Radioprotective Mechanisms of BSA−Green Tea Polyphenols−Chitosan Nanoparticles: Molecular and Biochemical Insights

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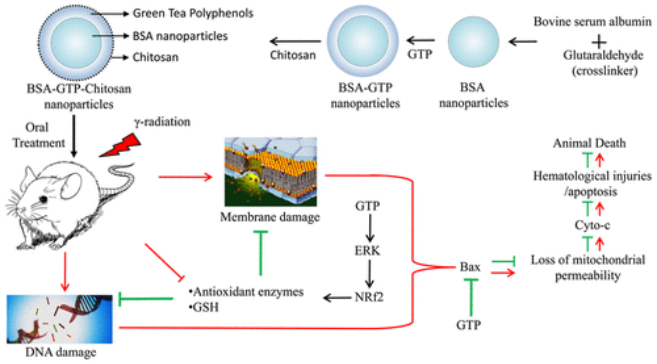
The efficacy of tea polyphenols (TPs) in mitigating normal tissue damage induced by ionizing radiation during cancer treatment is well-documented. However, their clinical application is hindered by poor bioavailability. In this study, we aimed to enhance the bioavailability of TPs through nanoformulation using bovine serum albumin (BSA) as the core matrix and chitosan as the outer shell. The resultant TPs nanoparticles exhibited spherical morphology and maintained stability under physiological and gastrointestinal conditions while preserving antioxidant activity.

Oral administration of these nanoparticles for 3 days prior to radiation exposure significantly protected mice from radiation-induced hematological injuries, thereby reducing radiation-induced lethality. Mechanistically, encapsulated TPs attenuated oxidative damage and apoptosis by restoring cellular redox balance through the Nrf2-ERK pathway and downregulating Bax expression.

Notably, encapsulated TPs demonstrated superior radioprotective efficacy compared to free TPs, highlighting their potential as effective radioprotective and pharmacotherapeutic agents. This nanoformulation shows promise for safeguarding normal tissues during radiotherapy and treating other free radical-mediated pathological conditions. Moreover, our encapsulation strategy may be extended to enhance the bioavailability of similar compounds vulnerable to gastric degradation.

Figure 1 shows the systematic radioprotection mechanism of BSA–Green Tea Polyphenols–Chitosan Nanoparticles.



References:

1. Kumar, S., Meena, R., & Rajamani, P. (2016). Fabrication of BSA–green tea polyphenols–chitosan nanoparticles and their role in radioprotection: a molecular and biochemical approach. *Journal of Agricultural and Food Chemistry*, *64*(30), 6024-6034.
2. Kumar, S., Singh, R. K., & Meena, R. (2016). Emerging targets for radioprotection and radiosensitization in radiotherapy. *Tumor Biology*, *37*, 11589-11609.