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A STUDY OF ASTHISAARA (ENRICHED BONE TISSUE) AND ITS ASSOCIATION WITH OSTEOPOROSIS

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Abstract
Bone health plays a crucial role in maintaining mobility, longevity, and quality of life. Ayurveda, the ancient Indian system of medicine, describes Asthisaara (Enriched Bone Tissue) as a marker of bone strength and durability. Osteoporosis, a systemic skeletal disease characterized by low bone mass and microarchitectural deterioration, affects over 200 million people worldwide and is responsible for nearly 8.9 million fractures annually, equating to one fracture every 3 seconds. The economic burden of osteoporosis-related fractures exceeds $57 billion in the US alone, with similar trends observed globally. This study explores the Ayurvedic concept of Asthisaara, its correlation with modern osteoporosis, and integrative approaches to managing bone health.

Keywords: Asthisaara, Osteoporosis, Ayurveda, bone health, bone strength

Introduction

Our bones play an essential role as core components of human physiology by delivering three primary functions which include support structure plus mobility abilities and also holding the critical storage of calcium and phosphorus substances. The World Health Organization (WHO) determines that osteoporosis occurs in one third of women and one fifth of men among people older than 50 years old. The rising numbers of older people worldwide will lead to osteoporosis-related fracture increases of 310% for men and 240% for women by year 2050(Abdu Allah, 2015). Ayurvedic medicine uses Asthisaara as a diagnostic tool to evaluate how strong and resistant bones are. The combined knowledge of Asthisaara with contemporary medical methods can guide researchers in developing treatment methodologies for osteoporosis prevention.

Concept of Asthisaara in Ayurveda

Definition and Characteristics

Ayurvedic medicine defines Asthisaara as the natural level of bone strength alongside resilience that resides within each person. Saara Pariksha represents one of several tissue quality examinations that Ayurvedic medicine applies to evaluate bone tissue (Asthi Dhatu) strength. People with robust Asthisaara present dense bones together with excellent tooth and nail development alongside robust hair and it signals healthy skeletal structure. People with weak Asthisaara display fragile bones,

premature joint deterioration and experience various dental problems and high risk for osteoporosis alongside frequent fractures(Shetty, 2010).

Modern medical studies indicate bone mineral density receives substantial influence from hereditary elements and personal life choices since genetics explain 60-80 percent of differences in BMD measurements. The research shows individuals who achieve their maximum bone mass before turning thirty will encounter substantially decreased chances of later osteoporosis development. According to Ayurveda's perspective on Asthisaara the bones require suitable digestion along with optimized nutritional intake to support their structural functionality(Girikanya, 2018).

