

Nutrients and Postmenopausal Osteoporosis

Subjects: Nutrition & Dietetics

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Osteoporosis is a debilitating disease that is worsened post-menopause due to oestrogen loss. The objective of this review was to investigate nutrient and dietary patterns that have been reported to be beneficial for bone health in postmenopausal women. We found calcium, vitamin D, B-vitamins, potassium, phosphorus, magnesium, vitamin C, and vitamin K are important nutrient requirements for bone health while foods such as low-fat dairy (including milk, yoghurt, and cheese), fish (with bones), fortified and fruits and vegetables are important for bone health maintenance.

Keywords: Nutrients ; diet ; nutrient/dietary patterns ; women ; postmenopause

1. Osteoporosis

Osteoporosis is a major public health concern with the aging populations ^[1]. Worldwide, 8.9 million fractures occur annually which results in an osteoporotic fracture every 3 s ^[2].

Postmenopausal osteoporosis is a condition on the rise amongst aged women as the world demography experiences marked ageing of the population. Globally, New Zealand is amongst one of the most affected by the burden of the disease. Postmenopausal osteoporosis is characterized by increased low-grade inflammation contributing to low bone mass and degradation of bone mineral content resulting in bone loss and/or fractures ^{[1][2]}.

Although the pathogenesis of osteoporosis is multifactorial, key drivers include oestrogen deficiency, poor dietary habits, chronic inflammation, smoking, excessive alcohol consumption and sedentary lifestyle. However, diet regulates the composition and function of the human gut microbiota with recent evidence suggesting that the gut microbiome plays essential roles in the host energy homeostasis, immune system enablement and metabolic function and health ^[3].

Menopausal hormone replacement therapy (HRT) has been employed in the treatment of menopausal treatments. However, its risks have also been documented which include increased occurrence of breast cancer, stroke, venous thromboembolism (VTE) and risk of coronary artery disease but the "timing hypothesis" has been suggested for a possible amelioration if administered early in menopause ^[4].

Nutraceuticals, also known as alternative pharmaceuticals products made from plants and foods which have medicinal properties, are non-hormonal natural therapies or approach to menopausal symptoms. These include phytoestrogenic plants or isoflavones, antioxidants, dietary supplements and fortified dairy products ^[5].

2. Nutrition and Lifestyle

Nutrition and lifestyle changes are essential in promoting health and in the prevention of metabolic diseases such as osteoporosis. Many nutrients are known to interact with each other thereby influencing their bioavailability and absorption ^[3]. Several key nutrients are known to affect bone mineral content (BMC) and bone mineral density (BMD). These nutrients, however, occur together in foods and dietary patterns, therefore the need to study the diet in its entirety. Unhealthy dietary patterns are known to be associated with some chronic diseases such as diabetes and cardiovascular disease ^[4]. Likewise, nutrients such as calcium and vitamin D are well-established as nutritional drivers in the maintenance of normal bone metabolism. Additionally, nutrients such as potassium, zinc, magnesium, iron, copper, vitamin C and vitamin K are micronutrients rich in fruits and vegetables that are beneficial for bone metabolism. However, the overall effects of dietary choices on bone health are not well understood and therefore need further research and discussion.

There are two main holistic methodologies used in describing and quantifying nutrient and/or dietary patterns/habits: 1. The a posteriori (data-driven) dietary pattern approach, i.e., the use of statistical methods such as principal component analysis (PCA) or factor analysis, reduced rank regression (RRR), cluster analysis and partial least square to generate

dietary patterns from data collected; and 2. The a priori dietary pattern approach, i.e., the use of created or predefined dietary indexes on the basis of existing knowledge in nutrition usually complying with dietary guidelines and recommendations [5].

The aim of this review was to investigate and discuss the reported relationships observed between nutrient and dietary patterns and bone health status (BMD, bone biomarkers and fracture risks) in postmenopausal women.

3. Findings

Studies on the nutrient patterns and BMD, although conducted in different communities and settings, indicate the importance of phosphorus, riboflavin, potassium, calcium, magnesium, vitamin B6, vitamin D, protein, fiber, vitamin K and folate from fruits and vegetables as well as milk intake [6][7][8].

Dietary patterns help elaborate the health attributes of food groups; in factor or cluster analysis as a combination of foods and in the reduced rank regression (RRR) analysis method to represent groups of food with health outcomes. It is not surprising that foods such as low-fat dairy, legumes, nuts, olive oil, fish, fruits and vegetables have emerged in this study as important for the prevention of non-communicable diseases such as osteoporosis and fractures. Similarly, Mediterranean-based dietary patterns have been reported to be directly associated with calcium absorption and therefore bone health status in men [9]. Although data-driven dietary patterns are known not to be reproducible and comparable across studies with the explanation that subjectivity of the approach or the fact that real habits of dietary intake across populations differ [5]. Data-driven dietary patterns, however, have the advantage of assessing the real dietary/food patterns in the populations.

On the other hand, processed and/or refined foods such as French fries, hamburgers, biscuits and cookies, and carbonated drinks known as the Western (unhealthy) food patterns, have frequently been inversely correlated with BMD and bone parameters both in children and aged adults. Sweet foods, coffee and tea have also been reported to be inversely correlated with BMD/BMC [10]. Similarly, foods high in sugar such as added sugar fruit drinks, chocolate, and confectionery and high-fat foods such as processed meat, French fries, mayonnaise and desserts [11] were all negatively correlated with BMD and/or BMC. Investigations on starchy-foods (rice) patterns have shown that a high intake of rice in foods was associated with a higher risk of osteoporosis [12][13]. Our nutrient and dietary-based investigation into the pathogenesis of osteoporosis in postmenopausal women showed the importance of an adequate and balanced diet.

Overall, the choice of foods is important for optimum health during aging and a “healthy” diet rich in vegetables and milk or a Mediterranean style diet may be beneficial for bone health in comparison to a Western-style traditional dietary pattern. The implementation of policies for an increase in the dietary intake of vegetables, fruits, non-refined grains and low-fat milk is warranted from childhood to adulthood.

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