



Review Article

www.ijrap.net

(ISSN Online:2229-3566, ISSN Print:2277-4343)



A CRITICAL APPRAISAL OF ASTHISAMHARAKADI CHOORNA IN THE MANAGEMENT OF ASTHIKSHAYA WITH REFERENCE TO OSTEOPENIA AND OSTEOPOROSIS

Prathush NJ Gowda¹, Smitha Jain^{2*}

¹ UG Scholar, Shri Dharmasthala Manjunatheshwara Institute of Ayurveda and Hospital, Bengaluru, Karnataka, India

² Assistant Professor, Department of Rasashastra and Bhaishajya Kalpana, Shri Dharmasthala Manjunatheshwara Institute of Ayurveda and Hospital, Bengaluru, Karnataka, India

Received on: 25/2/24 Accepted on: 02/7/24

*Corresponding author

E-mail: drsmithajn@gmail.com

DOI: 10.7897/2277-4343.154129

ABSTRACT

Osteoporosis is the most common bone disease, representing a major public health issue. Osteopenia & Osteoporosis characterize a spectrum of conditions that present with decreased bone mass and disrupted bone microarchitecture. According to Ayurveda, Asthikshaya (diminution of bone) and Asthisoushrya (porosity of bone) are the two conditions which allies with osteopenia and osteoporosis. Asthikshaya and Asthisoushrya consequently lead to high susceptibility of Asthibhagna (fracture). This bone loss is preventable through adequate nutrition, physical activity and appropriate treatment protocols. Detection and prevention in early stages is essential as it may cause burden at individual and socioeconomic level. Ayurveda provides several therapeutic approaches to remodel the depleted or degenerated tissues. Oral administration of Oushadha yogas (medicinal formulations) is one of the highly accepted therapeutic modality. Asthisamharakadi choorna is one such polyherbal formulation which is mentioned in Chakradatta in the context of Bhagna Chikitsa. The review aims to ascertain the pharmacological effects of ingredients of Asthisamharakadi choorna and to propose its probable mode of action in Asthikshaya (osteopenia). The detailed review of the formulation and its constituents was carried from several Ayurvedic classical texts and published research articles. This review presents a detailed understanding on anti-oxidant, anti-inflammatory and osteoblastogenesis activity of phytoconstituents of Asthisamharakadi choorna. It enables to comprehend the bone remodelling and stabilizing effect of phytoconstituents present in each ingredient of Asthisamharakadi choorna. The pharmacological appraisal of the formulation encourages the clinical employability of Asthisamharakadi choorna for the prevention and management of Asthikshaya or Asthisoushrya, osteopenia and osteoporosis.

Keywords: Asthikshaya, Asthisoushrya, Asthisamharakadi choorna, Osteopenia, Osteoporosis.

INTRODUCTION

The bony skeleton is a vital organ that serves as structural, functional and a reservoir entity. It provides mobility, support, and protection for the body. The skeleton is also a storehouse for essential minerals, primarily calcium and phosphorus. Bone is a metabolically active tissue capable of altering its structure and mass in order to adapt to changing requirements. The adaptation is achieved by different fundamental tissue-level activities, including growth, modelling, remodelling and healing. Bone remodelling and turnover is important for maintaining the structural function of the skeleton and for fracture healing. While an imbalance of bone resorption and formation results in several bone diseases. Generalized osteoporosis is the most common disease affecting most of the skeleton in humans, representing a major public health problem. Osteopenia and osteoporosis represent a spectrum of conditions with decreased bone mass and disrupted bone microarchitecture as a result of nutritional deficiencies, metabolic abnormalities, menopause and aging. Physiological aging is associated with various life altering comorbidities, osteoporosis being one of the most prevailing. Osteopenia serves as an early warning sign, prompting preventive measures. Osteopenia is a clinical term used to describe a decrease in bone mineral density (BMD), below normal reference values, yet not low enough to meet the diagnostic criteria to be considered osteoporotic¹. Osteoporosis is a disease that is characterized by low bone mass, deterioration of bone tissue, and disruption of bone microarchitecture which can lead to compromised bone strength and an increase in the risk of

fractures². The prevalence of osteoporosis varies significantly around the world due to age, gender, genetic, lifestyle and healthcare access factors. It is estimated that approximately 200 million people worldwide suffer from osteoporosis, of which 1 in 3 women (23.1%) and 1 in 5 men (11.7%) get affected³. It is most common in non-Hispanic whites, Caucasians and Asian races. It has been reported that 61 million of the Indian population suffer by osteoporosis⁴. An analysis identifies that osteoporosis affects 1 out of 5 adults and osteopenia affects 1 out of 2 adults in India. It is also identified that the South Indian females have slightly greater prevalence of osteoporosis⁵. It calls for the attention towards the severe emergence of the condition which is deemed as of low importance due to lack of awareness. Hence, it is the need of the hour to identify a greater number of individuals with bone loss and to prevent future risk of developing osteoporosis and fractures. The complications that may arise can negatively impact on physical, mental, social and emotional dimensions of health, with consequent deteriorated quality of life, indeed, leading to reduced mobility, dependence in daily activities and even social isolation of elderly subjects⁶. Because of the morbid consequences of osteoporosis, the prevention of this disease is considered crucial for the maintenance of health and quality of life. In the current medical framework, early detection and prevention is the key, as building healthy bones provides the evidence for affordable and important ways of reducing the personal and economic costs of osteoporosis. Fortunately, preventive treatments are available and they help to maintain or increase bone mineral density. Prevention and treatment involve combination of medications, lifestyle modifications and dietary

