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Editorial

Biological Effects of Ionizing Radiation (IR) in Human Health and Environmental Population: Global Scenario

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Ionizing radiation affects biological systems and high-radiation doses increase the risk of cancer among large population. Environmental factors influence carcinogenesis in humans. Rapid use of radiation technologies in medicine and industry has increased radiological and nuclear accidents affecting human health. People working in nuclear power plants and industries face health concerns due to radiation exposure. There is an urgent need for safe and cost effective radioprotective agents for persons working in radiation field. Radiation is always present in natural part of our environment. Radioactive sources from soil, water and air contribute to exposure of ionizing radiation. Radioactive materials are widely used in power generation, applications in industries, military and nuclear medicine. Depleted uranium (DU) used in nuclear power plants and weapons production. Uranium is a naturally occurring heavy metal found in rocks, soil and oceans. Approximately 90 µg (micrograms) of uranium exist in the human body (normal intakes of water), skeleton (66%), liver (16%), kidneys (8%) and 10% in other body tissues. Radiation exposure has strong impact on both populations (size, distribution, and genetic makeup) and ecosystems. Radiation can disrupt ecological relationships which can lead to a decline in biodiversity and increase risk of extinction [1]. If radioactivity is released into the environment from nuclear power plant or while transport of radioactive substances (iodine and caesium) for medicine, strontium and plutonium (nonvolatile radioactive substance), xenon or krypton (radioactive gases) this can lead to environmental consequences to radiological emergency. In our daily life we are continuously exposed to radioactivity. The biggest source of background radiation is radon (50%) for humans. Prolonged exposure to radon increases the health risk for lung cancers. Other sources of background radiation present in environment are cosmic rays (10%), food (11%), medical X-rays (13%), rocks and building materials (15%). Background radiation is always present in the environment. Today, radiation is frequently used in medicine (radiotherapy, X-rays and CT-scans). Exposure to electromagnetic fields can result in acute effects (skin burns). Our body consists of water, by low and high LET (linear energy transfer) radiations exposure in aquatic environments cause deleterious effects (DNA, RNA and protein) and leads to cell or organ damage. IR effects environment by increasing risk of cancer incidence and cause genetic effects [2]. Radiation at cellular and molecular levels induce DNA damage (single and double strand breaks), alterations in cell cycle distribution, generation of ROS (Reactive Oxygen Species), protein modifications (alteration in gene expression by activation of signal transduction) or activation of cell death pathways like MAPK (Mitogen Activated Protein Kinases), apoptotic signaling cascade (intrinsic and extrinsic) and hence promoting cancer

cell development or resistance to treatment [3]. Global scenario in 2025, risk associated with IR is a major concern, especially in areas with high background radiation. By understanding the biological effect(s) of ionizing radiation at cellular and subcellular levels various strategies for mitigation is being developed. Various international organizations are working on how to reduce IR exposure in areas with high background radiation like Hiroshima and Nagasaki (Japan). Emerging technologies have developed radiation counter agents, shielding materials and radiation detectors to reduce exposure, and improve radiation safety.

The recent report by United Nations Scientific Committee on the Effects of Atomic Radiation (UNSCEAR), The Scientific Committee took note from five member States (Argentina, Belgium, Iran (Islamic Republic of IRAN), the Russian Federation and the United Arab Emirates (UAE). The meeting held in Vienna from 20 to 24 May 2024, all major issues were noted, discussed and addressed. According to the data analysis on public exposures by ionizing radiation resulting from medical devices, industrial (coal) and research applications, it was concluded that annual doses from those sources ranged from few microsieverts (μSv)) to several hundred microsieverts (μSv) have affected large population worldwide [4].

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