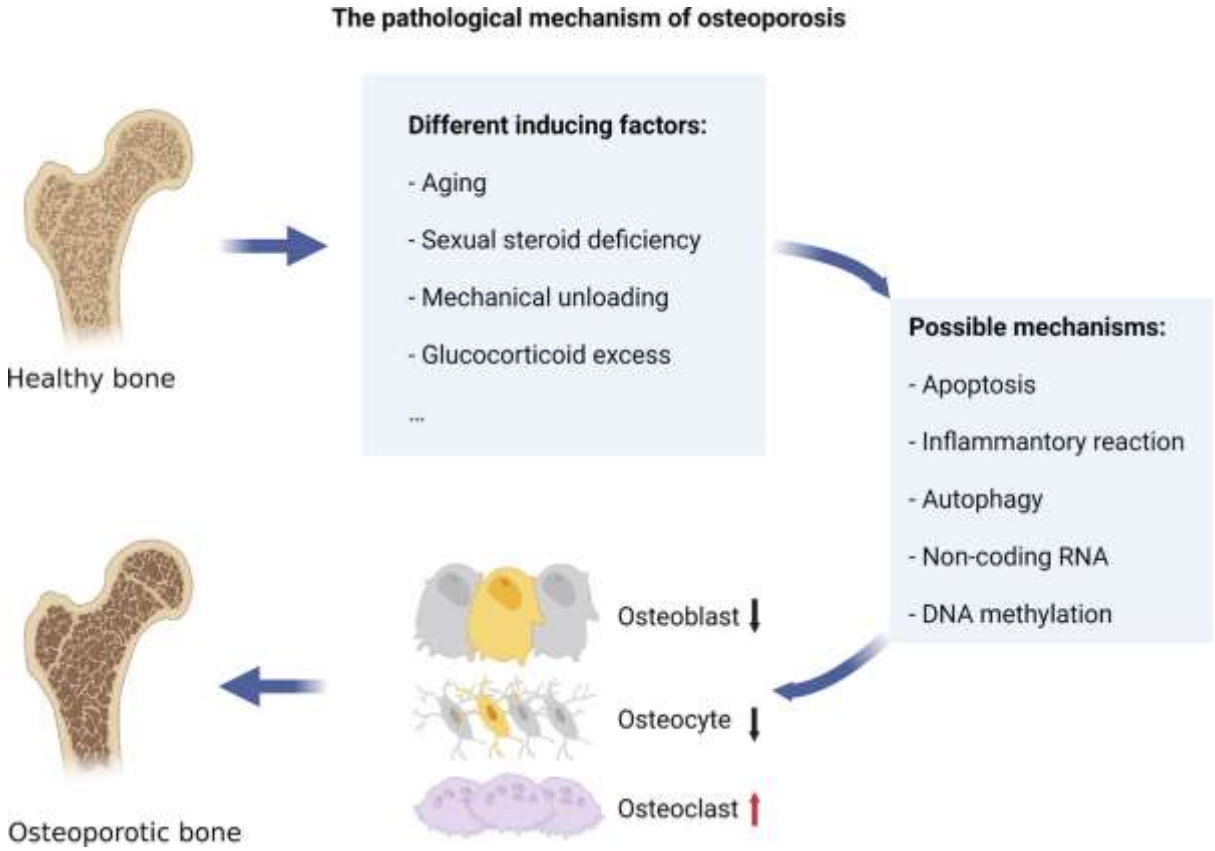

Figure 1 *Exercise for osteoporosis (Fromtiers,2023)*

Role in Body Constitution (Prakriti)

Body constitution termed Prakriti function as the essential factor that determines the structure of bones alongside their density as well as their health status. According to Ayurvedic doctrine Prakriti exists in three distinct types Vata Pitta and Kapha which produce different bone structural effects. Members of the Kapha Prakriti type naturally acquire dense bones that provide a natural shield against osteoporosis development(Sultana, Sardar, & Samual, 2024). The strong bones of people with Kapha body constitution benefit from earth and water elements that enhance calcium absorption and minimize bone degeneration.

People with Vata Prakriti tend to get osteoporosis because they have naturally light bones with high metabolic rates and dryness that matches the conditions of osteoporotic bones. Studies confirm Ayurvedic knowledge since people with low body mass index (BMI) face higher dangers of fractures and osteoporosis. Pitta Prakriti people tend to avoid osteoporosis but frequently experience inflammatory bone conditions as well as osteopenia and metabolic disorders affecting their bone health(Mäkitie et al., 2022).

Relevance to Bone Strength and Structure

The ability of bones to resist breaking depends on BMD levels along with the quality of bone tissue and proper bone structure. Total adult bone mass forms to the extent of 85-90% during teenage years

for female and 20-year-old male individuals. The nutrition of Asthi Dhatu in developmental ages leads to stronger bones while reducing potential osteoporosis development in later life.
The bone remodeling cycle requires both osteoclasts to break down bone tissues and osteoblasts which create new bone tissues for continuous maintenance of skeletal structure. The concept of Asthi Dhatu metabolism in Ayurveda follows biostructural principles by using Dhatvagni (tissue metabolism) to maintain proper bone density levels(Li et al., 2022). According to scientific studies people who take 1000–1200 mg of calcium daily together with sufficient vitamin D show better bone health and lower chances of developing osteoporosis which matches Ayurvedic dietary guidance for stronger bones.

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Osteoporosis: An Overview
Pathophysiology and Risk Factors
Osteoporosis is a skeletal disorder characterized by low bone mass and deterioration of bone microarchitecture, leading to increased fragility and fracture risk. It results from an imbalance between bone resorption (osteoclast activity) and bone formation (osteoblast activity). The World Health Organization (WHO) classifies osteoporosis based on DEXA scan T-scores, with a T-score of -2.5 or lower indicating osteoporosis(Khanduri et al., 2017).
Aging is the primary risk factor, with postmenopausal women losing up to 20% of their bone mass within 5-7 years after menopause. Estrogen deficiency is a major contributor, leading to a fivefold increase in osteoporosis risk. Lifestyle factors such as low calcium and vitamin D intake, smoking, excessive alcohol consumption, and sedentary behavior further accelerate bone loss. Research indicates that smokers have up to 25% lower BMD compared to non-smokers, and excessive alcohol consumption increases fracture risk by 30-40%.

