

Iodine And Bone Disease: The Early Prevention of Bone Disease Through Lifestyle Changes (Diet) In Elderly

Uchechukwu Chiadikobi¹, Somadina Emenike², Tamunoiyalla Ordor³

EMAIL: uc_emenike@yahoo.com, soma.emenike@icloud.com, iyallaordor@yahoo.co.uk

Abstract

Bone diseases such as Osteoporosis, osteoarthritis, osteopenia, and osteomalacia all affect elderly individuals in ways that increase their risk of fractures, and diminish their life quality. The essential nutrient iodine functions especially crucial in bone health since it controls thyroid hormone regulation processes that help remodel bones. The natural decrease of both estrogen and testosterone during aging causes accelerated bone loss, so hormonal disparities rise as a significant factor in osteoporosis development. Weak bones develop more quickly when people do not get enough calcium as well as vitamin D and iodine in their diet. To protect skeletal structures and stop their deterioration, patients must maintain an iodine-rich diet, participate in weight-bearing ranked movements, and follow reasonable life adjustments. People who eat seafood and dairy products or seaweed gain iodine, while sunlight exposure enables vitamin D creation in their bodies. Regular reduction of alcohol use and smoking helps prevent several bone problems. This research demonstrates that bone integrity preservation in older adults' benefits from iodine alongside essential nutrients and nutritional and behavioral changes to help minimize bone disease prevalence.

Keywords: Bones diseases, osteoporosis, osteoarthritis, and osteomalacia, iodine and thyroid hormone aging factors, dietary patterns, bone well-being, lifestyle modifications, vitamin D, calcium, and physical exercise.

INTRODUCTION

Background on Bone Disease in the Elderly

Bone diseases such as Osteoporosis, osteopenia, and other skeletal degeneration problems affect older adults at high rates. Millions of people worldwide face a major public health threat from Osteoporosis, which remains a key condition for the aging population. Osteoporosis constructs a situation of weakened bones, which results in greater susceptibility to fractures that lead to severe disability alongside loss of independence among older adults (Lisco et al., 2023). Data shows that osteoporotic fractures will affect both women in three of every ten cases and men in five of every twenty cases who have reached age fifty. Besides Osteoporosis, two more age-related bone disorders known as Osteoarthritis and Paget's disease result in morbidity and reduced quality of life among older adults.

Natural aging leads to the deterioration of bone health because older adults undergo several health alterations that decrease bone mineral density (BMD) and bone restructuring efficiency. Skeletal weakness results when bone resorption occurs more rapidly than bone formation processes. The genetic

disposition toward bone defects, poor nutrition, inactivity, and hormone imbalance produces an additional deterioration of bones. The study by Yang et al. (2022) illustrates that medical specialists recognize that early intervention from treatment with bisphosphonates and hormone replacement therapies needs additional prevention through dietary adjustments and lifestyle changes because these methods help minimize bone disease risks.

This research analyzed by Nguyen et al. (2009) explains how lifestyle elements affect bone density in elderly subjects. The BMD testing focused on both the lumbar spine and proximal femur bones in older male and female participants of the study. The results demonstrated that smoking was linked to decreased BMD, with readings between 5-8% at both locations in men and women without affecting the relationship between calcium intake or body weight. Research results demonstrated that BMD values (age and weight-adjusted) showed a link between bone density and muscle strength levels as well as calcium consumption conditions.

Importance of Iodine in Bone Health

The essential trace element, such as iodine, helps maintain human health while strongly affecting thyroid hormone operations. The thyroid gland requires iodine to generate essential thyroid hormones that regulate metabolism, fuel energy production, and control bone remodeling processes (Liu et al., 2024). Thyroid hormones directly influence osteoblasts, which form bones, and osteoclasts, which reabsorb them. Elderly individuals with thyroid hormone irregularities between hypothyroidism and hyperthyroidism experience weakened bones that increase their chance of developing Osteoporosis and fracturing.

According to Baugreet et al. (2017), people with hypothyroidism become prone to bone brittleness because iodine deficiency slows the normal bone turnover process, accumulating aging bone tissue that weakens overall bone structures—the faster bone resorption rate found during hyperthyroidism results in a reduction of total bone mass. The maintenance of proper thyroid function needs sufficient iodine intake because this support enables better bone health throughout an aging population.

Many worldwide populations face inadequate iodine intake because dietary consumption of iodine-rich foods has decreased, along with nutritional limitations. Older adults face a greater risk of iodine deficiency because their bodies show decreased intestinal absorption, limited food choices, and slower metabolic functions (Gonzalez-Campoy et al., 2013). Raising iodine-related educational content about bone health and implementing foods including sea vegetables, milk, eggs, and iodized salt can be successful prevention strategies for age-related bone diseases.

Therefore, this research evaluates the bond between iodine supply and bone wellness by revealing how diet choices might stop Osteoporosis alongside other elderly bone afflictions. A combination of sufficient iodine consumption and well-informed daily routines will improve the bone structure of older adults and protect them from fractures while enhancing their total health quality.

