, M. Rasheed, I. Alshalal, A.A. Rashed, M.A. Sarhan, R. Barillé, Res. Eng. Struct. Mater. 10 (2024) 743 http://dx.doi.org/10.17515/resm2023.21ma0922rs
[7] M. A. Sarhan, S. Shihab, B. E. Kashem, M. Rasheed, J. Phy.: Conf. Ser. 1879 (2021) 022122 https://doi.org/10.1088/1742-6596/1879/2/022122
[8] M. Rasheed, O. Alabdali, S. Shihab, J. Phy.: Conf. Ser. 1879 (2021) 032120 https://doi.org/10.1088/1742-6596/1879/3/032120
[9] S. Shahzadi, S. Fatima, Q. ul Ain, Z. Shafiq, M.R.S.A. Janjua, RSC Adv. 15 (2025) 3858 https://doi.org/10.1039/D4RA07519F
[10] O.S. Ashour, A.H. Al-Mashhadani, Rev. Mex. Fis. 70 (2024) 041101 https://doi.org/10.31349/revmexfis.70.041101
[11] S.M. Ahmed, H.S. Akbar, A.H. Al-Mashhadani, Iraqi J. Appl. Phys. 20 (2024) 291 https://doi.org/10.2025/1wayn345
[12] O.S. Ashour, A.H. Al-Mashhadani, Iraqi J. Sci. 66 (2025) 2812 https://doi.org/10.24996/ijs.2022.63.10.17
[13] F.M. Abdulsada, N.N. Hussein, G.M. Sulaiman, Iraqi J. Sci. 64 (2024) 2759 https://doi.org/10.4314/dujopas.v10i4a.35