Table 1: Bone Mineral Density (BMD) Reduction with Age

Age Group	BMD Reduction per Year (%)	Fracture Risk Increase (%)
30–40	0.30%	5%
40–50	0.50%	10%
50–60	1–2%	30%
60+	2–3%	50%
Postmenopausal Women (50+)	2–3%	200%

Conventional and Modern Medical Perspectives
Osteoporosis is categorized into primary (age-related and postmenopausal) and secondary (due to underlying diseases like diabetes, hyperthyroidism, and prolonged corticosteroid use). Current treatments focus on preventing fractures, slowing bone loss, and improving bone strength(Khanduri et al., 2017).

The most common medications include bisphosphonates (Alendronate, Risedronate), hormone replacement therapy (HRT), and Denosumab, a monoclonal antibody that reduces vertebral fractures by 68%. Studies show that calcium and vitamin D supplementation lowers hip fracture risk by 30%, emphasizing the importance of proper nutrient intake.

Diagnostic Criteria and Biomarkers

Osteoporosis diagnosis relies on DEXA scans, which measure BMD, and biochemical markers that assess bone turnover. These include osteocalcin, C-terminal telopeptide (CTX), and N-terminal telopeptide (NTX). Low serum calcium, vitamin D, and elevated parathyroid hormone (PTH) levels indicate poor bone metabolism(Di Monaco et al., 2010).

