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Modulatory role of Manganese dioxide nanoparticles in 3G Mobile phone frequency exposed male Wistar rats

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Extended Abstract

Low-intensity radio-frequency (RF) radiation such as cell phone radiation is an oxidative agent for living cells. Oxidative damage to cellular DNA can lead to mutations and may play an important role in the initiation and progression of various cancers [1]. Oxidative damage happens when a biological system is exposed to excessive reactive oxygen species (ROS). ROS are chemically reactive molecules and can interact with other molecules in the body and damage various macromolecules such as DNA, protein and lipids. A broad biological potential of ROS and other free radicals makes low-intensity RF radiation a potentially hazardous factor for human health [2]. Inorganic nanomaterials have received considerable attention in catalysis due to their large surface-to-volume ratio. Previous studies have shown that Manganese dioxide nanoparticles (MNP) have few enzymes mimicking properties. Nanomaterial-based enzyme mimics have the advantages of low cost and high stability in catalytic activities and can be potentially used in bioassays and medical diagnostics [3]. Present study shows the mimicking of MNP to superoxide dismutase (SOD).

MNP were prepared by co-precipitation method. Adult male Wister rats were divided into four groups with 8 rats per group. The first group was control, group II was given only nanoparticles intraperitoneally (30mg/kg) on alternative days for a 30 days, group III was exposed to mobile phone radiation (1910-2170 MHz) for 2 hrs per day, 6 days a week, and the fourth was exposed to both radiation and nanoparticles. SOD can catalyze the disproportionation reaction of $O2^{-}$, serving as one significant antioxidant enzyme in nearly all living cells. Previous work demonstrated that Mn-based materials possessed SOD-like property [3]. Therefore, in our system, MnO_2 nanoparticles were used to mimic SOD.

In the present work, SOD activity was found to be affected by mobile phone radiation in rats exposed to radiation and MNP plus radiation exposure. The activity is observed to be decreased in radiation exposed group whereas MDA level is increased. This may be due to cell collapse in the group, because of excessive ROS production. However, when nanoparticle was administered, it didn't affect the cells. When both radiation and MNP exposure was given, the cells started to recover and ROS production reduced to the level that did not damage the lipid membrane and thereby MDA level is approaching to the control. The radiation exposure also had its effect on sperm vitality. Due to radiation exposure the number of sperms swollen was less than the control and MNP groups giving a lesser percentage bending of sperms. Whereas in exposure plus MNP treated group showed the percentage bending of sperms similar to control group.

It was observed that the MNP is counteracting ROS in the radiation exposed animals, thus reducing the oxidative stress in them. MNP also helped recover liver and kidney functions of exposed rats. Thus, it plays a modulatory role in 3G Mobile phone exposed rats.

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