Structural Significance of Asthi Sharir in Osteoporosis – An Ayurvedic Perspective: A Review

Dr Maheswari Rajaram Terkar[1], Dr Vivek Vasantrao Kulkarni[2]
[1]*Assistant Professor, Department Rachana Sharir, Aditya Ayurved College Beed 413501*
[2]*Principal & Professor, Department of Rachana Sharir, Aditya Ayurved college, Beed 431122*

***Abstract*—Osteoporosis is a major global public health concern characterized by progressive reduction in bone mass, compromised bone quality, and increased susceptibility to fractures. Conventional biomedical science attributes osteoporosis to an imbalance between bone formation and resorption influenced by hormonal changes, nutritional deficiencies, aging, and genetic predisposition. Ayurveda, however, presents a unique structural and functional perspective through the concept of Asthi Sharir, which includes the formation, nourishment, maintenance, and degeneration of bone tissue (Asthi Dhatu) within the broader Dhatu Poshana framework. Classical Ayurvedic texts describe Asthi as one of the seven fundamental dhatus whose integrity is dependent upon the proper functioning of Agni, balanced Dosha, and unobstructed srotas. This review aims to bridge the conceptual framework of Asthi Sharir with modern osteobiology to provide a comprehensive understanding of osteoporosis. It examines classical structural classifications of bones, the role of Vata dosha in Asthi Kshaya, and the significance of Majja Dhatu in maintaining bone resilience. Furthermore, the review analyzes correlations between Ayurvedic pathogenesis and modern molecular mechanisms of bone demineralization and trabecular deterioration. The discussion highlights Ayurvedic preventive and therapeutic principles—including diet, lifestyle, Rasayana therapies, and Asthi-vriddhikara herbs—that may support skeletal health and mitigate osteoporosis progression. The synthesis of Ayurvedic and modern scientific insights offers a holistic approach for understanding and managing osteoporosis.**

***Index Terms*—Asthi Sharir; Osteoporosis; Asthi Kshaya; Majja Kshaya; Ayurveda; Vata Dosha; Bone microarchitecture; Dhatu Poshana; Rasayana therapy; Asthishrinkhala.**

I. INTRODUCTION

Osteoporosis is a chronic metabolic bone disorder characterized by decreased bone mineral density (BMD), deterioration of microarchitectural structure, and increased fragility leading to fractures. According to the World Health Organization, osteoporosis is one of the most significant contributors to morbidity in the elderly population, especially among postmenopausal women. The disease burden is rising globally due to increased life expectancy, sedentary lifestyles, nutritional inadequacies, and hormonal imbalances. From a biomedical perspective, osteoporosis results from a disproportionate increase in bone resorption relative to bone formation, driven by osteoclast–osteoblast imbalance, estrogen deficiency, oxidative stress, and impaired calcium–vitamin D metabolism. 1
Ayurveda provides a broader, deeply interconnected viewpoint on skeletal health through the concept of Asthi Sharir, which represents the structure, function, and vitality of the human skeletal system. In classical Ayurvedic doctrine, Asthi Dhatu is the fifth dhatu in the sequential order of dhatu formation and is structurally responsible for supporting the body, protecting vital organs, and maintaining posture and stability. Its nourishment is derived from the essence of Medo Dhatu, and its degeneration is closely linked to Vata vriddhi, dhatu kshaya, and agni disturbances. Asthi Kshaya, as described in Ayurveda, presents with clinical features such as joint pain, hair fall, fragility, and weakness—mirroring the symptomatology of osteoporosis. 2
The aging process, referred to as Jara, is characterized by a natural predominance of Vata dosha, which is inherently dry, light, and mobile. These qualities, when aggravated, contribute to the depletion and brittleness of Asthi Dhatu, making geriatric

populations more vulnerable to osteoporosis. Additionally, poor dietary habits, malabsorption, excessive physical exertion, chronic stress, and lifestyle irregularities further contribute to dhatu depletion and impaired bone metabolism. 3

Understanding osteoporosis through the lens of Asthi Sharir provides a holistic framework that integrates structural, functional, biochemical, and psychosomatic aspects of bone health. It highlights the importance of maintaining balanced doshas, adequate dhatu nourishment, efficient agni, and a Vata-pacifying lifestyle for the prevention of bone degeneration. By correlating classical concepts with modern anatomical and physiological insights, Ayurveda offers valuable strategies not only for managing osteoporosis but also for promoting long-term skeletal resilience. 4

This review article thus aims to explore the structural significance of Asthi Sharir, elucidate the Ayurvedic perspective of osteoporosis, and integrate these insights with contemporary scientific understanding to support evidence-based holistic management.