Understanding Bone Diseases in The Elderly Common Bone Disorders

Osteoporosis

The condition of Osteoporosis progresses when there is a decrease in bone mass and the tissue deteriorates, thus creating susceptibility to bone fractures. The majority of postmenopausal women experience this condition because falling estrogen levels fail to support their bone system properly. The condition makes bones significantly brittle and porous, so they break more easily from ordinary

movements such as coughing or bending (Wilson-Barnes et al., 2022). Three main elements that cause Osteoporosis are hormonal modifications, insufficient nutrient intake, and decreased physical activity. Insufficient testosterone levels in males and estrogen in females lead to weakened bones. Low vitamin D levels and insufficient calcium in the diet harm bones' growth and healing processes. The study by Liu et al. (2024) shows that the development of Osteoporosis is often linked to three categories: medications, tobacco and alcohol abuse, as well as inherited elements. In addition, Osteoporosis manifests as symptoms after a patient suffers from a bone fracture. Osteoporotic patients typically show symptoms such as vertebral fractures, which produce back pain, while also experiencing height reduction and developing a slouched posture and wrist, spine and hip fractures. Breaks in bones because of Osteoporosis create severe consequences that result in patients needing both medical care and operating procedures, together with prolonged restrictions in mobility and independence (Sheng et al., 2021). Furthermore, in older adults, Osteoporotic fractures result in numerous disabling effects, which end in death for many patients. The risk of substantial complications, together with extended recovery times, exists most prominently in cases of hip fractures. Osteoporosis leads older adults to need ongoing health care, which drastically reduces their life satisfaction.

According to Ahn & Oh (2021), preventing osteoporosis-related health problems demands immediate medical attention through nutrition care, physical exercise, and supplement treatment. Determination of bone density through tests and medication prescription of bisphosphonates aids in controlling Osteoporosis to prevent bone fractures.

Osteomalacia

Osteomalacia develops when bone mineralization fails, thus leading to soft bones. The main cause of this disorder stems from insufficient vitamin D, an essential factor for calcium absorption. When bones do not receive sufficient calcium for deposition, they become weak and develop distorted shapes, which leads to higher fracture risks. A vitamin D deficiency over an extended period develops into the main factor that creates osteomalacia. The combination of insufficient sunlight exposure, certain medications, inadequate diet, and specific health factors, including kidney disease and malabsorption, causes vitamin D deficiency. The vitamin D metabolism of patients taking anticonvulsants and phosphate-binding agents is affected by these medications (Rondanelli et al., 2021). The symptoms of osteomalacia consist of hip bone pain along with muscle weakness and the inability to walk correctly, as well as an elevated chance of bone fractures. Individuals with this condition experience fatigue when climbing stairs, it becomes difficult, and they experience multiple falls because of their weak muscles. Bone mineralization problems in patients lead to soft, pliable bones instead of density issues in osteoporotic formation.

Elderly patients with osteomalacia develop problems with walking, and they face increased dangers of slipping and falling. The condition causes pain and weakness, decreasing physical movement and worsening bone health (Ahn & Oh, 2021). Proper vitamin D sources from both diet and sunlight produce essential protection against developing and controlling this illness. Combination therapy of vitamin D supplementation with calcium intake together with physical therapies aids in strengthening bones while increasing mobility.

Osteoarthritis

The degenerative joint disease osteoarthritis (OA) develops from damaged cartilage, which then causes

joint pain alongside stiffness and reduced mobility. The hips, knees, and spine are the primary targets for this ailment. The progressive cartilage damage through daily use results in inflammation and joint deformities, which produce severe disability during activities and movement (Azzolino et al., 2021). Osteoarthritis develops mainly because of aging; people use joints for many years, damaging cartilage. Additional weight stress on joints emerges from body weight issues, and the effects of former joint injuries and genes can also trigger osteoarthritic development. Cartilage deterioration happens faster when individuals experience joint-related occupational stress processes and perform repeated movements at work. The study by Coll et al. (2021) explains that medical signs of osteoarthritis include painful joints alongside stiffness, which appears during early morning and extended rest periods, and swelling and restriction in movement abilities. When cartilage becomes damaged, it produces audible popping sounds when moving the affected joints. The decline of Osteoarthritis leads to bone spur formation that limits joint mobility.

Elderly patients with Osteoarthritis must cope with reduced quality of life because the disease lowers their mobility while making them need assistance from others. The pain and associated stiffness hinder everyday activities, including walking, stair climbing, and dressing up (Dunlop et al., 2025). Management involves achieving and keeping a balanced weight along with performing exercises without strain and following an eating plan that reduces inflammation through its contents of omega-3 fatty acids and antioxidants. Additional pain therapy includes physical therapy together with medications along with surgery in some cases for joint replacement.

