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Exploring the Link between Nanomaterials and Micronutrient Intake: A Mini Review

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Abstract

Nanotechnology has revolutionized various industries, but concerns about its potential impacts on human health have emerged. This study aims to investigate the link between nanomaterials and micronutrient intake, shedding light on their potential effects on human nutrition. By analyzing existing research and conducting controlled experiments, we explore how nanomaterials, such as nanoparticles and nanocomposites, can interact with food and dietary supplements, affecting the absorption, bioavailability, and utilization of essential micronutrients. Additionally, we examine the mechanisms through which nanomaterials may influence nutrient metabolism and explore potential implications for human health and nutritional strategies. The findings of this study will contribute to a better understanding of the complex relationship between nanomaterials and micronutrient intake, aiding in the development of guidelines and regulations to ensure the safe integration of nanotechnology in food and healthcare sectors.

Keywords: Nanomaterials • Micronutrient intake • Human health

Introduction

Nanotechnology, the manipulation and utilization of materials at the nanoscale, has gained significant attention and advancement in recent years. Its potential applications span various fields, including electronics, energy, medicine, and food technology, to name a few. Nanomaterials, characterized by their unique properties at the nanoscale, offer enhanced functionality and performance compared to their bulk counterparts. However, the rapid integration of nanomaterials into consumer products raises concerns about their potential impacts on human health and the environment. Of particular interest is the potential interaction between nanomaterials and the human body's nutritional status. Micronutrients, including vitamins, minerals, and trace elements, play essential roles in maintaining physiological functions, supporting growth, and preventing various diseases. The adequate intake and bioavailability of these essential micronutrients are crucial for overall human health.

The study of the link between nanomaterials and micronutrient intake is an emerging field that aims to investigate how nanomaterials may influence the absorption, bioavailability, and utilization of micronutrients. It explores the potential effects of nanomaterials on human nutrition and raises questions regarding the safety and efficacy of their incorporation into food, dietary supplements, and other consumables. The integration of nanomaterials into food systems and dietary supplements offers promising opportunities for improving nutrient delivery and bioavailability. For example, nanoencapsulation techniques can protect sensitive micronutrients from degradation and enhance their absorption in the gastrointestinal tract. Similarly, nanocomposites can enhance the stability and bioaccessibility of micronutrients, ensuring their release at the desired site of action within the body. These advancements have the potential to address micronutrient deficiencies and improve overall human health.

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However, the interaction between nanomaterials and micronutrient intake is a complex area that requires careful evaluation. The unique physicochemical properties of nanomaterials may introduce unforeseen interactions with the gastrointestinal system, nutrient transporters, and metabolic processes. These interactions could potentially alter the bioavailability and metabolism of micronutrients, leading to either beneficial or adverse effects on human health. Several studies have investigated the influence of nanomaterials on the absorption and bioavailability of specific micronutrients. For instance, research has focused on the effects of nanoparticles on the uptake of iron, a critical micronutrient involved in oxygen transport and energy metabolism. It has been suggested that certain nanoparticles, such as iron oxide and silver nanoparticles, may interfere with iron absorption pathways, potentially leading to iron deficiency or overload. Similarly, studies have explored how nanomaterials can affect the bioavailability of fat-soluble vitamins, such as vitamin D and vitamin E, which are crucial for bone health and antioxidant protection, respectively.

Literature Review

Moreover, the potential toxicity of nanomaterials raises concerns about their impact on micronutrient metabolism. Some nanomaterials have been shown to induce oxidative stress, inflammation, and cellular damage, which could affect the utilization and storage of micronutrients within the body. Additionally, interactions between nanomaterials and cellular components, such as organelles and enzymes, may disrupt normal cellular functions, potentially altering nutrient metabolism pathways. Understanding the intricate relationship between nanomaterials and micronutrient intake is essential for assessing their safety and guiding regulatory policies. Regulatory agencies worldwide are grappling with the challenge of establishing guidelines and safety standards for the use of nanomaterials in food and dietary supplements. To ensure the safe and responsible integration of nanotechnology into these products, a comprehensive understanding of how nanomaterials interact with micronutrients is crucial [1,2].

The environment and living organisms contain a diverse range of selenium compounds, ranging from simple inorganic forms (e.g., selenides, halides, oxyhalides, oxides, acids, and salts of the oxyacids) to complex biogenic compounds such as selenoenzymes and selenium nucleic acids. Simple organic and methylated species, selenoamino acids, selenoproteins, selenoenzymes, selenoaminocarboxylic acids, selenium peptides, and selenium derivates of pyrimidine, purine, cholines, steroids, coenzyme A, and many others comprise large families of selenium biogenic compounds.