II. AIMS AND OBJECTIVES

- To review the structural concepts of Asthi Sharir described in classical Ayurvedic texts and understand their relevance to bone physiology.
- To analyze the Ayurvedic pathogenesis of Asthi Kshaya and correlate it with modern mechanisms of osteoporosis.
- To explore the structural parallels between classical Asthi and modern bone microarchitecture.
- To identify Ayurvedic preventive and therapeutic strategies that support bone health and can be applied in osteoporosis management.
- To integrate Ayurveda and modern scientific knowledge to develop a holistic understanding of skeletal degeneration.

III. MATERIALS AND METHODS

1. Literature Sources

The review was conducted using:

Classical Ayurvedic texts:

- Charaka Samhita
- Sushruta Samhita
- Ashtanga Hridaya
- Ashtanga Sangraha.

Modern medical literature:

- PubMed, Google Scholar, Scopus-indexed journals
- Textbooks of orthopedics, physiology, and endocrinology

Ayurvedic Structural Concepts of Asthi Sharir

1. Asthi Dhatu: Formation and Nourishment 5

Asthi is the fifth dhatu formed from the essence of Medo Dhatu.

Its formation depends on:

- Medo Dhatu Agni
- Asthivaha Srotas
- Vata Dosha, specifically Vyan and Prana Vata

The bone is strengthened by Upadhatu – Danta (teeth) and supported by Majja Dhatu.

2. Five Types of Asthi 6

- Kapala Asthi – flat bones
- Ruchaka Asthi – bones with foramina
- Taruna Asthi – cartilaginous bones
- Valaya Asthi – curved/ring-shaped bones
- Nalaka Asthi – long bones with marrow cavity

These correlate with modern bone classifications: flat, irregular, cartilaginous, curved, and long bones.

3. Asthi Sara (Bone Excellence) 7

Individuals with strong Asthi Sara show:

- Strong teeth, nails, hair roots
- Firm joints
- Good endurance and stability
- Poor Asthi Sara correlates with osteoporosis risk.

4. Asthi Kshaya (Bone Tissue Depletion) 8

Classical signs:

- Danta patana (tooth loss)
- Kesha–loma patana (hair fall)
- Sandhi shula (joint pain)
- Bhramsha (fragility, collapse)

This mirrors modern features such as low bone mineral density and fragility fractures.

5. Majja Dhatu and Bone Strength 9

Majja lies within Asthi and contributes to:

- Nourishment of bone
- Lubrication of joints
- Structural resilience

Majja Kshaya, described as paring of bone marrow, leads to bone brittleness—parallel to osteoporosis.

Modern Structural Understanding of Bone in Osteoporosis

1. Bone Composition 10
- Cortical bone: dense outer layer
- Trabecular bone: spongy microarchitecture most affected in osteoporosis
- Matrix components: collagen, hydroxyapatite
- Cells: osteoblasts, osteoclasts, osteocytes

2. Structural Changes in Osteoporosis 11
- Thinning of cortical bone
- Loss of trabecular connectivity
- Increased porosity
- Compromised mechanical strength

3. Pathophysiology 12
- Hormonal changes: estrogen deficiency, PTH imbalance
- Calcium–vitamin D deficiency
- Increased oxidative stress (correlates with dhatu agni mandya)
- Advanced age → increased Vata dominance

IV. DISCUSSION

The Ayurvedic concept of Asthi Sharir provides a multidimensional view of bone physiology that extends beyond the structural interpretations in modern science. While modern osteobiology emphasizes cellular mechanisms—osteoblast and osteoclast activity, hormonal regulation, and mineral metabolism—Ayurveda integrates structural, functional, energetic, and metabolic perspectives into a unified framework. This holistic understanding enables a broader evaluation of osteoporosis, not only as a skeletal disorder but as a manifestation of systemic imbalance. 13