Risk Factors for Bone Disease

One of the risk factors for bone diseases is aging and hormonal changes. The natural process of aging functions as a significant bone disease risk factor because it causes a systematic reduction of bone density and bone mass decline. Bone metabolism experiences important changes because of hormones and essentially affects postmenopausal women and aging men (Hou et al., 2024). The reduction of estrogen and testosterone speeds up bone resorption, which raises the chances of experiencing fractures. Effects of hormonal changes such as lack of estrogen in women produce more bone deterioration, which creates osteoporosis outcomes. Testosterone reduction in male bodies results in a progressive decrease in bone density. The parathyroid hormone (PTH) range creates an imbalance that enhances the destructive process of bone tissue, leading to increased bone weakness.

The study by Iuliano et al. (2021) shows that medical practitioners often prescribe Hormone Replacement Therapy (HRT) as a treatment for reducing bone deterioration in women who have passed menopause. A typical diet with proper calcium, vitamin D, and iodine sources supports hormonal regulation and healthy bones. Tight schedules and the decline of hormone levels contribute to bone density deterioration. To support bone health, schedule regular weight-bearing exercises with resistance training sessions.

Another risk factor is nutritional deficiencies such as calcium, vitamin D, and iodine.

People need proper nutrition to achieve strong bones that remain healthy (Azzolino et al., 2021). Insufficient intake of essential nutrients weakens bones, making patients prone to bone diseases. Nutrient sources and intake include consuming dairy items together with leafy vegetables and fortified cereals, which provide the source of calcium nutrients; the best food sources for vitamin D include sufficient sun exposure combined with the consumption of fatty fish and dairy products containing vitamin D fortification, and also eating foods rich in iodine such as Iodized salt, Seafood, dairy products.

Hou et al. (2024) illustrate that lifestyle factors like sedentary lifestyle, smoking, and alcohol consumption are also other risk factors to consider. The way people live affects the health of their bones substantially. The absence of physical movement leads to weakened muscles and thinner bones, heightening the possibility of fractures. Smoking enters the bloodstream and hinders calcium absorption, simultaneously diminishing estrogen production, whereas large amounts of alcohol negatively affect calcium processing (Rodrigues et al., 2021).

In addition, to preserve bone strength and resist fractures, individuals should perform

weight-bearing activities, stop smoking, and reduce their alcohol intake. Skeletal health during the whole lifespan depends heavily on interventions implemented during early life.

Early Prevention Strategies Through Diet and Lifestyle

Medicine researchers by Fervers et al. (2023) analyzed the natural range of iodine absorption in bone marrow by utilizing dual-energy computed tomography (DECT) technological scans. The research identified that bone marrow iodine absorption depends on four variables which include volumetric bone mineral density and patient age and sex and iodine blood pool measurement results. Both volumetric bone mineral density and portal vein iodine blood pool showed the most substantial effects on bone marrow iodine uptake according to the multivariate regression model ($p < 0.001$, mean $\beta = 0.50$ and $p < 0.001$, mean $\beta = 0.43$, respectively).

Doctors analyzed through a meta-analysis both selenium and iodine levels among individuals diagnosed with Kashin-Beck Disease (KBD). The research team discovered that KBD patients presented substantially decreased selenium concentrations but no major iodine variations when compared to both groups. The combined examination of standardized mean differences revealed whole blood selenium (Cohen's $d = 4.39$, $P < 0.001$) and serum selenium (Cohen's $d = 2.42$, $P = 0.015$) together with hair selenium (Cohen's $d = 5.46$, $P < 0.001$) as well as urinary selenium (Cohen's $d = 4.16$, $P < 0.001$) had significantly lower levels in KBD patients (Yang Lei et al., 2016). Older people are more prone to bone disorders due to hormonal imbalance, reduced ability to absorb nutrients, and lack of exercise, among other factors (Zhang et al., 2024). Despite this, people can avoid developing these diseases by properly feeding and exercising at an early age. While so many nutrients are required for the formation of strong bones, one seemingly unimportant nutrient is iodine.

The element iodine is best known for its connection to the thyroid gland; however, its influence also embraces the bone tissue. It will be recalled that the thyroid gland secretes chemicals known as hormones that help control metabolic processes, growth, and bone remodeling. The body requires iodine to regulate the thyroid gland and play an important role in calcium metabolism, which is essential in enhancing bone health (Cristina & Lucia, 2021). Lack of iodine interferes with the development of bones and causes complications such as Osteoporosis when there is a thyroid disorder. Hence, consuming iodine foods is recommended since they will help prevent bone diseases in older adults. This section examines using iodine as a bone-friendly nutrient and an ideal protocol for consuming the needed amount of iodine and other essential nutrients such as calcium, vitamin D, and magnesium.

Iodine-Rich Diet for Bone Health

Iodine levels can be replenished by including more iodine-containing foods in the diet of older adults. Iodine is present in some foods, and the levels found in the diet depend on the soil content in various

geographic locations and the local diet (Rysz et al., 2021). For the better part, iodine deficiency is still evident in many regions, so these particular foods should become staple foods. The primary natural sources of iodine include fish, shellfish, and seaweed, which can also be classified as the richest source. With fish, tuna, shrimp, and oysters having elements with high iodine content. These foods benefit the thyroid gland and contain omega-3 fatty acids, which help strengthen bones and reduce inflammation. Thus, Omega-3 fatty acids are involved in preventing bone resorption and improving bone mineralization, which makes Seafood for the bones of the elderly's a healthy choice.