changes. External factors, such as diet and physical activity, are critically important to bone health throughout life.

Ayurveda, the health science is keen to preserve the well-being of healthy individuals and address the ailments. It offers a number of therapeutic techniques that aim to mitigate or alleviate the diseases and its complications. According to Ayurveda, the disequilibrium state of Dosha (regulatory functional factors), Dhatu (tissues or structural components), and Mala (excretory products) is known as disease⁷. This disequilibrium may be either because of Vriddhi (morbid increase) or Kshaya (diminution). Among the seven Dhatus, Asthi (bone) is the fifth Dhatu, which does Dharana (holding body frame) and Majja pushti (nourishing the bone marrow). The vitiated Vata, if localized in the Asthi dhatu can lead to Asthikshaya or Asthishushirya. Asthikshaya occurs majorly due to two rationalities. Firstly, due to the deficiency of nutrients that nourish the bone and secondly due to Srotorodha (obstructed channels), which impedes the supply of nutrition due to Ama. Ama is a state of incomplete digestion, transformation or metabolism, caused by the imbalance of Dhathvagni⁸. The symptoms of Asthikshaya are Asthishoola (bone pain), Katishoola (pain in pelvic area), Sandhishoola (joint pain), Shrama (tiredness), Keshapatana (hair fall), Ati manda cheshta (very slow action/less active)^{9,10}. Consequential progress of the condition may lead to vulnerability to Asthi bhagna (bone fracture). By the above understanding, Bhagna chikitsa (treatment of fracture) can be adopted for the treatment of Asthikshaya. Ayurveda manuscripts explain several prevention and treatment

modalities. Ayurveda explains a choice of single drug of herbal, animal, metal or mineral origin and polyherbal or herbomineral compounds¹¹. Asthisamharakadi choorna is one such polyherbal compound formulation mentioned in Bhagna chikitsa of Chakradatta. This review elaborates the anti-osteoporotic potential of Asthisamharakadi choorna and also encourages further clinical research.

Systemic Review

A thorough and critical review of each ingredient of Asthisamharakadi choorna has been done. Rasapanchaka and Karma (Ayurvedic pharmacological attributes) of the ingredients were anthologized from Ayurvedic literature. The details of the pharmacological actions of each drug were collected from various published research articles and databases. Collected data is tabulated orderly and critically reviewed.

Asthisamharakadi choorna

Asthisamharakadi choorna is recommended as an oral dosage form in Bhagna Chikitsa of Chakradatta¹² and Bhaishajya Ratnavali¹³. The formulation composition includes four herbal ingredients as mentioned in Table 1. The Rasa (taste), Guna (properties), Veerya (potency), Vipaka (biotransform), Doshaghnata (effect on Doshas) and Karma (action) of each ingredient are mentioned in Table 2.

Table 1: Ingredients of Asthisamharakadi choorna

Ingredient	Common name	Botanical name	Family	Ratio
Asthisamharaka	Adamant creeper, devil's backbone, edible stemmed vine	<i>Cissus quadrangularis</i> Linn.	Vitaceae	1 part
Laksha	Lac, shellac, resinous glaze, confectioner's glaze	<i>Laccifer lacca</i> Kerr.	-	1 part
Godhuma	Wheat	<i>Triticum aestivum</i> Linn.	Poaceae	1 part
Arjuna	Arjuna	<i>Terminalia arjuna</i> Linn.	Combretaceae	1 part

Table 2: Rasapanchaka and Dosha karma of the formulation Asthisamharakadi choorna

Ingredient	Rasa	Guna	Virya	Vipaka	Dosha karma	Karma
Asthisamharaka ³⁹	Madhura (sweet), Katu (pungent)	Laghu (lightness), Ruksha (dryness), Sara (mobility)	Ushna (hot)	Madhura	Kaphavatahara, Pitta kara	Asthisamyojaka (unites fracture), Deepana (appetizing), Pachana (digestive), Vrushya (aphrodisiac), Rakta shodhaka (blood purifier).
Laksha ⁴⁰	Kashaya (astringent)	Snigdha (oiliness), Laghu	Sheeta (cold)	Katu	Kapha Pitta hara	Balya (strengthening), Varnya (complexion enhancer), Vranaropana (wound healing).
Godhuma ⁴¹	Madhura	Guru (heaviness), Snigdha, Sara	Sheeta	Madhura	Vata Pitta hara, Kaphakara	Balya, Shukrakara (semen increasing), Sandhanakara (union promoting), Brhmana (bulk enhancing), Vranaropana, Sthirakara (stabilizing).
Arjuna ⁴²	Kashaya	Ruksha, Sheeta (coldness)	Sheeta	Katu	Kapha Pitta hara	Hridya (enhance health and function of heart, mind-pleasing), Kshayajit (overcomes depleted body condition).

