

Bone Health: A Comprehensive Review of Nutraceuticals and Functional Foods

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Abstract

Maintaining optimal bone health is crucial for overall well-being and quality of life, yet bone-related disorders such as osteoporosis pose significant health challenges, particularly among aging populations. In recent years, there has been growing interest in the role of nutraceuticals and functional foods in promoting bone health and preventing bone-related conditions. This comprehensive review provides an overview of the current evidence on the efficacy and mechanisms of action of various nutraceuticals and functional foods in supporting bone health. Key topics covered include the impact of dietary nutrients, bioactive compounds and herbal extracts on bone metabolism, bone mineral density and fracture risk. Additionally, emerging trends in bone health research, including personalized nutrition approaches and the influence of gut microbiota on bone health, are discussed. By synthesizing current knowledge and highlighting areas for future research, this review aims to inform healthcare professionals, researchers and consumers about the potential role of nutraceuticals and functional foods in optimizing bone health and reducing the burden of bone-related disorders.

Keywords: Bone health • Nutraceuticals • Functional foods • Dietary supplements • Osteoporosis

Introduction

Maintaining healthy bones is essential for supporting mobility, structural integrity and overall quality of life throughout the lifespan. However, bone-related disorders, such as osteoporosis, osteopenia and bone fractures, represent significant health concerns globally, particularly among aging populations. While conventional treatments for bone-related conditions often focus on pharmacological interventions, there is growing recognition of the potential role of nutrition and dietary factors in supporting bone health and reducing the risk of bone-related disorders. Nutraceuticals, defined as bioactive compounds or dietary supplements with purported health benefits beyond basic nutrition and functional foods, which provide additional health benefits beyond their basic nutritional value, have garnered increasing attention for their potential to promote bone health. These compounds and foods may exert beneficial effects on bone metabolism, Bone Mineral Density (BMD) and fracture risk through various mechanisms, including modulation of bone turnover, enhancement of calcium absorption and regulation of inflammatory pathways [1].

This comprehensive review aims to provide a comprehensive overview of the current evidence on the efficacy and mechanisms of action of nutraceuticals and functional foods in supporting bone health. Key topics to be explored include the impact of dietary nutrients such as calcium, vitamin D and vitamin K, as well as bioactive compounds such as polyphenols, flavonoids and omega-3 fatty acids, on bone health parameters. Additionally, the potential synergistic effects of herbal extracts, probiotics and prebiotics on bone metabolism and gut microbiota composition will be discussed. By synthesizing existing research findings and identifying gaps in knowledge, this review seeks to inform healthcare professionals, researchers and consumers about the role of nutraceuticals and functional foods in promoting bone health and preventing bone-related disorders. Furthermore, emerging trends in bone

health research, including personalized nutrition approaches and the impact of gut microbiota on bone metabolism will be explored, highlighting avenues for future research and clinical practice [2].

Literature Review

Numerous studies have investigated the potential of nutraceuticals and functional foods in promoting bone health and reducing the risk of bone-related disorders. Calcium and vitamin D are among the most extensively studied nutrients, with ample evidence supporting their role in maintaining optimal bone mineralization and preventing osteoporosis. Supplementation with calcium and vitamin D has been shown to improve bone mineral density and reduce fracture risk, particularly in individuals with inadequate dietary intake or limited sun exposure. In addition to calcium and vitamin D, vitamin K has garnered attention for its role in bone metabolism, particularly in regulating calcium deposition in bone tissue. Clinical trials have demonstrated the efficacy of vitamin K supplementation, particularly vitamin K2, in improving bone mineral density and reducing fracture risk, especially in postmenopausal women and older adults [3].

Bioactive compounds found in fruits, vegetables and herbs have also shown promise in supporting bone health. Polyphenols, such as resveratrol and quercetin, possess antioxidant and anti-inflammatory properties that may help preserve bone mass and prevent bone loss. Similarly, flavonoids, such as genistein and Epigallocatechin Gallate (EGCG), have been shown to inhibit bone resorption and stimulate bone formation in preclinical studies. Omega-3 fatty acids, primarily found in fatty fish and certain plant oils, have been investigated for their potential role in bone health. While evidence regarding the direct effects of omega-3 fatty acids on bone density is mixed, some studies suggest that these fatty acids may exert anti-inflammatory effects and promote bone formation, particularly in combination with other nutrients such as vitamin D and calcium. Emerging research has also focused on the interplay between gut microbiota and bone health. Preclinical studies suggest that alterations in gut microbiota composition may influence bone metabolism and fracture risk through mechanisms such as nutrient absorption, immune modulation and production of short-chain fatty acids. Probiotics and prebiotics have shown potential in modulating gut microbiota composition and improving bone health parameters in animal models, although further research is needed to elucidate their effects in humans [4].

