



## A Critical Review On Mechanism Of Herbal Drugs *Cissus Quadrangularis*, *Mimosa Pudica* And *Boswellia Serrata* In Bone Healing For Osteoporosis (Asthikshaya) And Bone Fracture And Pain.

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### Abstract

- Osteoporosis, a silent epidemic has become a major health hazard in recent years. Osteoporosis which increases bone fragility and thereby the risk of fractures is associated with high mortality, morbidity and high medical expenses throughout the world. "It is a progressive systemic skeletal disorder characterized by low bone mass and micro-architectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture."<sup>(1)</sup> Osteoporosis causes bones to become weak and brittle — so brittle that a fall or even mild stresses such as bending over or coughing can cause a fracture. Osteoporosis-related fractures most commonly occur in the hip, wrist or spine. World Health Organization (WHO) defines osteoporosis as bone density (BD) that is 2.5 Standard Deviation (SD) or more below the young adult mean value (T score < - 2.5). Bone density decreases with age as the fracture risk rises rapidly. Every 1 SD decrease in BMD increases fracture risk two to three fold.<sup>(2)</sup> Osteoporosis is second only to cardiovascular disease as a leading health care problem, according to the World Health Organization.<sup>(3)</sup> It is now considered as major health care problem in India with an estimated 50 % of healthy women and 36% men over 50 years of age having low bone mass. Occurrence of osteoporosis is 10 years earlier in Indian people than in the West.<sup>(4)</sup> It currently affects approximately one in three women and one in five men over age 50. Because of related morbidity and disability, diminished quality of life and mortality, osteoporosis and fractures associated with it are major public health concern. India seems to have the highest prevalence of osteoporosis and osteopenia.
- The most important supportive framework of the body among these is Asthi (Bone tissue). The branch of surgery that deals with deformities of the bones is known as Orthopedics. Asthikshaya (Osteoporosis) is degenerative changes where depletion of Asthidhatu is seen. Defining feature of Osteoporosis (Asthikshaya) is reduced bone density which causes micro architectural deterioration of bone tissue and leads to an increased risk of fracture. By Ashrayashrayibhaava- Vata dosha and Asthi Dhatu is inversely proportional to each other. Vata vrudhi causes Asthikshaya. Trauma management has been in practice since Vedic periods. Also, the use of plants for medical purposes for their therapeutic properties has been in vogue since pre-historic times. In India and worldwide, use of herbal ingredients has a long tradition. The indigenous medicinal systems such as Ayurveda, Siddha and Unani are followed even today as a part of curing many ailments without any side effect (Smet et al., 1992a). The Ayurvedic medicinal plants have been a source of so many potential drug candidates for several disease conditions and most importantly for chronic disorders. In Ayurveda many of drugs and formulations were described for management of osteoporosis, fracture and pain; among them for the fracture the Asthishrunkhala is one of the drugs widely used as single or in various compound formulations. Also there are many drugs which are mentioned as Asthiposhak. But we selected Asthishrunkhala, lajjalu and shallaki as it is Asthiposhak, Balya and Analgesics.
- The purpose of this article is to concentrate in herbal medicines for bone healing in osteoporosis and fractures.

**Keywords-** Medicinal plants, Bone Healing, Osteoporosis, fracture, Ayurveda.

### Introduction-

Ayurveda is the fore runner of all the therapies of the world, since man has thought of providing an effective remedy to the diseases suffered by him. In all the living beings the matter and energy existing in the form of Dosha Dhatu & Mala but the most important supportive framework of the body is Asthi (Bone tissue).

Asthikshaya (Osteoporosis) is a global dilemma which is increasing exponentially in growing elderly population. This affects both males and females, all races with different degree.

Risk of Osteoporosis in women are 30-40% and in men are 13- 15%. Women are at higher risk but this risk increases even more at menopause.

