

## **Bio-Nanotechnology Approach of Nano-Size Iron Particles as Promising Iron Supplements: An Exploratory Study to Combat the Problems of Iron Fortification in Children and Pregnant Women of Rural India**

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**Abstract :** India, with a humongous population, remains the world's poorest developing nation in terms of nutritional status, with iron deficiency anaemia (IDA) affecting the population. Despite efforts over the past decades, India's anaemia prevalence has not been reduced. Researchers are interested in developing therapies that will minimize the typical side effects of oral iron and optimize iron salts-based treatment through delivery methods based on the physiology of hepcidin regulation. However, they need to come up with iron therapies that will prevent making the infection worse. This article explores using bio-nanotechnology as the alternative, promising substitution of providing iron supplements for the treatment of diarrhoea and gut inflammation in kids and pregnant women. This article is an exploratory study using a literature survey and secondary research from review papers. In the realm of biotechnology, nanoparticles have become extremely famous due to unexpected variations in surface characteristics caused by particle size. Particle size distribution and shape exhibit unusual, enhanced characteristics when reduced to nanoscale. The article attempts to develop a model for a nanotechnology based solution in iron fortification to combat the problems of diarrhoea and gut inflammation. Certain dimensions that have been considered in the model include the size, shape, source, and biosynthesis of the iron nanoparticles. Another area of investigation addressed in the article is the cost-effective biocompatible production of these iron nanoparticles. Studies have demonstrated that a substantial reduction of metal ions to form nanoparticles from the bulk metal occurs in plants because of the presence of a wide diversity of biomolecules. Using this concept, the paper investigates the effectiveness and impact of how similar sources can be used for the biological synthesis of iron nanoparticles. Results showed that iron particles, when prepared in nano-metre size, offer potential advantages. When the particle size of the iron compound decreases and attains nano configuration, its surface area increases, which further improves its solubility in the gastric acid, leading to higher absorption, higher bioavailability, and producing the least organoleptic changes in food. It has no negative effects and possesses a safe, effective profile to reduce IDA. Considering all the parameters, it has been concluded that iron particles in nano configuration serve as alternative iron supplements for the complete treatment of IDA. Nanoparticles of ferric phosphate, ferric pyrophosphate, and iron oxide are the choices of iron supplements. From a sourcing perspective, the paper concludes green sources are the primary sources for the biological synthesis of iron nanoparticles. It will also be a cost-effective strategy since our goal is to treat the target population in rural India. Bio-nanotechnology serves as an alternative and promising substitution for iron supplements due to its low cost, excellent bioavailability, and strong organoleptic properties. One area of future research can be to explore the type of size and shape of iron nanoparticles that would be suitable for the different age groups of pregnant women and children and whether it would be influenced based on the topography in certain areas.

**Keywords :** anemia, bio-nanotechnology, iron-fortification, nanoparticle

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