Asthisamharaka (*Cissus quadrangularis* Linn.)

Asthisamharaka is also known as Asthishrunkhala, Asthisamdhani, Asthisanghata, Asthisohara. As per Ayurveda, it exhibits various actions such as Asthi sthapana (bone strengthening), Sandhaniya (union promoting), Kshaya apaha (reduces depletion), Vrana ropana (wound healing), Shotha hara (anti-inflammatory) and Rasayana (rejuvenative). *Cissus quadrangularis* (CQ) is renowned as "Hadjod" or "bone-setter" because of its specific application in orthopaedics. It helps in ossification, preventing osteoporosis, fracture healing via osteoblast stimulation and relieving fracture related pain and inflammation. CQ consists of various constituents, such as

flavonoids like quercetin, daidzein and genistein; triterpenoids like friedelin; Vitamin C, stilbene derivatives like quadrangularin-A. The pharmacological uses of the plant are linked to cell reinforcement, free radical search, bone regeneration and pain relief actions¹⁴. CQ is considered as an osteogenic regulator for bone tissue engineering as its capability of invoking early biomineralization and osteogenesis is established by an *in vitro* investigation¹⁵. Another *in vitro* study employed to delineate the effects of ethanolic extract of CQ on the regulation of Insulin-like growth factor (IGF) system components proved that it has a favourable effect on the IGF system components of human osteoblast like SaOS-2 cells¹⁶. An experimental study, where the phytoestrogen steroids isolated from CQ showed influence on

early regeneration and quick mineralization of bone¹⁷. A study revealed that CQ has effectively inhibited bone loss in the cancellous and cortical bones of femur and proximal tibia in experimental animal¹⁸. A clinical study found the osteogenic potential of CQ, as the oral administration of CQ tablets enhanced the rate of new bone formation with significant increase of bone density¹⁹. A randomised controlled clinical study proved the efficacy of CQ in pain and swelling management after dental implant placement. CQ emerged as a good supplement for accelerating the bone healing after implant placement²⁰.

Laksha (*Laccifer lacca* Kerr.)

Shellac or Lac is a natural resin secreted by the lac bug. It has a great significance in the management of joint disorders and in diseases that occur due to loss of bone mineral density such as osteoporosis and osteomalacia²¹. Laksha has properties like Bhagna sandhana (fracture healing), Vrana ropana (wound healing), and Rakta sthambhana (haemostasis). Lakshadi Guggulu, a compound formulation containing Laksha as the chief ingredient is recommended in Ayurvedic texts for several orthopaedic conditions. Earlier studies have evaluated antiarthritic and chondroprotective potentials of Lakshadi Guggulu, where in vivo studies revealed the cartilage regenerative activity of Lakshadi Guggulu²². Studies have shown that Lakshadi Guggulu has combined effects of bone healing and promoting calcium deposition²³. The application of Lakshadi plaster in the cases of Bhagna (fracture) has achieved the aim of immobilization as effective as the Plaster of Paris without any complications in colles' fracture²⁴. In a clinical study of Lakshadi Guggulu in Osteoporosis, the quality of life and serum calcium improved significantly²⁵. Effectiveness of Laksha Guggulu is also proved in uncomplicated and new cases of knee osteoarthritis, as significant improvements were observed on joint pain, restricted joint movement, joint stiffness and local crepitation²⁶. A randomized controlled clinical study showed that administration of Lakshagrishitksheeradi churna to patients of closed fractures of long bones showed significant improvement in pain, tenderness, swelling along with great improvement in bone callus index²⁷. Many anthraquinone derivatives like laccaic acid are present in *Laccifer lacca*²⁸. Phytochemicals such as tannins, saponins, triterpenoids and flavonoids support the anti-inflammatory and bone nourishing ability²⁹.

Godhuma (*Triticum aestivum* Linn.)

Ayurveda has precisely mentioned Godhuma (Common Wheat or Bread wheat) as a Satmya ahara (compatible food) for all, as it is Brimhana (nourishing), Balya (strengthening), Sandhanakara (union promoting) and Vrishya (aphrodisiac)³⁰. According to Ayurveda, wheat is mentioned not only as food, but its therapeutic potential is also described. It is a rich source of carbohydrates, protein, fat and minerals like magnesium, potassium, calcium, phosphorus, manganese, zinc and selenium. Vitamins like E and B1, B2, B3 are also present³¹. Administration of aqueous extract of *T. aestivum* in animal model showed maintenance of calcium homeostasis, formation of collagen and scavenging of free radicals thereby combating osteoporosis induced by glucocorticoids³². A wheat germ peptide ADWGGPLPH exhibited a notable effect of reducing the level of oxidative stress and improving the microstructure and bone mineral density in senile osteoporotic rats³³.

