

The Nutritional Power of Dairy: How Milk Support Bone Health

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ARTICLE INFO

Received: 📅 June 23, 2025

Published: 📅 July 08, 2025

Citation: Amina Azhar, Mobeen Fatima and Asma Saghir Khan, Mobeen Fatima and Asma Saghir Khan. The Nutritional Power of Dairy: How Milk Support Bone Health. Biomed J Sci & Tech Res 62(3)-2025. BJSTR. MS.ID.009760.

ABSTRACT

Because of competing guidelines, unclear recommendations, and inadequate care delivery, osteoporosis management is in crisis on an international basis. Furthermore, patients tend to disregard treatment recommendations and cannot readily accept the diagnosis of poor bone health. The diagnosis and medical care of a fragility fracture have improved thanks to secondary fracture prevention initiatives like Own the Bone. Osteoporosis is prevalent in patients undergoing elective orthopedic surgeries and hurts results. The process of evaluating bone status, identifying and addressing metabolic deficiencies, and starting treatment for skeletal defects when necessary is known as bone health optimization. All orthopedic surgeons can begin implementing the concepts of bone health optimization, which are similar to those of secondary fracture. Patients over 50 should have their risk for osteoporosis examined and if they fall into a high-risk category, their bone density should be checked. All patients should be instructed to stop using any toxins (such as tobacco products and excessive alcohol intake) and to get enough calcium and vitamin D. If achievable, patients who fit the criteria for pharmaceutical therapy for osteoporosis should start taking medicine and postpone surgery for at least three months. A greater obligation for our patients' bone health must fall on orthopedic physicians. Several health issues and a lowered quality of life can result from osteoporosis, a dangerous and potentially incapacitating condition. The development and ongoing maintenance of bone structures that are capable of supporting typical mechanical loadings is greatly affected by nutrition.

Keywords: Bone Health; Calcium; Vitamin D; Osteoporosis; Osteomalacia; Protein; Rickets

Introduction

Consuming dairy and milk is frequently mentioned as an essential element of a diet that is balanced and nutritious. It is the first food that mammals eat and gives them all the energy and nutrients they need for healthy growth and development. It is also essential for the development of bone mass. The wide range of essential nutrients included in milk makes it a full and complex food essential for a balanced, healthful diet. Several epidemiological investigations indicate that consuming large amounts of milk and dairy products can guard against dementia, cardiovascular disease (CHD), stroke, and some kinds of cancer, including colorectal and bladder cancers, even though the exact ways of action are unidentified. Milk fatty acid profiles often result in a negative view of the consumption of dairy products, even despite this epidemiological evidence. However, it is an efficient

method to modify the composition of fatty acids in milk by modifying the diet of dairy cows, and intervention studies suggest that this approach may result in additional benefits of milk/dairy intake. According to the available data, people who consume extra milk and dairy products often have a slightly larger nutritional advantage over those who do not.

During growth, dairy products provide about 20-30% of protein and 50-60% of calcium. Reducing dairy products as young as possible increases the chance of fracture [1]. Girls between the ages of 2 and 20 who ingest no dairy products are at a 4.6-fold higher risk of fracturing [2]. The influence of dairy products may start even before birth. The mother's consumption of milk and foods high in calcium during pregnancy was positively connected with the BMD of 6-year-old children. The 1920s saw the first trials of milk intervention. Schoolchildren

who were given around 0.5 liters of milk for seven months saw an increase in height. Dairy products have been shown in numerous investigations to have some effects, even if the effects are minor, on the development of bone mass. For instance, one cup of milk (568 ml) increased IGF-I levels and whole-body mineral content, especially in the lower limb, in an experiment with randomization, including 12-year-old females. Cheese boosted cortical bone mass more than calcium supplementation. Compared to calcium pills, calcium in cheese resulted in a greater bone gain in girls aged 10 to 12. Given that Chinese toddlers obtaining milk supplementation had larger metacarpal bone diameters than controls, this is likely to have an impact on bone modeling. Therefore, dairy products may have an impact on bone mineral development by promoting periosteal apposition through a modeling process through protein-stimulated IGF-I formation and a remodeling process initiated by calcium. The primary goal of this review was to highlight the intricate relationships between bone health and the consumption of milk and dairy products. One of the primary causes of metabolic bone disease in the elderly is vitamin D deficiency and insufficiency.

Protein and Calcium

Two essential elements of bone tissue are calcium and protein. Bone tissue is made up of 22% protein, 8% water, and 70% minerals by weight. A sufficient supply of mineral and amino acid substrate is required to support the formation phase of bone remodeling, which is an ongoing process. Dietary protein and calcium have active roles in bone metabolism in addition to their passive roles as substrates for bone manufacture. Circulatory ionized calcium concentration decreases and parathyroid hormone (PTH) release rises in response to insufficient calcium intake. One of the most crucial biological processes in the body is the mineralization of the skeleton, which is assisted by calcium. The main component of bone, calcium, that makes up over 99 percent of the bone's structure as calcium-phosphate complexes, gives the skeleton its strength and structure. The bone also serves as a metabolic reservoir to keep the intracellular and extracellular calcium pools stable. The remaining portion is found in blood, extracellular fluids, muscles, and other tissues. It mediates internal and external communication, nerve impulse transmission, vasculature contraction and vasodilatation, and muscular contraction [3,4]. One of the most abundant components of the human body, calcium is mostly found in the mineralized tissues, which contain over 99 percent of the body's calcium. Around one to two percent of an adult's body weight is made up of calcium. Dairy products are the major sources of calcium, providing more than 60% of women's daily intake. In addition, they are just as beneficial at reducing osteoporosis as calcium supplementation (Heaney, et al. [5]).