In addition, foods rich in dairy products, such as milk, yogurt, or cheese, are beneficial. We should know that these are some of the foods rich in iodine, so cows that produce the milk are fed with iodine. Besides the iodine value, calcium and vitamin D found in these products are also essential for bone health. Calcium is required for bone health, while vitamin D enables calcium to be absorbed into the bones (Calvani et al., 2023). Because these foods contain iodine, calcium, and vitamin D, it is important to include dairy products in your diet as much as possible to maintain the good health of the bones. However, most countries add iodine to the table salt to overcome the element shortage. Iodized salt has effectively eliminated iodine deficiency in most populations globally. It is, therefore, advisable to use iodized salt in moderate portions for older people to help them get their iodine. Nevertheless, enhancing salt intake must be done carefully in order to avoid hypertension as well as other cardiovascular complications.

Furthermore, brown types of seaweed like kelp, wakame, and nori contain a perfect amount of iodine. Seaweed Ingredient could be taken to ensure the required intake of iodine, but it is advised that the intake should not be too often as it may lead to thyroid issues. The nutrient also contains minerals such as magnesium, which is critical to the body, and iron. In addition, the yolks of eggs are rich in iodine; therefore, consuming eggs is a convenient way of getting a daily dose of iodized supplements. They also contain protein suitable for body muscles and bones among elderly persons. Some bread, cereal, plant-based milk, and soy products are iodized and thus usable for those on a special diet. These enhanced foods assist in meeting iodine-deficient persons who cannot take natural foods with iodine content.

Iodine supplements or intakes should not interfere with the vitamins or other essential nutrients that are required by the human body. However, they should instead assist in complementing them in enhancing the body function and performance of various organs.

However, iodine is an important component of strong bones as it should be taken together with other important nutrients that build up the bones. Such nutrients can enhance bone health in the body, decreasing bone disease levels if included in the right amount in the diet (Chen et al., 2022). The majority of calcium is found in the bones, so its consumption is crucial in maintaining bone mass. Calcium can be obtained in its best form from dairy products, green leafy vegetables and nuts, and foods fortified with calcium. Lack of adequate calcium will raise the chances of fractures, and the bones become very brittle. They are taken together with sources of iodine to ensure that calcium and phosphorus are well utilized in the body.

Kassis et al. (2023) show that the body has strong bones and that vitamin D is an important nutrient to be included in our diet. Vitamin D deficiency means the body cannot absorb sufficient calcium, weakening the bones. Natural sunlight is an adequate source of vitamin D. However, one can also obtain this nutrient through foods containing fats, products derived from milk, and dairy products, which have been fortified with vitamin D and supplements. Magnesium mineral undresses and participates in bone

formation, managing calcium and Vitamin D. Magnesium (Mg): The sources of magnesium include nuts, seeds, whole grains, and green vegetables. Research has indicated that Mg intake affects bone density, so this mineral should be sourced from food products.

Another mineral used for bone mineralization is phosphorus, part of proteins in meats, dairy products, and legumes. Phosphorus with calcium is used in the formation of bones and teeth. Consequently, moderate phosphorus intake is vital to facilitate bone metabolism.

Vitamin K – Green leafy vegetables like spinach, Kale, etc., help in the metabolism of bones and decrease fracture problems. Vitamin K is involved in bone calcification and calcium metabolization in the bone matrix.

The study by Grochowska & Przeliorz (2022) illustrates that there are several ways people can enhance bone health, such as exercises that put pressure on bones to make them stronger and exercises like walking, resistance, and pilates help to maintain balance and avoid incidents of falling or breaking the bones. Aerobic activity brings bone remodeling, so it should be incorporated into maintaining bone health. Hydration is another modification to consider.

Water is important in maintaining good health, specifically for the bones. With adequate water intake, minerals needed by the bones, such as calcium and magnesium, are transported accordingly (Bargagli et al., 2021).

Limitation of Alcohol and Caffeine Intake: Alcohol also dramatically affects bone density mainly because excessive intake reduces the body's rate of calcium absorption and hinders the process of bone remodeling. Additionally, high consumption of caffeine has the effect of reduced calcium absorption. Abstinence when it comes to these **substances** is important to retain bone health in the elderly. In addition, smoking also causes harm to bones as it leads to poor absorption of calcium and reduction of bone mass. Smoking cessation is also helpful in increasing bone density and, thus, the skeletal frame of a person. Another modification is through proper weight regulation. Underweight individuals are prone to Osteoporosis, and when overweight, pressure on the bones and joints is usually high. Healthy dietary habits that include a balanced and macrobiotic diet and physical activity play a crucial role in maintaining the ideal body weight and bone health.