Arjuna (*Terminalia arjuna* Linn.)

Ayurveda recommends Arjuna for healing of fracture due to its Bhagna sandhanakara (fracture healing) property. The stem bark contains calcium carbonate, tannin, saponins, flavonoids, gallic

acid, ellagic acid, oligomeric pro-anthocyanidins, phytosterols, and minerals. The presence of terpenoids, calcium, phosphorus, and alkaline phosphatase plays an important role in osteoblastic activity³⁴. Aqueous extract of *T. arjuna* is reported to have 23% calcium salts and 16% tannins³⁵. A study carried out to evaluate the osteoinductive potential of bark extract of *T. arjuna* in bone substitutes, showed *in vitro* biomineralization³⁶. Study on osteopotential activity of *T. Arjuna* bark extract demonstrated increased alkaline phosphatase and calcium release, hence the observed osteoblastogenic induction effect of *T. arjuna* extract holds promise for its development as a bio supplement in bone tissue engineering research³⁷. Methanolic extract of *T. arjuna* showed great anti-osteoporotic activity in bilateral ovariectomized induced post-menopausal osteoporosis in experimental rats evaluated on the basis of biochemical, bone mineral density, biomechanical, and histopathological parameters³⁸.

DISCUSSION

Osteoporosis is a main public health issue in older adults as it leads to fractures associated with morbidity and decreased quality of life. Osteopenia and osteoporosis are caused by disequilibrium between bone resorption and formation. In Ayurveda, health and disease are explained in terms of Samya (equilibrium) and Vaishamyā (disequilibrium) of Dosha, Dhātu and Mala. Asthi is one among the Dhatus, where its disequilibrium may occur either because of Vriddhi (morbid increase) or Kshaya (diminution) leading to various skeletal disorders. Asthi and Vata are inversely proportional to each other by Ashrayi-Ashraya Bhava Sambandha. Primarily, Vata vitiating causative factors will lead to Asthikshaya. Due to Asthikshaya, the uttara dhātu (following dhātu) i.e., Majja will undergo kshaya leading to Asthisushirya. Hence, Asthikshaya and Asthisushirya are the two conditions which are equivalent with osteopenia and osteoporosis in contemporary science. Though Asthikshaya is not explained as a separate disease entity, Ayurveda texts have elaborated about the causes, symptoms and treatments of Asthikshaya. This state of deterioration of bone mass can be the major risk factor for fracture. Hence Asthibhagna is the most prevalent complication of Asthikshaya. As the treatment principles mentioned in Bhagna roga and Asthikshaya are similar, the line of treatment and medications of Bhagna can be applied in Asthikshaya⁴³. This condition is considered under Madhyama rogamarga (medial pathway of disease), where internal administrations are preferred. Medicaments for Asthikshaya aim to improve the deprived status of Asthi Dhātu. Alleviating Vata dosha and nourishing Majja dhātu are also equally essential in any Asthi dhātu related conditions. If Asthi dhātu is nourished, serially the Uttara dhātu will also be nourished by Poshaka dhātu (preceding dhātu). The above effect can be achieved when the medication comprises Guru, Snigdha, Sheeta, Sthira guna and Asthi sandhana, Balya, Asthi poshana, Vata hara, Shoolahara karma. It is observed that the above specific functions are exhibited by the ingredients of Asthisamharakaadi choorna. All ingredients have Asthi sandhanakara and Bhagna sandhanakara property. Asthisamharaka has Shoolahara quality. Madhura rasa and vipaka of Asthisamharaka and Godhuma reduces Vata. Kashaya rasa of Laksha and Arjuna supports the Sthambhana (stabilizing) action. The Snigdha, Guru gunas of the ingredients pacify Vata and they support Asthi poshana. In addition to focusing on supplements that promote Asthivridhi (bone growth), it's crucial to consider their assimilation. The Ushna virya and Katu vipaka of the ingredients contribute for Deepana and Pachana actions. Whereas the Sara, Laghu and Ruksha guna influence in mitigating the Ama, in turn leading to Sroto vishodhana (cleanse the channels). Asthisamharakadi choorna not only supports bone health but also acts beneficial for overall health.