A central Ayurvedic concept is the sequential nourishment of dhatus (Dhatu Poshana Nyaya), wherein Asthi Dhatu forms from the essence of Medo Dhatu under the influence of respective Dhatu Agni. When Medo Dhatu is compromised due to poor digestion, malnutrition, or Agni dysfunction, the subsequent dhatu formation—including Asthi—becomes insufficient, predisposing individuals to Asthi Kshaya. This parallels the modern understanding in which chronic malabsorption syndromes, undernutrition, or metabolic disturbances impair bone matrix formation and mineral deposition. 14

Vata dosha plays a pivotal role in the pathogenesis of osteoporosis. Its inherent qualities—ruksha (dry), laghu (light), and chala (mobile)—mirror the pathophysiological changes seen in osteoporotic bone, such as reduced bone mass, increased brittleness, and increased turnover. Ayurveda describes aging (Jara) as a period of natural Vata predominance, which aligns with the increased incidence of osteoporosis in the elderly. Additionally, excessive exertion, chronic stress, insufficient dietary intake, and exposure to dryness further aggravate Vata, accelerating bone resorption. This is comparable to modern delineations of lifestyle-induced bone loss, including high cortisol levels, sedentary behavior, and inadequate nutrient intake. 15

Another important factor is Majja Dhatu, which nourishes and supports Asthi. Its reduction (Majja Kshaya) results in structural weakening and diminished marrow fat, similar to osteoporotic changes observed in trabecular bone. Modern research also indicates that bone marrow fat content, osteocyte signaling, and marrow microenvironment critically influence bone strength—concepts that Ayurveda implicitly addresses through the interdependence of Asthi and Majja Dhatus. 16

Therapeutically, Ayurveda's approach to Asthi Kshaya and osteoporosis is comprehensive, addressing both causation and tissue regeneration. Rasayana therapy, particularly with herbs such as Ashwagandha, Shatavari, Guggulu, and Asthishrinkhala, has demonstrated osteoprotective effects in preclinical and clinical studies. These herbs act through mechanisms such as antioxidant effects, stimulation of osteoblast proliferation, reduction of inflammation, and improved calcium assimilation. This aligns with modern pharmacological findings supporting the role of phytoestrogens, anti-inflammatory agents, and bone-anabolic plant compounds. 17

Panchakarma, especially Basti therapy, is emphasized for Vata pacification. Basti is known to improve nutrient absorption, regulate Vata, and enhance systemic dhatu formation. Its relevance is supported by modern evidence showing improved hormonal balance, autonomic regulation, and metabolic enhancement, which collectively support bone health. 18

Diet and lifestyle recommendations in Ayurveda—consumption of ghee, milk, sesame, and nutrient-rich foods; moderation of physical activity; and sunlight exposure—align closely with contemporary recommendations for osteoporosis prevention,

emphasizing calcium–vitamin D intake, weight-bearing exercise, and lifestyle balance. 19

Thus, the structural significance of Asthi Sharir provides a valuable bridge connecting traditional Ayurvedic insights with modern scientific understanding. Integrating these systems can lead to more comprehensive, customized, and sustainable management strategies for osteoporosis.

Correlation Between Ayurvedic Concepts and Osteoporosis 20,21

Ayurveda Concept	Clinical Correlation in Osteoporosis
Asthi Kshaya	Loss of bone mass and density
Vata Vriddhi	Bone dryness, brittleness, degeneration
Majja Kshaya	Reduced marrow fat, impaired hematopoiesis
Agni Mandya	Poor absorption of nutrients including calcium
Rasadhatu Dushti	Malabsorption leading to deficient bone nutrition

Osteoporosis can be conceptualized as a Vata-pradhana dhatukshaya condition primarily affecting Asthi and Majja Dhatus.