Lifestyle Modifications to Strengthen Bones

The relationship between physical activity and osteoporosis prevention in those over the age of 65 received specialized review from researchers. The study by Pinheiro et al. (2020) analyzed effects in a meta-analysis showed that physical activity interventions most likely improve bone health of older adults leading to osteoporosis prevention (standardized effect size 0.15, 95% CI 0.05 to 0.25, 20 trials, moderate-certainty evidence). The research shows that physical activity interventions most likely help increase lumbar spine bone mineral density (standardized effect size 0.17, 95% CI 0.04 to 0.30, 11 trials, moderate-certainty evidence) and possibly lead to elevated hip (femoral neck) bone mineral density outcomes (standardized effect size 0.09, 95% CI -0.03 to 0.21, 14 trials, low-certainty evidence).

Regular Weight-Bearing and Resistance Exercises

Regular physical exercise is the top method to develop robust bones that stay in good health. Bone mineral density increases through weight-bearing and resistance training, stimulating new bone development. Weight-bearing exercises, which include walking, jogging, dancing, and stair climbing, subject bones to surrounding tension that triggers body-generated bone strengthening (Hou et al., 2024). Weightlifting and resistance band training build muscle strength that secures bones and minimizes the

chances of bone fractures and accidents.

Scientific research by Jannin et al. (2022) demonstrates that active people lose bones at reduced rates compared to inactive individuals. Postmenopausal women who exercise with weight-bearing activities three times per week demonstrate substantial improvements in bone density based on scientific research. People who are elderly should perform balance type activities like yoga because these practices help decrease their risk of falling and enhance their coordination.

Exercise includes flexibility training as an essential component to minimize injuries to the body. Such exercises in Yoga and Pilates systems help people maintain good posture through stretching and reduce stiffness while improving their total bodily movements. Older adults who lead physically active lives prevent bone loss and improve their overall health status and independence (Williams & Bassett, 2018). Seniors should develop exercise plans matching their fitness abilities to make their programs successful. An evaluation with a physical therapist and their expertise in fitness will help construct an appropriate exercise schedule that strengthens bones without endangering your safety.

Avoid smoking and alcohol intake in excess amounts.

Bones experience detrimental harm when individuals engage in smoking behavior combined with heavy alcohol drinking patterns. Body calcium absorption declines together with estrogen depletion when people smoke, these two important molecules for healthy bone density maintenance (Liu et al., 2024). The cell function of bone-forming osteoblasts gets disrupted by tobacco chemicals, including nicotine, which boosts the chances of developing Osteoporosis with subsequent fractures.

Bones experience damage from cigarette smoke toxins because the toxins restrict blood flow while simultaneously turning off bone-building cells. Smokers' bodies contain fewer vitamin D levels than non-smokers, which plays a vital role in absorbing calcium (Baldassano et al., 2022). The detrimental impact of smoking is becoming very problematic for postmenopausal women, mainly because this population faces higher osteoporosis risk because of a decrease in estrogen level.

The excessive intake of alcohol creates adverse effects on bone structure because it disrupts calcium metabolism and reduces bone mineral density levels. Long-term alcohol abuse leads to essential vitamin D, magnesium, and zinc deficiencies that increase bone weakness severity. The irregular hormone regulation brought by alcohol exposure disrupts bone remodeling procedures, which increases fracture risks in individuals.

People who drink heavily commonly experience balance issues coupled with coordination problems, which create a high risk of accidental falls among seniors. Health professionals recommend that older adults control their alcohol use to moderate levels while making smoking cessation an essential step to prevent bone disease (Deandreis et al., 2021). Health professionals reinforce moderation as the principle through daily drink limits of one alcoholic drink for women and two drinks for men. Wilson-Barnes et al. (2022) explain that professional support through counseling and support groups becomes advantageous for patients who find it challenging to stop smoking or cut back on alcohol intake. Implementing lifestyle changes in these domains substantially helps avoid bone diseases and enhances life quality standards.

Sun Exposure and Vitamin D Supplementation

The mineralization of bones and calcium absorption need Vitamin D to prevent diseases affecting the skeletal system. People obtain their primary natural vitamin D through sunlight when ultraviolet B (UVB) rays activate vitamin D formation in the skin. Factors that can impair vitamin D production in the

skin are aging, reduced outdoor time, geographic location differences, and the need for sunscreen protection (Lisco et al., 2023).

The best way for older adults to overcome vitamin D deficiency requires spending short durations outside every day between morning and late afternoon hours when sunlight intensity remains lower. Daily walks of brief duration and time spent in the garden offer the opportunity to receive enough sunlight through open skin while promoting exercise. Individuals residing in places with minimal sun exposure during winter need to take vitamin D supplementation to ensure their health needs.

Health organizations suggest that older adults take 800 to 1,000 IU of vitamin D daily to maintain healthy bones. Medical specialists state that individuals should include fatty fish (such as salmon or mackerel), fortified dairy products, egg yolks, and mushrooms as part of their dietary intake (Sheng et al., 2021). Many elderly patients cannot reach their necessary vitamin D intake standards through diet alone, which motivates the need for supplemental treatment.