Based on the theory of the continuum of the microcosm and macrocosm (Loka-Purusha Samya) an important Ayurvedic principle, thick perennial stems of Asthisamharaka is comparable to the chain of bones in appearance. Therefore, it is generally believed to protect the bones from their destruction. Several studies have ascribed the administration of CQ in osteopenia and osteoporosis due to its osteogenic potential. Early bone biomineralisation and osteogenic regulation is achieved by CQ. Phytoestrogen rich action shows its potential in the management of menopausal induced osteoporosis. Lakshadi Guggulu, a polyherbal compound containing Laksha as main ingredient is usually preferred by Ayurveda practitioners in several orthopaedic conditions. Chondroprotective action of laksha may certainly support the cartilage regenerative activity in senile osteoporosis. Antiarthritic action of Laksha is also important here, as there is an established link between osteoporosis and inflammatory arthritis. Godhuma when administered here as a medicine, it might help in fulfilling the nutritional requirements. Arjuna is a multidimensional drug which supports overall stability of all dhatus. Arjuna might be highly effective in post-menopausal osteoporosis as it showed anti-osteoporotic activity in bilateral ovariectomized animal model. The above-mentioned ingredients have anti-osteoporotic action, helping to maintain bone density and reduce the risk of fracture by speeding up the process of bone building⁴⁴. Anti-inflammatory action can inhibit chondrogenic differentiation of mesenchymal stem cells, which deprive bone healing⁴⁵. Bone remodelling action is associated with the removal of old or damaged bone by osteoclasts and the subsequent replacement of new bone cells formed by osteoblasts⁴⁶. Anti-oxidants support to decrease the osteoclastic activity by reducing oxidative stress and counteract the factors that inhibit bone metabolism. They also support to boost osteogenic activity of osteoblasts and promote bone matrix formation⁴⁷.

Ksheera (milk) and Ghrita (ghee) are mentioned as Anupana (adjuvant) for the administration of Asthisamharakadi choorna⁴⁸. Anupana in general enhances the efficacy of drug. As per Ayurveda, properties of the milk promotes Ojas (essence of vitality) of the body. It is said to be the foremost among the vitalizers and rejuvenators of health⁴⁹. Pharmacologically milk promotes muscle growth, bone mass protection, helps in assimilation of bioactive materials and improves immunity. The addition of milk to the diet may potentially increase the likelihood of preventing bone loss by restoring bone homeostasis through the modulation of the Calcium-Parathyroid Hormone-Vitamin D Axis and bone remodelling rate⁵⁰. Ghee has qualities that promotes memory, intelligence, Agni (metabolic factor) and Ojas. It alleviates Vata and Pitta due to Sheeta guna and virya; Madhura rasa, Madhura vipaka⁵¹. Ghee comprises 99.5% fat and is a source of fat-soluble vitamins including vitamin D and phospholipids⁵². Hence the use of milk and ghee as an adjuvant with Asthisamharakadi choorna will potentiate its anti-osteoporotic effect.

Review of each ingredient of the formulation revealed overall actions such as Asthisandhanakara, Shoolahara, Sthirakara and Vatahara assisting in alleviating the disequilibrium of Vata, Asthi and Majja. Pharmacologically anti-inflammatory, anti-oxidant, chondroprotective, anti-arthritic, osteogenic and bone remodelling actions are demonstrated by the ingredients of Asthisamharakadi choorna. Possibly, a combination of all these activities will synergistically function to produce the anti-osteoporotic activity in Asthikshaya (diminution of bone) and Asthisoushirya (porosity of bone).

CONCLUSION

Asthisamharakadi choorna is a simple polyherbal formulation indicated primarily in Asthi bhagna as explained in Chakradatta. Asthikshaya if unrecognized and untreated can increase the risk of Asthi bhagna. Osteopenia and osteoporosis must be prevented at the earliest to reduce further associated risks. This review establishes the Asthi sandhanakara, Shoolahara, Sthirakara karma of the ingredients in the formulation as per Ayurveda. Pharmacologically anti-oxidant, chondroprotective, osteogenic and bone remodelling properties contribute to the overall anti-osteoporotic effect of Asthisamharakadi choorna. Thus, this article gives an insight on the potentiality of this formulation in treating Asthikshaya (diminution of bone) and Asthisoushirya (porosity of bone). Hence, it encourages the clinical application of Asthisamharakadi choorna for the prevention and management of Asthikshaya. Additionally, it is essential to evaluate the osteogenic or anti-osteoporotic effect of this formulation in clinical sitting.