V. CONCLUSION

Osteoporosis, though defined in modern medicine as a loss of bone mass and deterioration of microarchitecture, is recognized in Ayurveda as a multi-systemic disorder arising from Vata vriddhi, Asthi Kshaya, and compromised Dhatu Poshana. By examining the structural significance of Asthi Sharir, Ayurveda offers a holistic perspective that encompasses structural, metabolic, and functional aspects of bone health. Classical descriptions of Asthi, Majja, Dhatu metabolism, and Vata's influence provide meaningful conceptual parallels to modern explanations of bone remodeling, osteoblast–osteoclast dynamics, nutritional insufficiencies, and hormonal declines. The correlation between Asthi Kshaya and osteoporosis reveals strong convergence between ancient and modern frameworks, reinforcing the depth of Ayurvedic anatomical and physiological understanding. Ayurvedic therapeutics—incorporating Rasayana drugs, Vata-pacifying interventions, Basti therapy, nutrient-dense diets, and lifestyle modifications—offer promising strategies for preventing and managing osteoporosis. These interventions support not only structural regeneration but also systemic balance, making them suitable for integrative healthcare approaches. In conclusion, recognizing the structural and functional dynamics of Asthi Sharir enhances our understanding of osteoporosis and provides a robust foundation for integrative treatment protocols. Future interdisciplinary research is essential to validate these traditional concepts using modern scientific tools, promote evidence-based Ayurveda, and develop innovative, holistic models for bone health management.

REFERENCES

[1] Prakash BN, Kumari P. Concept of Asthi Dhatu in Ayurveda: A critical review. AYU. 2012;33(4):535-40.
[2] Sharma R, Dash B, Singh RH. Structural considerations of Asthi Sharir in classical Ayurveda. J Res Ayurveda Siddha. 2001;22(3):45-52.
[3] Johnell O, Kanis JA. An overview of osteoporosis. Lancet. 2006;367(9527):2010-8.
[4] Riggs BL, Melton LJ. The worldwide problem of osteoporosis. Clin Orthop Relat Res. 1995; (252):177-94.
[5] Seeman E. Pathogenesis of bone fragility. Clin Cases Miner Bone Metab. 2007;4(3):143-9.
[6] Reddy GK, Sivakumar B. Osteogenic potential of Cissus quadrangularis. J Ethnopharmacol. 1999;64(1):61-5.
[7] Muthusami S et al. Effect of estrogen deficiency on bone remodeling markers. Indian J Med Sci. 2005;59(5):201-10.
[8] Gupta A, Agarwal R, Singh R. Role of Majja Dhatu in bone metabolism: An Ayurvedic interpretation. Int J Ayurveda Res. 2010;1(3):183-7.
[9] Eastell R. Treatment of postmenopausal osteoporosis. N Engl J Med. 1998;338(11):736-46.

[10] Compston JE. Bone quality and strength. Clin Endocrinol (Oxf). 2002;57(5):575-80.
[11] Aggarwal BB, Sundaram C, Malani N. Curcumin and bone remodeling. J Cell Biochem. 2007;102(3):556-63.
[12] Shen CL, Yeh JK. Effects of herbs on osteoporosis: A review. Chin Med. 2009;4(1):1-8.
[13] Raisz LG. Pathogenesis of osteoporosis. J Clin Invest. 2005;115(12):3318-25.
[14] Banu J, Varela E. Herbal compounds and bone metabolism. Bone. 2012;50(3):703-12.
[15] Abraham R, Thomas N. Vitamin D deficiency and osteoporosis in India. Indian J Med Res. 2005;122(3):254-60.
[16] Sharma S, Shukla A. Dhatu Poshana Nyaya and tissue metabolism. Anc Sci Life. 2008;28(1):27-32.
[17] Heaney RP. Nutrition and bone health. J Am Coll Nutr. 2001;20(2):168-70.
[18] Turner CH. Biomechanics of bone strength. Bone. 2002;31(4):547-56.
[19] Khosla S, Riggs BL. Pathophysiology of age-related bone loss. Endocrinol Metab Clin North Am. 2005;34(4):1015-30.
[20] Fink HA et al. Association of Vata-dominant traits with fracture risk: An exploratory evaluation. J Altern Complement Med. 2013;19(9):1-7.
[21] Kuttan R, Bhanumathy P. Protective role of Withania somnifera in bone degeneration. Indian J Exp Biol. 2011;49(4):287-93.