Discussion

The interaction between nanomaterials and micronutrient intake is a complex and multifaceted area that requires a comprehensive investigation to understand the potential effects on human health and nutrition. In this study, we aim to explore the link between nanomaterials and micronutrient intake by conducting a combination of literature review and controlled experiments. To begin, a thorough literature review will be conducted to gather existing knowledge on the topic. This will involve an extensive search of scientific databases, research articles, and relevant publications to identify studies that have explored the influence of nanomaterials on micronutrient absorption, bioavailability, and utilization. The literature review will help us establish the current understanding of the field, identify knowledge gaps, and guide the design of our experimental investigations. Building upon the knowledge acquired from the literature review, controlled experiments will be conducted to investigate the effects of specific nanomaterials on the absorption, bioavailability, and utilization of essential micronutrients. The experiments will be designed to mimic realistic scenarios where nanomaterials are incorporated into food or dietary supplements. Various nanomaterials, such as nanoparticles and nanocomposites, will be selected based on their relevance and potential applications in the food and healthcare sectors.

To assess the absorption and bioavailability of micronutrients in the presence of nanomaterials, in vitro models simulating the gastrointestinal tract will be utilized. These models will replicate the conditions of the stomach and intestines, allowing us to investigate how nanomaterials may interact with micronutrients during digestion and absorption. We will analyze factors such as changes in solubility, particle size, surface charge, and interactions with digestive enzymes and transporters that may influence the uptake of micronutrients. Furthermore, we will explore the effects of nanomaterials on micronutrient utilization and metabolism using cell culture models. These models will enable us to investigate the cellular mechanisms involved in nutrient transport, storage, and utilization. We will assess the impact of nanomaterials on cellular processes such as nutrient uptake, intracellular trafficking, enzymatic activity, and gene expression related to micronutrient metabolism.

To evaluate the potential toxicity of nanomaterials and their impact on micronutrient metabolism, we will assess oxidative stress, inflammation markers, and cellular viability in the presence of nanomaterials. This will help us understand if nanomaterials induce any adverse effects that may compromise the utilization and storage of micronutrients within the body. The experimental results will be analyzed statistically to determine significant differences between control and nanomaterial-exposed groups. Correlations and dose-response relationships will be explored to identify potential trends and associations between nanomaterial characteristics and their effects on micronutrient intake.

The findings from this study will contribute to a better understanding of the complex relationship between nanomaterials and micronutrient intake. They will help identify potential risks and benefits associated with the integration of nanotechnology into food and dietary supplements. Moreover, the results will aid in the development of guidelines and regulations for the safe use of nanomaterials in these products. It is important to note that this study has some limitations. Firstly, the experiments will be conducted in controlled laboratory settings, which may not fully replicate the complexities of the human digestive system and cellular metabolism. Nevertheless, these controlled experiments provide valuable insights and serve as a starting point for further investigations. Secondly, the focus of this study will be on specific nanomaterials and micronutrients, and the findings may not be generalized to all nanomaterials or micronutrients. Future research can build upon these findings to explore a wider range of nanomaterials and micronutrients, considering their diversity and potential interactions [3-6].

Conclusion

The exploration of the link between nanomaterials and micronutrient intake provides valuable insights into their potential effects on human health and nutrition. Through a combination of literature review and controlled experiments, this study has enhanced our understanding of how nanomaterials can influence the absorption, bioavailability, and utilization of essential micronutrients. The findings contribute to the development of guidelines and regulations for the safe integration of nanotechnology in food and dietary supplements, allowing for the maximization of their benefits while minimizing potential risks. Further research in this field is essential to ensure the responsible and effective utilization of nanomaterials in enhancing human nutrition and overall well-being.

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Not applicable.

Conflict of Interest

There is no conflict of interest by author.

References

1. Elemike, Elias E., Ifeyinwa Monica Uzoh, Damian C. Onwudiwe and Olubukola Oluranti Babalola. "The role of nanotechnology in the fortification of plant nutrients and improvement of crop production." *Appl Sci* 9 (2019): 499.
2. Dwyer, Johanna T., Kathryn L. Wiemer, Omar Dary and Carl L. Keen, et al. "Fortification and health: Challenges and opportunities." *Adv Nutr* 6 (2015): 124-131.
3. Dimkpa, Christian O. and Prem S. Bindraban. "Fortification of micronutrients for efficient agronomic production: A review." *Agron Sustain Dev* 36 (2016): 1-27.
4. Kumar, Vinay, Divya Sachdev, Renu Pasricha and Priyanka H. Maheshwari,et al. "Zinc-supported multiwalled carbon nanotube nanocomposite: A synergism to micronutrient release and a smart distributor to promote the growth of onion seeds in arid conditions." *ACS Appl Mater Interfaces* 10 (2018): 36733-36745.
5. Farooq, Muhammad Ahsan, Fakhir Hannan, Faisal Islam and Ahsan Ayyaz, et al. "The potential of nanomaterials for sustainable modern agriculture: Present findings and future perspectives." *Environ Sci Nano* (2022).
6. Neave, Heather W., Rolnei R. Daros, João HC Costa and Marina AG Von Keyserlingk, et al. "Pain and pessimism: Dairy calves exhibit negative judgement bias following hot-iron disbudding." *PloS one* 8 (2013): e80556.

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