REFERENCES

1. Matthew A Varacallo, Edward Fox. Osteoporosis and its complications. Medical Clinics of North America. 2014 July; 98(4): 817-31.
2. Klibanski A, Adams-Campbell L, Bassford T, Blair SN, Boden SD, Dickersin K *et al.* Osteoporosis prevention, diagnosis, and therapy. Journal of the American Medical Association. 2001 Feb; 285(6): 785-795.
3. Cooper C, Campion G, Melton L J. Hip fracture in elderly: A world-wide projection. Osteoporosis International. 1992 Nov; 2(6): p 285-9.
4. Joshi V R, Mangat G, Balakrishnan Canchi, Mittal Gayatri. Osteoporosis – Approach in Indian Scenario. Journal of the Association of Physicians of India. 1998 Nov; 46(11): 965-7.
5. Babhulkar Sushruta, Seth Shobith. Prevalence of osteoporosis in India: An observation of 31238 adults. International Journal of Research in Orthopaedics. 2021 Mar; 7(2): 362-8.
6. Maria Rizzo, Tammaro Gisella, Guarino Amedeo, Basso Morena, Cozzolino Andrea *et al.* Quality of life in osteoporotic patients. Orthopedic Reviews. 2022 Oct; 14(6): 1-5.
7. Agnivesha, Charaka Samhita, revised by Charaka and Dridhabala with Ayurveda Dipika commentary by Chakrapani, edited by Jadavji Trikamji. Sutrasthana; Chapter 9, Verse 4. Reprint ed. 2022; Varanasi: Chaukhamba Surbharati Prakashan: p 62.
8. Keerti Rotti, B Poornima, Mamta Walikar. Conceptual study on the etiopathogenesis of Asthikshaya w.s.r. to Postmenopausal Osteoporosis. Journal of Ayurveda and Integrated Medical Sciences. 2022 Oct; 7(9):105-14.
9. Agnivesha, Charaka Samhita, revised by Charaka and Dridhabala with Ayurveda Dipika commentary by Chakrapani, edited by Jadavji Trikamji. Sutrasthana; Chapter 17, Verse 67. Reprint ed. 2022; Varanasi Chaukhamba Surbharati Prakashan: p 103.
10. Harita, Harita Samhita with Hari Hindi commentary by Pt. Hariharaprasad Tripathi, Tritiyasthana, Chapter 9, Verse 22. Reprint ed. 2002; Varanasi: Chaukhamba Krishnadas Academy: p 264.
11. R Sreelekshmi. Understanding Osteoporosis and its Ayurvedic Management - A Review. International Journal of Ayurveda and Pharma Research. 2022 Dec; 10(11): 88-94.
12. Chakrapani Datta, Chakradatta with Savimarsha Bhaavartha Sandeepani Hindi commentary by Jagadeeshwarprasad

