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# Investigation of The Genotoxic Effect of Iron Oxide ($Fe_2o_3$) Nanoparticle and Microparticle Forms on *Alium Cepa*

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**Abstract**

Magnetic nanoparticles are important particles that have started to find widespread use as a contrast agent in magnetic resonance imaging (MRI), hyperthermia treatment, cell separation and detection, and drug delivery. Of these, iron oxide ($Fe_2O_3$) nanoparticles (NP) have begun to be widely used in clinical applications, as they are physically and chemically stable, biocompatible, and considered environmentally safe. However, some of the studies conducted in recent years revealed that $Fe_2O_3$ NPs can induce genotoxic effects. On the other hand, nanoparticles generate more toxic effects than micron-sized particles do. Therefore, this study aimed to investigate the genotoxic effects of two different sizes of $Fe_2O_3$, nanoparticles (<50 nm) and microparticles (bulk) (<5 µm), using *Allium cepa*. 125, 250, 500, and 750 µg/mL of both nanoparticles and microparticles of $Fe_2O_3$ were applied to *A. cepa* root tip cells for 48 hours. Both nano- and microparticles (except 125 µg/mL) of $Fe_2O_3$ caused a significant decrease in mitotic index (MI) in *Allium cepa* root tip cells compared to the control. Also, both nanoparticles and microparticles of $Fe_2O_3$ induced various mitotic and chromosomal aberrations such as stickiness, bridge, C-metaphase, and multipolarity. The frequency of aberrations was significant compared to the control and dose-dependent. Increasing aberrations were higher in nanoparticle treatments compared to microparticles. This study showed that both nanoparticle and microparticle forms of $Fe_2O_3$ significantly decreased the mitotic index and increased aberrations. The hazardous effect of nanoparticles was 1,26, 1,15, 1,40, and 1,92 fold higher than those of the microparticles at 125, 250, 500, and 750 µg/mL. These results revealed that both nano- and microparticles of $Fe_2O_2$ may induce genetic risk for humans and other organisms. Therefore, additional studies are necessary to clarify the genotoxic potentials of $Fe_2O_3$ particles.



**Keywords**: *Iron oxide nanoparticle, Microparticle, Allium cepa, Genotoxicity*