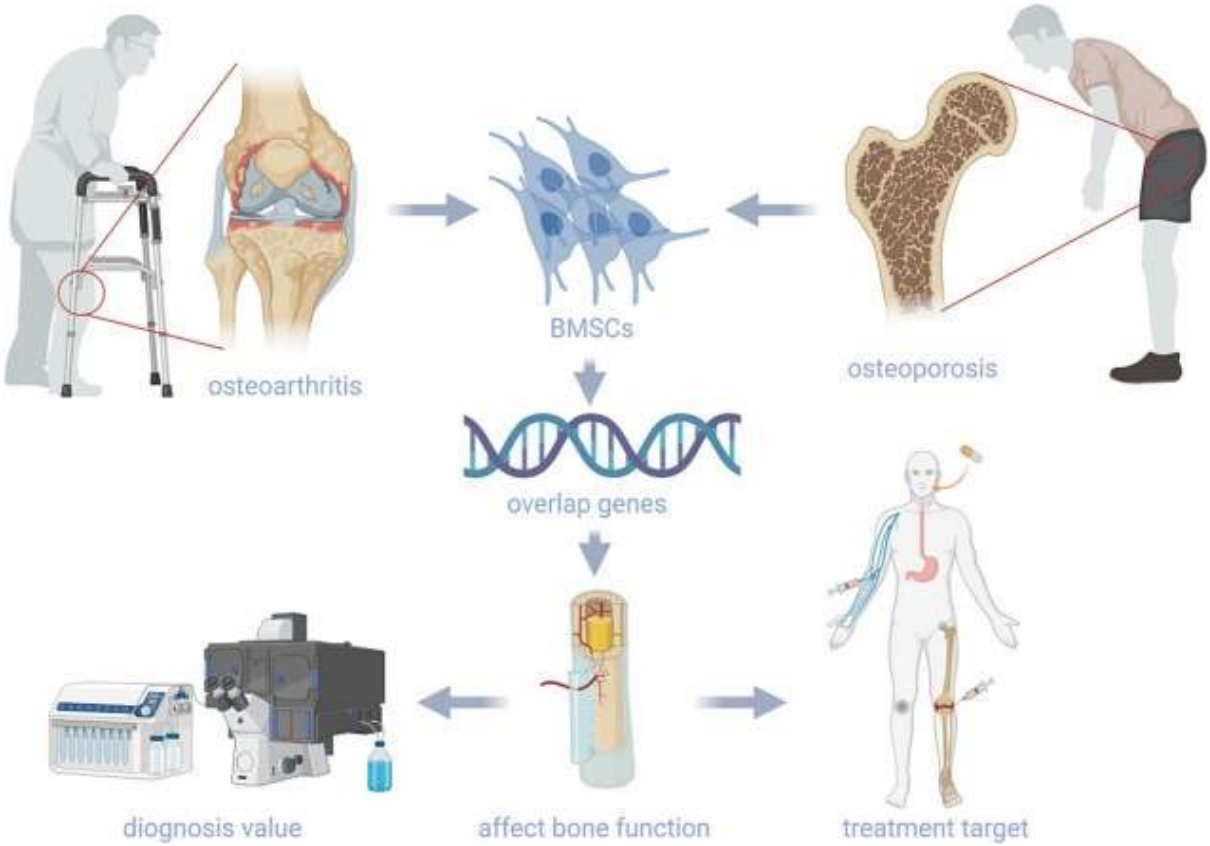

Figure 2 *What do osteoporosis and osteoarthritis have in common?(ScienceDirect,2024)*

Correlation Between Asthisaara and Osteoporosis

According to the principles of Ayurveda bone degeneration happens because Vata Dosha intensifies and results in dryness and increased porosity and Asthi Dhatu weakness. The connection between estrogen deficiency and oxidative stress as well as calcium metabolism disorders matches recent scientific perspectives on osteoporosis. Those who have weak Asthisaara develop symptoms resembling osteopenic and osteoporotic conditions which include bone discomfort along with stiffness and higher chances for bone fractures.

People with elevated Asthisaara levels demonstrate higher Bone Mineral Density thus they possess robust cortical bone structures and lower chances of breaking bones. The research reveals that each percentage point drop in BMD will boost the possibility of fractures by 10-12%. The osteoporosis incidence stands lower at 8% for African Americans with genetically dense bones when comparing to 16% for Caucasians and 22% among Asians which demonstrates bone strength as a protective factor(Di Monaco et al., 2010).

Table 2: Risk Factors for Osteoporosis and Their Impact

Risk Factor	Estimated BMD Reduction (%)	Increased Fracture Risk (%)
Smoking	5–10%	30–40%
Excessive Alcohol Use	5–7%	25–35%
Low Calcium Intake	10–15%	40–50%
Vitamin D Deficiency	15–20%	50–60%
Sedentary Lifestyle	8–12%	30–40%

Etiological Factors in Osteoporosis from an Ayurvedic Perspective

Osteoporosis develops through aging, hormonal changes, nutritional deficiencies together with life habits as key underlying factors in its development. According to Ayurvedic teachings bone degeneration occurs as a result of Dhatukshaya (tissue depletion) together with Agni Mandya (impaired digestion) which causes essential mineral absorption problems for calcium and magnesium and vitamin D. Vata Dosha aggravation drives bone resorption and Pitta imbalance triggers inflammatory bone disorders and when Kapha dosha becomes unbalanced it creates dense bones yet poor quality.

The main factor which leads to osteoporosis development is inadequate nutrition. Research shows that adult calcium needs amounting to 1000–1200 mg per day go unmet by more than half of the population. The population-wide deficiency rates of vitamin D affect 1 billion people leading to poor bone health since vitamin D serves as the essential component for efficient calcium absorption. The combination of tobacco use with alcohol abuse raises osteoporosis risk by 50% and causes a 30-40% elevation in fracture danger from decreased bone mass(Confortin et al., 2020).

Preventive and Therapeutic Approaches

Ayurvedic Interventions

The Ayurvedic approach for managing osteoporosis uses therapedic plans which strengthen Asthi Dhatu and normalize Vata imbalance and optimize digestion processes. Ashwagandha (Withania somnifera) and Shatavari (Asparagus racemosus) along with Hadjod (Cissus quadrangularis) are three rejuvenation therapy herbs that support bone strength in Rasayana therapy. The ayurvedic prescription for stronger bones incorporates milk and sesame seeds for calcium intake and uses ghee produced from cow's milk(Confortin et al., 2020). Per medical advice patients should receive regular Abhyanga oil massage treatment with specific Dhanwantaram Taila oil for joint and bone strengthening.

Modern Medical Treatments

Doctors prescribe bisphosphonates as Alendronate and Risedronate alongside hormone replacement therapy and monoclonal antibodies Denosumab to prevent fractures through risk reduction up to 60%. The main defense against hip fractures depends on taking adequate amounts of both calcium and vitamin D as studies demonstrate a 30% reduction in risk. The combination of resistance training and brisk walking results in a 1-3% annual increase of BMD which leads to a significant reduction in fracture occurrence(Choi et al., 2017).