- Tripathi. Chapter 49, Verse 9. Reprint ed. 2012; Varanasi: Chaukhamba Sanskrit Series: p 371.
13. Kaviraj Govind Das Sen, Bhaishajya Ratnavali of edited with Siddhiprada Hindi commentary by Siddhi Nandan Mishra, Chapter 49, Verse 8. Reprint ed. 2019; Varanasi: Chaukhamba Surbharati Prakashan: p 832.
 14. Sundaran Jeganath, Begum Raleena, Vasanthi Muthu, Kamalopathy Manjalam, Bupesh Giridharan *et al.* A short review on pharmacological activity of *Cissus quadrangularis*. Bioinformation. 2020 Aug; 16(8): 579-85.
 15. Nair R Praseetha, S Sreeja, GS Sailaja. *In vitro* biomineralization and osteogenesis of *Cissus quadrangularis* stem extracts: An osteogenic regulator for bone tissue engineering. Journal of Biosciences. 2021; 46(88): 1-14.
 16. Aswar Urmila, Mohan Vishwanathan, Bodhankar Subhash Lakxmanrao. Antiosteoporotic activity of phytoestrogen-rich fraction separated from ethanol extract of aerial parts of *Cissus quadrangularis* in ovariectomized rats. Indian Journal of Pharmacology. 2012 May; 44(3): 345-50.
 17. Sridhar Muthusami, Ilangovan Ramachandran, Senthilkumar Krishnamoorthy, Ramajayam Govindan, Srinivasan Narasimhan. Affiliations *Cissus quadrangularis* augments IGF system components in human osteoblast like SaOS-2 cells. Growth Hormone Induced Growth Factor Research. 2011 Dec; 21(6): 343-8.
 18. Jameela Banu, Erika Varela, Ali N Bahadur, Raheela Soomro, Nishu Kazi *et al.* Inhibition of Bone Loss by *Cissus quadrangularis* in Mice: A Preliminary Report. Journal of Osteoporosis. 2012 Jun: 1-10.
 19. Alaa Abdelqader Altaweel, Abdel Aziz Baiomy, Hazem Shawky Shoshan, Hisham Abbas, Ahmed Abdel-Shakour Abdel-Hafiz *et al.* Evaluation of osteogenic potential of *Cissus quadrangularis* on mandibular alveolar ridge distraction. BioMed Central Oral Health. 2021 Oct; 21(1): 1-8.
 20. Anil Managutti, Disha Shah, Jigar Patel, Nagaraj Puttanikar, Dishan Shah *et al.* Evaluation of clinical efficacy of *Cissus quadrangularis* in pain management and bone healing after implant placement – A pilot study. Medico research chronicles. 2015 Oct; 2(5): 618-25.
 21. Reshma BV, Nithin Manohar R, Anaha VI. A review on *Laccifer lacca*. World Journal of Pharmaceutical Research. 2018 May; 7(10): 206-18.
 22. Rasika M Samarasinghe, Kuldeep Kumar, Jagat R Kanwar. Antiarthritic and chondroprotective activity of Lakshadi Guggul in novel alginate-enclosed chitosan calcium phosphate nanocarriers. Nanomedicine (London). 2014 May; 9(6): 819-37.
 23. Mohammed Yusuf, Mohammed Aijaz, Nishith Keserwani, Nizamul Haque Ansari, Shafat Ahmad Khan. Ethnomedicinal, Pharmacological and Commercial Perspectives of *Laccifer lacca* Body Exudate (LBE). Letters in Applied Nano Bio Science. 2023; 12(1): 1-10.
 24. Sharma Shailendra, Bhandari A, Husain A, Sharma RB, Verma R. Pharmacognostical and phytochemical evaluation of exudate obtained from *Laccifer lacca*. International Journal of Universal Pharmacy and Bio Sciences. 2013 Jul-Aug; 2(4): 440-7.
 25. Brijesh Singh, Gopikrishna BJ, P Hemantha Kumar. Clinical evaluation of Laksha guggulu and Mukta shukti pishti in the management of osteopenia/osteoporosis. World Journal of Pharmaceutical Research. 2015 Aug; 4(9): 1785-93.
 26. Kshipra Rajoria, Sarvesh Kumar Singh, RS Sharma, SN Sharma. Clinical study on Laksha Guggulu, Snehana, Swedana & Traction in Osteoarthritis (Knee joint). AYU. 2012 Jan; 31(1): 80-7.
 27. Shivay Gupta, Pradeep S Shindhe, Amit Pingat, Ramesh S Killedar. Bone healing efficacy of Lakshagrishtiksbeeradi churna over Calcium +Vit D3 in Avrana Kanda Bhagna (Closed fractures of long bones) - A Randomized controlled clinical trial. International Journal of Ayurvedic Medicine. 2023 Jan-Mar; 14(1): 145-50.
 28. Keerthi GK, MV Saiteja, Dilip Rajashekhar Maddirela, Abbasi Begum Meer Rownaq Ali. A Multi-disciplinary Pharmacological Approach for Management of Osteoporosis Affecting Implant Bone Healing – A Review. Saudi Journal of Oral and Dental Research. 2020 June; 5(6): 262-5.
 29. Dudhamal Tukumar Sambhaji, Mahanta Vyasadeva, Gupta Sanjay Kumar. Efficacy of Lakshadi Plaster and Laksha Guggulu in the Management of Bhagna (Stable Colle's Fracture) Case Report. International Journal of Ayurvedic Medicine. 2012; 3(2): 124-9.
 30. Sushruta. Sushruta Samhita, edited by Jadavji Trikamji. Sutra sthana, Chapter 20, Verse 5. Reprint ed. 2022. Varanasi: Chaukhamba Surbharati Prakashan; p 94.
 31. Pawan Kumar, RK Yadav, Babita Gollen, Sandeep Kumar, Ravi Kant Verma, Sanjay Yadav. Nutritional Contents and Medicinal Properties of Wheat: A Review. Life Sciences and Medicine Research. 2011 Jan; Volume 22: p 1-10.
 32. David Banji, Otilia JF Banji, Vijaya Laxmi Chiluka, Saidulu Abbagoni. Role of *Triticum aestivum* aqueous extract in glucocorticoid induced osteoporosis in rats. Indian Journal of Experimental Biology. 2014 Feb; 52(2): 153-8.
 33. Wang Fang, Yang Gaohong, Li Yu, Tang Zhijuan, Du J *et al.* A peptide from wheat germ abolishes the senile osteoporosis by regulating OPG/RANKL/RANK/TRAF6 signalling pathway. Phytomedicine 2022 Sep; 104
 34. Joshi Devi Dutt, Lokesh Deb, Bharat G Somkuwar, Virendra Singh Rana. Potential use of barks of woody vascular plants in bone mending: A review. Saudi Pharmaceutical Journal. 2023 Sep; 31(9): 1-9.
 35. Amalraj Augustine, Gopi Sreeraj. Medicinal properties of Terminalia arjuna (Roxb.) wight & Arn.: A review. Journal of Traditional Complementary Medicine. 2016 Mar; 7(1): 65-78.
 36. G Krithiga, Thiagarajan Hemalatha, Ramani Deepachitra, Kaushik Ghosh, TP Sastry. Study on Osteopotential activity of *Terminalia arjuna* bark extract incorporated bone substitute. Bulletin of Materials Science. 2014 Oct; 37(6): 1331-8.
 37. Raksha Parashar MS, Chaithra V, Kiran Kumar DJ, Anil Kumar KV, Rama T. Study on Osteopotential activity of *Terminalia arjuna* bark extract using UMR 106 cells. Journal of Pharmacognosy and Phytochemistry. 2020; 9(2): 1690-3.
 38. Nimisha Kakadia, Niranjan Kanaki. Anti-osteoporotic effect of *Terminalia arjuna* (Roxb.) Wight & Arn. in bilateral ovariectomized induced post-menopausal osteoporosis in experimental rats. Journal of Complementary and Integrated Medicine. 2021 Nov; 20(2): 395-403.
 39. Bhavamishra, Bhavaprakasa, translated by K R Srikantha Murthy. Chapter 6 (4), Verse 226 – 227; Volume 1; Varanasi: Chaukhamba Krishnadas Academy, 2016: p 264.
 40. Bhavamishra, Bhavaprakasa, translated by. K R Sri kantha Murthy. Chapter 6 (2), Verse 193 – 195; Volume 1; Varanasi: Chaukhamba Krishnadas Academy, 2016: p 190.
 41. Bhavamishra, Bhavaprakasa, translated by. K R Srikantha Murthy. Chapter 6 (9), Verse 33 – 35; Volume 1; Varanasi: Chaukhamba Krishnadas Academy, 2016: p 367.
 42. Bhavamishra, Bhavaprakasa, translated by. K R Srikantha Murthy. Chapter 6 (6), Verse 26 – 27; Volume 1; Varanasi: Chaukhamba Krishnadas Academy, 2016: p 297.