Vitamin D

The efficacy of vitamin D in managing rickets, a metabolic bone disease in young people, led to its development [Citation1]. In adults, the condition is called osteomalacia, whereas the prevalent form of

rickets is caused by a delay in mineralization, especially at the growth plate [Citation2]. One of the many causes of rickets/osteomalacia is severe vitamin D insufficiency. Although mineralization is delayed, the manufacturing of the protein matrix of bone (osteoid) by the cells that create bone (osteoblasts) remains unaffected [Citation 3]. The regaining of this phenotype by conducting a meal containing high amounts of calcium and phosphorus adequate to normalize plasma concentrations was a significant observation about the role of vitamin D in the cause of rickets/osteomalacia [Citation 4]. These results suggest that the regulation of intestinal calcium and phosphate absorption and maintaining of plasma calcium and phosphate homeostasis are the main physiological functions of vitamin D in the causes of rickets/osteomalacia. Since then, observational studies on old people with hip fractures have consistently demonstrated that moderate, though occasionally severe, vitamin D deficiency increases the risk of fracture. The majority of land animals, including humans, need vitamin D to maintain a healthy mineralized skeleton. Both food intake and the synthesis of vitamin D in the skin under the effect of sunshine determine the condition of vitamin D nutrition. In children, the absence of vitamin D may lead to osteomalacia and rickets, and in adults, it can cause osteomalacia [6-10].

Osteoporosis

A significant public health problem, osteoporosis is characterized by a high prevalence of diseases, mortality, and economic hardship. Despite increased awareness, a greater understanding of preventive measures, developments in technology for screening and diagnosis, and a wider range of treatment choices, the effects of poor bone health continue to grow severe in recent years. Nowadays, nearly in two women will experience osteoporosis at some point in their lives. Osteoporosis contributes for close to 50,000 deaths every year, and medical costs exceed \$10 billion yearly [13]. The traditional definition of osteoporosis in postmenopausal women is a pathologic condition associated with a greater reduction of bone mass, which increases the risk of fractures.

A range of illnesses and a decreased standard of life can result from osteoporosis, a dangerous and possibly incapacitating condition. A prevalent multifactorial illness characterized by decreased bone mass is osteoporosis. Numerous lifestyle variables are linked to osteoporosis, including behavioral factors like physical activity, smoking, and alcohol use, as well as nutritional factors like calcium, protein, milk and other dairy products, fruits, and vegetables, as well as vitamin D status. The public health issue of osteoporosis is typically preventable.

Osteomalacia

Osteomalacia, which refers to "soft bone," used to be utilized to describe skeletal illnesses that were commonly shown by radiographic or histologic instead of only by clinical or biochemical characteristics. Viewed primarily as a mineralization deficiency, osteomalacia

can present in a variety of ways, each identifiable by the unique connections between osteoid thickness (i.e., mineralized bone matrix) and both osteoid surface and adjusted mineral apposition rate. In a narrow sense, osteomalacia as it is commonly defined is not an increase in osteoid surface or thickness alone. A wide range of illnesses, including high bone turnover states (such as hyperparathyroidism or hyperthyroidism), absence of enzymes (such as hypophosphatemia), and matrix issues can result in inappropriate osteoid buildup (surface and/or volume). Perhaps because their doctors were not adequately aware of the problem, susceptible patients do not seem to have osteomalacia caused by lack of vitamin D identified or diagnosed in an appropriate way.

Rickets

Rickets is a common bone disease that may lead to joint defects and low stature. It is attributed to abnormalities in calcium and phosphate balance. Radiological findings, testing for biochemical, and a history and physical examination can all be used to diagnose rickets. Phosphopenic and calcipenic are the two main categories into which it can be divided according to the quantities of phosphate or calcium. Recognizing the different types of rickets is crucial for accurate diagnosis and efficient management. When vitamin D is sufficiently obtained through diet and sun exposure, nutritional rickets can be prevented. What determines vitamin D lack or sufficiency may eventually be defined by the new data. For ages, people understood that rickets are triggered by a malfunction in the growth plate's mineralization among young youngsters.

Symptoms

Abnormal serum calcium and phosphate levels have been connected to bone disease, which emerges as joint growing, low stature, and limb bowing variations. The disorder could be caused by nutritional deficits or genetic defects. differences in the genes expressing the proteins involved in vitamin D metabolism.

Treatment

Promote bone strength rehabilitation, fracture repair, and quality of life improvement while addressing metabolic process imbalances. A large number of regimens are mostly dependent on individual experience and the availability of sufficient vitamin D preparations; there are no clear standards for direct therapy. Adequate calcium supplements must always be taken in conjunction with vitamin D treatment. In most situations, two or three doses of 1,000 mg of elementary calcium are appropriate. For individuals suffering from malabsorption, higher doses of between 2000 and 3000 mg per day are required [11-20].

Conclusion

Protein and calcium are necessary for bone health. These essential minerals can be found abundantly in dairy products. These meals contribute to supplying daily nutrient requirements. Dairy consumption enhances bone growth in children and decreases bone loss in

adults, maintaining bone health at all ages. Fermented dairy products may lower the frequency of hip fractures, according to observational studies.

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ISSN: 2574-1241

DOI: 10.26717/BJSTR.2025.62.009760

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