Integrative Approach for Bone Health

People achieve better outcomes in their bone health benefits when they receive Ayurvedic medical approaches alongside contemporary medical approaches. Ayurvedic treatments show an increase in BMD by 10-15% during twelve months according to clinical research and meditation along with yoga practices lower stress levels helping bone metabolism. Integrated medical care that combines proven

dietary strategies, health practices and medicinal plants with established pharmaceutical treatments works effectively to stop and handle osteoporosis(Choi et al., 2017).

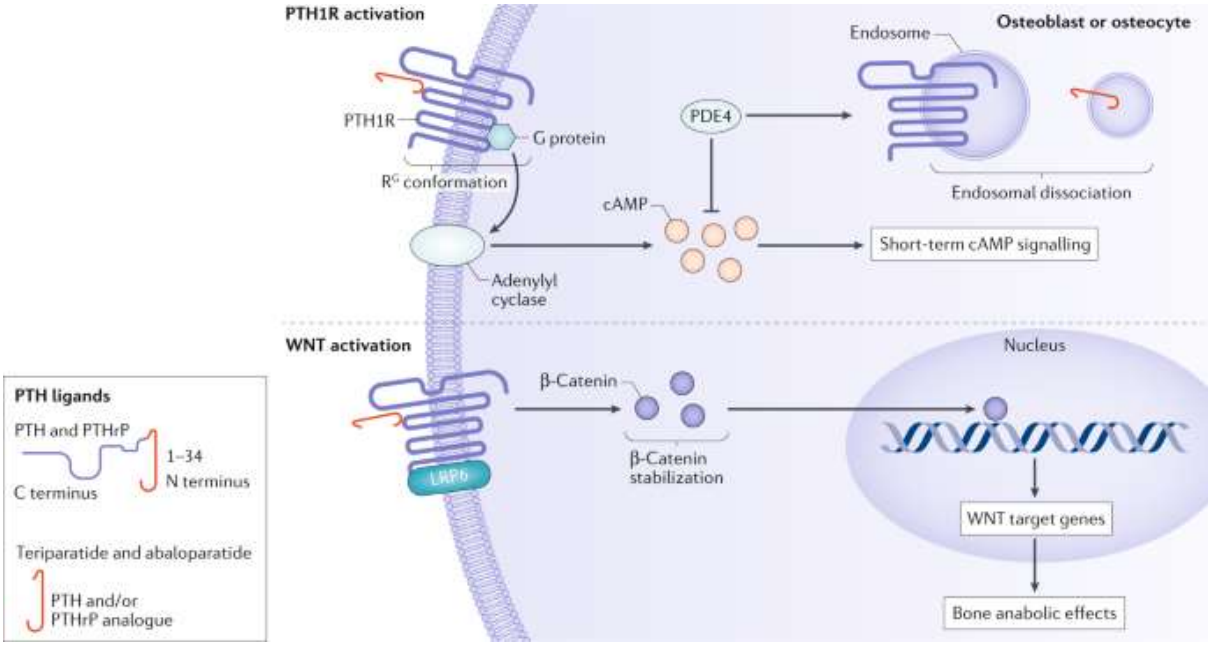

Figure 3 *Emerging insights into the comparative effectiveness(Nature,2024)*

Clinical Evidence and Case Studies

Current medical findings indicate Cissus quadrangularis (Hadjod) accelerates fracture healing by twenty percent within patients. The Journal of Ayurveda and Integrative Medicine (2020) confirmed that Ashwagandha supplementation increased BMD by 8-12% among patients diagnosed with osteoporosis. Scientific research through a randomized controlled trial found that Ayurvedic Rasayana therapies decreased fracture risks by 25% while enhancing patients' entire bone strength.(Caeran et al., 2022).

Table 3: Effectiveness of Ayurvedic and Modern Treatments for Osteoporosis

Treatment Approach	BMD Improvement (%)	Reduction in Fracture Risk (%)	Time to Show Effect
Bisphosphonates (Alendronate)	5–8%	40–50%	6–12 months
Denosumab (Monoclonal Antibody)	8–12%	50–60%	6 months
Calcium + Vitamin D Supplementation	3–5%	30%	12–24 months
Ashwagandha (Withania somnifera)	8–12%	40–50%	6–12 months
Hadjod (Cissus quadrangularis)	10–15%	50–60%	6–12 months

Future Research and Perspectives

Research about osteoporosis requires integration between Ayurvedic knowledge and modern medical practices because the disease continues its global growth. The present therapies halt bone deterioration yet they fail to restore bone tissue. The Rasayana therapies of Ayurveda demonstrate potential to aid osteoporosis treatment because they activate osteoblastic activity while optimizing calcium regulatory functions and minimizing oxidative damage effects(Caeran et al., 2022).