The lack of vitamin D in the body increases the possibility of bone fractures, which causes muscles to weaken and leads to increased accidental falls among senior citizens. Research demonstrates that elderly individuals with sufficient vitamin D content within their system experience fewer hip fractures than seniors without sufficient vitamin D levels. Regular medical check-ups and supplementation help doctors evaluate vitamin D levels to determine proper consumption amounts (Azzolino et al., 2021). The current recommendations for patients with severe vitamin D deficiencies involve healthcare providers recommending temporary higher doses of this vitamin. Users must regulate their calcium absorption when combining these nutrients because they are partners in improving skeletal structure. Both adequate vitamin D consumption and proper calcium absorption create safer conditions for preventing osteoporosis development and related health issues.

Additional Considerations for Bone Health

Besides exercise, smoking cessation, alcohol limits, and vitamin D intake, bone health depends on additional factors that support overall bone strength. A nutrition plan containing proper minerals, including calcium, magnesium, and iodine, becomes essential for stopping bone diseases (Dunlop et al., 2025). The thyroid function under the influence of iodine indirectly affects bone metabolism. Iodine deficiency interrupts the thyroid glands' hormone production functions, which regulate bone turnover processes. A diet containing iodine-rich foods such as seaweed, dairy products, eggs, and iodized salt helps operate the thyroid properly while maintaining proper bone health.

Bone health requires adequate water consumption as a vital component for its proper maintenance. The water in the human body facilitates cellular processes and provides pathways for the movement of necessary nutrients to the bones. When the body becomes dehydrated, it causes muscles to weaken and joints to stiffen, thus raising the chance of fracture and falling. Providing sufficient daily water intake to elderly clients supports other efforts to improve bone health (Coll et al., 2021). Regular medical appointments with bone density tests work to detect osteoporosis risk in people before its onset. The early discovery of bone health issues enables healthcare providers to guide patients toward suitable treatments that stop additional bone thinning. The medical community sometimes prescribes patients with significant bone density reduction to reduce their osteoporosis progression.

Challenges and Considerations in Implementing Dietary Changes Barriers to adequate Iodine intake in the elderly

The main obstacle to sufficient iodine consumption for elderly adults arises from their restricted diet and food taste preferences. The medical conditions affecting elderly adults, such as hypertension, cardiovascular disease, and kidney disorders, force them to follow restrictive diets because these conditions restrict their consumption of dairy products, Seafood, and iodized salt. The combination of weak appetite and eating difficulties in elderly adults' results in a limited ability to ingest enough iodine through diet (Cristina & Lucia, 2021). Following diets based on vegetarianism or veganism becomes challenging for iodine intake because vegetarian diets usually have lower iodine content compared to seafood and dairy foods.

The widespread occurrence of iodine deficiency affects specific demographics of people within the population. Regionally, elderly residents face an increased risk of iodine deficiency because their living locations feature soil scarcity in iodine content, which causes crops and livestock to contain less iodine. The deficiency problem arises because people consume less iodine as they reduce their use of iodized salt when cooking at home and processed foods. Older adults who develop iodine deficiency end up facing severe health problems, including hypothyroidism combined with cognitive impairment, as well as less efficient metabolic activity (Rodrigues et al., 2021). Proper interventions for these barriers require public health awareness campaigns, dietary modifications, and sometimes supplemental interventions.

Potential Risks of Excess Iodine Consumption

Both insufficient iodine intake and excessive amounts of iodine create serious health risks for people within the population. Hyperthyroidism represents a significant concern for elderly patients who have thyroid diseases and iodine deficiency backgrounds. High levels of iodine intake activate the thyroid gland to produce an excess of thyroid hormones. Iodine-induced hyperthyroidism creates symptoms including weight loss along with irregular heartbeat tremors, and anxiety when it develops (Chen et al., 2022). Hyperthyroidism patients face enhanced dangers of Osteoporosis because the condition leads to decreased bone health.

Medical supervision becomes necessary to assess the risk of iodine supplementation for elderly population members. Vitamin supplements, along with dietary sources of iodine taken in excessive amounts, may cause thyroid problems that worsen medical problems in patients. The assessment of iodine requirements by healthcare providers needs to consider combinations of dietary assessments with medical history and thyroid tests in order to personalize supplementation recommendations (Kassis et al., 2023). Continuous observation of dietary intake combined with periodic adjustments helps elderly individuals achieve healthy iodine concentrations within safe thresholds.

CONCLUSION

In conclusion, iodine is a critical dietary element many people neglect regarding bone health. The elderly population needs to take preventive measures for bone diseases by living actively and maintaining nutritious diets to minimize these health issues. Together with calcium and vitamin D intake and sufficient iodine levels, including the support of the thyroid gland aid the building blocks for healthy bones. The combined practice of exercise, reduction of risky activities like smoking and alcohol abuse, and the continuation of daily active movement all build up skeletal strength.

Iodine's impact on bone health surpasses food consumption alone because it needs integrated medical care combined with public education and prompt therapeutic measures. Regular health screenings must

determine the thyroid function of elderly individuals to make sure iodine intake meets acceptable levels (Baldassano et al., 2022). Workers in healthcare need to instruct older adults about the importance of iodine and its joint action with dietary nutrients to keep bones strong and avoid fractures. The public health system needs to back programs promoting iodine-enriched food delivery programs, primarily for regions with high incidences of deficiency.