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Discussion

The findings from the literature review underscore the potential of nutraceuticals and functional foods in supporting bone health and reducing the risk of bone-related disorders. Calcium, vitamin D and vitamin K remain essential nutrients for maintaining bone mineralization and preventing osteoporosis, particularly in high-risk populations such as postmenopausal women and older adults. However, the optimal dosages and formulations of these nutrients warrant further investigation, as well as the potential interactions between them and other dietary factors. Bioactive compounds found in fruits, vegetables and herbs offer promising avenues for enhancing bone health through their antioxidant, anti-inflammatory and bone-stimulating properties. Polyphenols, flavonoids and omega-3 fatty acids have shown potential in preserving bone mass and preventing bone loss, although the specific mechanisms of action and optimal dosages require further elucidation. Moreover, the emerging field of gut microbiota research has shed light on the intricate relationship between the gut microbiota and bone metabolism. Probiotics and prebiotics hold promise in modulating gut microbiota composition and improving bone health parameters, although clinical studies are needed to confirm their efficacy and safety in humans. Overall, while nutraceuticals and functional foods offer exciting opportunities for promoting bone health, further research is needed to fully understand their mechanisms of action, optimal dosages and long-term effects. Additionally, personalized nutrition approaches tailored to individual needs and risk factors may enhance the efficacy of these interventions in preventing bone-related disorders and improving overall bone health outcomes [5,6].

Conclusion

In conclusion, nutraceuticals and functional foods have emerged as promising strategies for promoting bone health and reducing the risk of bone-related disorders. Calcium, vitamin D and vitamin K remain essential nutrients for maintaining bone mineralization, while bioactive compounds found in fruits, vegetables and herbs offer additional benefits through their antioxidant, anti-inflammatory and bone-stimulating properties. Omega-3 fatty acids and emerging research on gut microbiota further contribute to our understanding of the complex interplay between diet, gut health and bone metabolism. Despite the progress made in this field, several knowledge gaps and research challenges remain. Further investigation is needed to elucidate the mechanisms of action of nutraceuticals and functional foods, optimize dosages and formulations and explore personalized nutrition approaches tailored to individual needs. Moreover, well-designed clinical trials are needed to confirm the efficacy and safety of these interventions in diverse populations, including high-risk groups such as postmenopausal women and older adults. By addressing these challenges and building upon the existing evidence base, nutraceuticals and functional foods have the potential to play a significant role in promoting bone health and reducing the burden of bone-related disorders, ultimately contributing to improved quality of life and well-being for individuals worldwide.

Acknowledgement

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Conflict of Interest

There are no conflicts of interest by author.

References

1. Weaver, Connie M., Christine M. Gordon, Kathleen F. Janz and H. J. Kalkwarf, et al. "The National Osteoporosis Foundation's position statement on peak bone mass development and lifestyle factors: A systematic review and implementation recommendations." *Osteoporos Int* 27 (2016): 1281-1386.
2. Zheng, Hou-Feng, Jon H. Tobias, Emma Duncan and David M. Evans, et al. "WNT16 influences bone mineral density, cortical bone thickness, bone strength and osteoporotic fracture risk." *PLoS Genet* 8 (2012): e1002745.
3. Faienza, Maria Felicia, Flavia Urbano, Mariangela Chiarito and Giuseppe Lassandro, et al. "Musculoskeletal health in children and adolescents." *Front Pediatr* 11 (2023).
4. Ramchand, Sabashini K. and Benjamin Z. Leder. "Sequential therapy for the long-term treatment of postmenopausal osteoporosis." *J Clin Endocrinol Metab* 109 (2024): 303-311.
5. Greendale, Gail A., Sharon Edelstein and Elizabeth Barrett-Connor. "Endogenous sex steroids and bone mineral density in older women and men: The Rancho Bernardo Study." *J Bone Miner Res* 12 (1997): 1833-1843.
6. Krishnan, Venkatesh, Henry U. Bryant and Ormond A. MacDougald. "Regulation of bone mass by Wnt signaling." *J Clin Invest* 116 (2006): 1202-1209.

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