43. R Sreelekshmi. Understanding Osteoporosis and its Ayurvedic Management – A Review. *International Journal of Ayurveda and Pharma Research*. 2022 Nov; 10(11): 88-94.
44. Cenk Aypak, Mustafa A Bircan, Ayse Ozdemir. Anti-osteoporotic Drug Utilization Rates for Secondary Prevention among Patients with Osteoporotic Fractures. *Rambam Maimonides Medical Journal*. 2022 Jul; 13(3): 1-6.
45. Michalis Panteli, Gavin Walters, Peter V Giannoudis. NSAIDs inhibit bone healing through the downregulation of TGF- β 3 expression during endochondral ossification. *Journal of Injury*. 2021 Jun; 52(6): 1294-9.
46. Feng Xu, McDonald M Jay. Disorders of bone remodelling. *Annual Review on Pathology*. 2011; 6(1): 121-45.
47. Marcucci Gemma, Domazetovic Vladana, Nediani Chiara, Ruzzolini Jessica, Farve Claudio *et al*. Oxidative Stress and Natural Antioxidants in Osteoporosis: Novel Preventive and Therapeutic Approaches. *Antioxidants (Basel)*. 2023 Feb; 12(2): 1-27.
48. Kaviraj Govind Das Sen, Bhaishajya Ratnavali edited with Siddhiprada Hindi Commentary by Siddhi Nandan Mishra. Chapter 49, Verse 8. Reprint ed. 2019. Varanasi: Chaukhamba Surbharati Prakashan: p 832.
49. Agnivesha, Charaka Samhita, revised by Charaka and Dridhabala with Ayurveda Dipika commentary by Chakrapani, edited by Jadavji Trikamji. Sutrasthana; Chapter 27, Verse 217. Reprint ed. 2022; Varanasi Chaukhamba Surbharati Prakashan: p 165.
50. Hidayat Khemayanto, Chen Jing Si, Wang Tian Chi, Liu Yu Jie, Shi Yu Jie *et al*. The Effects of Milk Supplementation on Bone Health Indices in Adults: A Meta-Analysis of Randomized Controlled Trials. *Advances in Nutrition*. 2022 Aug; 13(4): 1186-99.
51. Agnivesha, Charaka Samhita, revised by Charaka and Dridhabala with Ayurveda Dipika commentary by Chakrapani, edited by Jadavji Trikamji. Sutrasthana; Chapter 27, Verse 231-232. Reprint ed. 2022; Varanasi Chaukhamba Surbharati Prakashan: p 166.
52. Kumar Manoj, Sharma Vivek, Lal Darshan, Kumar Amith, Seth Raman. A comparison of the physico-chemical properties of low-cholesterol ghee with standard ghee from cow and buffalo creams. *International Journal of Dairy Technology*. 2010 May; 63(2):252–5.

Cite this article as:

Prathush NJ Gowda and Smitha Jain. A critical appraisal of Asthisamharakadi choorna in the management of Asthikshaya with reference to Osteopenia and Osteoporosis. *Int. J. Res. Ayurveda Pharm.* 2024;15(4):109-114
DOI: <http://dx.doi.org/10.7897/2277-4343.154129>

Source of support: Nil, Conflict of interest: None Declared

Disclaimer: IJRAP is solely owned by Moksha Publishing House - A non-profit publishing house, dedicated to publishing quality research, while every effort has been taken to verify the accuracy of the content published in our Journal. IJRAP cannot accept any responsibility or liability for the site content and articles published. The views expressed in articles by our contributing authors are not necessarily those of the IJRAP editor or editorial board members.