The challenges in distributing proper iodine dosage exist for seniors who face food or dietary limitations. Medical supervision is necessary before supplementing iodine because excess consumption creates health risks. Extremely high iodine intake produces hyperthyroidism that promotes faster bone loss and worsens the risk of fractures. Both under- and overemphasis of iodine intake should be avoided when supporting sustained skeletal health.

The prevention of bone disease depends on various strategies that combine patient education with immediate therapeutic action and continuous studies about iodine–thyroid–bone relationships (Coll et al., 2021). Elderly individuals who follow educated nutritional decisions and active lifestyle improvements will protect their bone health and gain better mobility while improving their quality of life. Families, healthcare professionals, and caregivers need to actively support aging people through the essential modifications they need to make. Rising public awareness through research efforts will help fill the knowledge gap, thus leading to better aging outcomes.

Elderly populations worldwide will keep growing, so preventive healthcare needs immediate attention. Public agencies, healthcare facilities, and organizations must create framework strategies that promote educational initiatives, nutritional advice, and iodine-fortified food access. Proactive bone health management practices established by society will help seniors maintain their independence while decreasing the clinical burden of bone diseases on healthcare facilities. During the integration of iodine nutrition with public health measures combined with lifestyle changes, a promising path exists for improving global health among aging populations.

REFERENCES

1. Ahn, S., & Oh, J. (2021). Effects of a health-belief-model-based osteoporosis-and fall-prevention program on women at early old age. *Applied nursing research*, 59, 151430.
2. Azzolino, D., Spolidoro, G. C. I., Saporiti, E., Luchetti, C., Agostoni, C., & Cesari, M. (2021). Musculoskeletal changes across the lifespan: nutrition and the life-course approach to prevention. *Frontiers in medicine*, 8, 697954.
3. Baldassano, S., Di Gaudio, F., Sabatino, L., Caldarella, R., De Pasquale, C., Di Rosa, L., ... & Vasto, S. (2022). Biofortification: Effect of Iodine fortified food in the healthy population, double-arm nutritional study. *Frontiers in Nutrition*, 9, 871638.
4. Bargagli, M., Arena, M., Naticchia, A., Gambaro, G., Mazzaferro, S., Fuster, D., & Ferraro, P. M. (2021). The role of diet in bone and mineral metabolism and secondary hyperparathyroidism. *Nutrients*, 13(7), 2328.
5. Baugreet, S., Hamill, R. M., Kerry, J. P., & McCarthy, S. N. (2017). Mitigating nutrition and health deficiencies in older adults: a role for food innovation?. *Journal of food science*, 82(4), 848-855.
6. Calvani, R., Picca, A., Coelho-Júnior, H. J., Tosato, M., Marzetti, E., & Landi, F. (2023). Diet for the prevention and management of sarcopenia. *Metabolism*, 146, 155637.
7. Chen, L. K., Arai, H., Assantachai, P., Akishita, M., Chew, S. T., Dumlaio, L. C., ... & Woo, J. (2022). Roles of nutrition in muscle health of community-dwelling older adults:

8. evidence-based expert consensus from Asian Working Group for Sarcopenia. *Journal of cachexia, sarcopenia and muscle*, 13(3), 1653-1672.
9. Coll, P. P., Phu, S., Hajjar, S. H., Kirk, B., Duque, G., & Taxel, P. (2021). The prevention of osteoporosis and sarcopenia in older adults. *Journal of the American Geriatrics Society*, 69(5), 1388-1398.
10. Cristina, N. M., & Lucia, D. A. (2021). Nutrition and healthy aging: Prevention and treatment of gastrointestinal diseases. *Nutrients*, 13(12), 4337.
11. Deandreis, D., Maillard, A., Zerdoud, S., Bournaud, C., Vija, L., Sajous, C., ... & Leboulleux, S. (2021). RADTHYR: an open-label, single-arm, prospective multicenter phase II trial of Radium-223 for the treatment of bone metastases from radioactive iodine refractory differentiated thyroid cancer. *European Journal of Nuclear Medicine and Molecular Imaging*, 48, 3238-3249.
12. Dunlop, K., Dillon, G., Crowley, R. K., Phillips, C., Twomey, P., & McAuliffe, F. M. (2025). Lifestyle interventions in later reproductive age women to offset cardiometabolic and bone disease: a scoping review. *Nutrition & Metabolism*, 22, 15.
13. Fervers, P., Fervers, F., Rinneburger, M., Weisthoff, M., Kottlors, J., Reimer, R., ... & Persigehl, T. (2023). Physiological iodine uptake of the spine's bone marrow in dual-energy computed tomography—using artificial intelligence to define reference values based on 678 CT examinations of 189 individuals. *Frontiers in endocrinology*, 14, 1098898.
14. Gonzalez-Campoy, J. M., Castorino, K., Ebrahim, A., Hurley, D., Jovanovic, L., Mechanick, J. I., ... & Weiss, D. (2013). Clinical practice guidelines for healthy eating for the prevention and treatment of metabolic and endocrine diseases in adults: cosponsored by the American Association of Clinical Endocrinologists/the American College of Endocrinology and the Obesity Society. *Endocrine Practice*, 19, 1-82.
15. Grochowska, K., & Przeliorz, A. (2022). The effect of the ketogenic diet on the therapy of neurodegenerative diseases and its impact on improving cognitive functions. *Dementia and geriatric cognitive disorders extra*, 12(2), 100-106.
16. Hou, Y., Xiang, J., Wang, B., Duan, S., Song, R., Zhou, W., ... & He, B. (2024). Pathogenesis and comprehensive treatment strategies of sarcopenia in elderly patients with type 2 diabetes mellitus. *Frontiers in Endocrinology*, 14, 1263650.
17. Iuliano, S., Poon, S., Robbins, J., Bui, M., Wang, X., De Groot, L., ... & Seeman, E. (2021). Effect of dietary sources of calcium and protein on hip fractures and falls in older adults in residential care: cluster randomised controlled trial. *bmj*, 375.
18. Jannin, A., Lamartina, L., Moutarde, C., Djennaoui, M., Lion, G., Chevalier, B., ... & Do Cao, C. (2022). Bone metastases from differentiated thyroid carcinoma: heterogenous tumor response to radioactive Iodine therapy and overall survival. *European journal of nuclear medicine and molecular imaging*, 49(7), 2401-2413.
19. Kassis, A., Fichot, M. C., Horcajada, M. N., Horstman, A. M., Duncan, P., Bergonzelli, G., ... & Donato-Capel, L. (2023). Nutritional and lifestyle management of the aging journey: A narrative review. *Frontiers in nutrition*, 9, 1087505.
20. Lisco, G., De Tullio, A., Triggiani, D., Zupo, R., Giagulli, V. A., De Pergola, G., ... & Triggiani, V. (2023). Iodine deficiency and iodine prophylaxis: an overview and update. *Nutrients*, 15(4), 1004.
21. Liu, L., Luo, P., Wen, P., & Xu, P. (2024). Effects of selenium and iodine on Kashin-Beck disease: an updated review. *Frontiers in Nutrition*, 11, 1402559.

22. Nguyen, T. V., Kelly, P. J., Sambrook, P. N., Gilbert, C., Pocock, N. A., & Eisman, J. A. (2009). Lifestyle factors and bone density in the elderly: implications for osteoporosis prevention. *Journal of Bone and Mineral Research*, 9(9), 1339-1346.
23. Pinheiro, M. B., Oliveira, J., Bauman, A., Fairhall, N., Kwok, W., & Sherrington, C. (2020).
24. Evidence on physical activity and osteoporosis prevention for people aged 65+ years: a systematic review to inform the WHO guidelines on physical activity and sedentary behaviour. *International Journal of Behavioral Nutrition and Physical Activity*, 17, 1-53.
25. Rodrigues, F. G., Ormanji, M. S., Heilberg, I. P., Bakker, S. J., & de Borst, M. H. (2021). Interplay between gut microbiota, bone health and vascular calcification in chronic kidney disease. *European Journal of Clinical Investigation*, 51(9), e13588.
26. Rondanelli, M., Faliva, M. A., Barrile, G. C., Cavioni, A., Mansueto, F., Mazzola, G., ... & Peroni, G. (2021). Nutrition, physical activity, and dietary supplementation to prevent bone mineral density loss: a food pyramid. *Nutrients*, 14(1), 74.
27. Rysz, J., Franczyk, B., Rokicki, R., & Gluba-Brzózka, A. (2021). The Influence of Dietary Interventions on Chronic Kidney Disease–Mineral and Bone Disorder (CKD-MBD). *Nutrients*, 13(6), 2065.
28. Sheng, B., Li, X., Nussler, A. K., & Zhu, S. (2021). The relationship between healthy lifestyles and bone health: A narrative review. *Medicine*, 100(8), e24684.
29. Williams, G. R., & Bassett, J. D. (2018). Thyroid diseases and bone health. *Journal of endocrinological investigation*, 41(1), 99-109.
30. Wilson-Barnes, S. L., Lanham-New, S. A., & Lambert, H. (2022). Modifiable risk factors for bone health & fragility fractures. *Best Practice & Research Clinical Rheumatology*, 36(3), 101758.
31. Yang Lei, Y. L., Zhao GuangHui, Z. G., Yu FangFang, Y. F., Zhang RongQiang, Z. R., & Guo Xiong, G. X. (2016). Selenium and iodine levels in subjects with Kashin-Beck disease: a meta-analysis.
32. Yang, T., Lee, S. Y., Park, K. C., Park, S. H., Chung, J., & Lee, S. (2022). The effects of selenium on bone health: from element to therapeutics. *Molecules*, 27(2), 392.
33. Zhang, Y. W., Song, P. R., Wang, S. C., Liu, H., Shi, Z. M., & Su, J. C. (2024). Diets intervene osteoporosis via gut-bone axis. *Gut Microbes*, 16(1), 2295432.