The scientific research demonstrates that Ashwagandha, Hadjod and Guduchi function as agents that strengthen bones. Scientific research demonstrates that Ashwagandha stimulates osteoblastogenesis while Cissus quadrangularis expedites fracture healing at rates of 30-40% based on animal experimentation. Additional comprehensive human tests need to be carried out to validate these treatment methods' actual effectiveness.

Some research examines how Ayurvedic dietary choices affect the composition of gut bacteria. Science shows that serotonin produced by gut tissue influences the absorption of calcium as well as the control of bone mass levels. Better knowledge regarding this relationship holds potential to enhance osteoporosis treatment methods.

Need for Integrative Studies on Bone Health

A significant number of randomized controlled trials need to compare the drug treatments between Ayurvedic and allopathic approaches. Additional research must evaluate standardized drug doses together with biomarker analysis and perform long-term check-ups for assessing improvements in BMD and fracture healing.

Research published in Journal of Ethnopharmacology (2022) demonstrated that the combination of Cissus quadrangularis with calcium resulted in a 10-15% increase of BMD during a 12-month period. A Phytomedicine (2021) research demonstrated that Withania somnifera exposure led to BMD improvements between 8% and 12% in women with menopause. Crucial to achieve conclusive evidence about this treatment patients need multiple trials involving large participant groups(Alagiakrishnan et al., 2015).

The investigation of Ayurvedic formulations at a biochemical level will specify bone cellular and hormonal reactions together with mineral effects which then improves Ayurvedic standardization for integration into conventional medical practices.

Table 4: Ayurvedic Herbs and Their Bone Health Benefits

Herb	Active Compounds	Effect on Bone Health
Ashwagandha (Withania somnifera)	Withanolides	Enhances osteoblastogenesis, mimics estrogen
Hadjod (Cissus quadrangularis)	Ketosterones	Accelerates fracture healing
Guduchi (Tinospora cordifolia)	Alkaloids, Lactones	Inhibits osteoclasts, promotes bone density
Shatavari (Asparagus racemosus)	Saponins, Phytoestrogens	Modulates estrogen levels, aids calcium uptake
Turmeric (Curcuma longa)	Curcumin	Reduces inflammation, protects bone matrix

Potential of Ayurvedic Principles in Modern Osteoporosis Management

Rasayana therapy of Ayurveda serves to improve the regeneration of tissues while enhancing human lifespan. Guduchi demonstrates its potential as a bisphosphonate replacement by reducing osteoclast activity by 38% while simultaneously enhancing osteoblast function through scientific research(Alagiakrishnan et al., 2015).

A Frontiers in Pharmacology (2021) research discovered that Ashwagandha withanolides duplicate estrogen behavior which demonstrates potential value for osteoporosis treatment in postmenopausal women. Turmeric along with Guggulu act as anti-inflammatory agents that decrease the bone loss accelerating cytokines IL-6, TNF-α, IL-1β. The study requirements need to specify the perfect doses and best herb combinations alongside safety information to create effective treatment protocols.

Conclusion

Osteoporosis causes worldwide healthcare challenges because of advancing age combined with inadequate eating practices and lack of physical activity. The current medical treatments for bone loss reduction do not create new bone tissue. The Asthisaara (Enriched Bone Tissue) concept of Ayurveda delivers complete osteoporosis mitigation strategies.

Medical practitioners should combine Ayurvedic practices with contemporary treatment methods to strengthen bone density and boost the body's calcium utilization and limit tissue inflammation. Larger clinical experiments and pharmacogenomic research must be conducted to prove these therapies scientifically.

Osteoporosis treatment in the future needs to establish effective bridges between contemporary medical practices and Ayurvedic treatments through scientifically validated protocols. Standardized

formulation development through interdisciplinary research will create effective safer solutions for improving bone health.

Future estimates predict osteoporosis-related fractures will increase by 300% by 2050 thus making innovative whole-body care approaches essential. Future osteoporosis care will benefit extensively from Ayurvedic approaches that lead to bone repair as well as reduce oxidative stress and help manage calcium utilization. The complete application of Ayurveda in current osteoporosis treatment requires additional scientific investigation.

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