Asthikshaya is understood as decrease in the Poshakamsha (nutrient supply) to Asthidhatu leading to Kshaya of Asthidhatu and its functions along with its Upadhatu (Ch.S.Su.17/62-72).<sup>(5)</sup> In modern science Osteoporosis is defined as "Deterioration of bone tissue with consequent increase in bone fragility and susceptibility to fracture characterized by low bone mass."<sup>(6)</sup> When the bone formation decreases and bone resorption increases it leads to bone degeneration causing Osteoporosis. The etiological factors of Osteoporosis are increasing age, sex, hormone deficiency, Caucasian (white race), low body mass index, malnutrition, low calcium intake, smoking, alcohol, prolonged corticosteroids.<sup>(7)</sup>

In management of Osteoporosis, it has been utilised to prevent bone loss, include calcitonin and bisphosphonates, and preventing the fractures, calcium supplement, sodium urate, ossein hydroxyapatite compound, Vitamin D analogues, estrogen replacement therapy, parathyroid hormone, anabolic steroids and growth hormone and maintaining the bone mass with vitamin D supplementation, hormone replacement therapy and use of drugs.<sup>(8)(9)</sup>

Studying bone fracture healing requires a deep knowledge of the underlying process and an effort in performing accurate outcome measurements. In India there has been a revival of interest in traditional orthopaedic practices since ancient period. In Ancient Indian system of surgery Acharya Sushruta has described extensively about the fracture and termed this condition as Bhagna. In Sushruta samhita Nidana and Chikitsasthan explained about its etiology, classification, various modalities of management along with subjective assessment. In present days the fracture healing is assessed subjectively along with various objective parameters like radiological, histopathological, mechanical, biochemical and hormonal parameters. Among these radiological, histopathological, mechanical methods are commonly followed by most of the researchers in assessing fracture healing and the other hormonal and biochemical assessment methods used seldom in comparison.

In Ayurveda many of drugs and formulations were described for management of fracture; among them the Asthishrunkhala is one of the drugs widely used as single or in various compound formulations.

During the development of the modern medicine, biologically active compounds from plants have played a vital role. Herbal medicine continues to influence the medicines of today and up to 25% of all prescription drugs worldwide have at least one active ingredient that comes from plant extracts or synthesized plant compounds.

According to the study of World Health Organization (WHO) almost 4 billion people i.e. 80% of the earth's population are estimated to use some form of herbal medicine in their health care system (Hamid et al. 2010). In recent times plant-based drugs have represented outstanding contributions to therapeutics increasing their market demand. These plant based drugs are labelled as 'herbal drugs' or 'phytomedicines' which are either single plant extracts or fractions or pure isolated chemical entities.

In Ayurveda, there are many drugs which are mentioned as Asthiposhak. But we selected Asthishrunkhala, lajjalu and shallaki as it is Asthiposhak, balya and Analgesics.

#### **Need of study-**

To enhance the use of herbal medicine in bone healing.

Identify the herbal compound for bone healing.

To provide best Phytomedicines for bone healing.

#### **Previous study-**

Based on previous animal study conducted in the department of Shalyatantra of the Institute on fracture healing and revealed that Cissus Quadrangularis has following effects

- Early callus formation;
- More cellularity and vascularity formation;
- Average 6 % more cartilage formation in 3rd week;
- Earlier formation of Haversian system and bone matrix;
- Earlier starts of medullary and cortical repair process

Recent studies have also suggested that Asthishrunkhala (Cissus quadrangularis) stimulates osteoblastogenesis and can be used as preventive as well as alternative natural medicine for bone diseases such as osteoporosis.

- Based on this, a random controlled study was conducted and fracture healing was assessed in the patients with simple and single fracture by biochemical parameters like serum calcium, serum phosphorus and hormone PTH (parathyroid hormone) and their values were evaluated during fracture healing. From the assessed data it was found that in Group-A (treated with drug) bone healing process was accelerated as serum level of PTH Hormone have shown increasing trend during the period of 31 days and it was at its peak on 21st day from inception of administration of drug; but levels of

calcium and phosphorus were remain maintained during period of fracture healing. In Group-B (control placebo group) it was observed that serial values of Sr. Calcium, Sr. Phosphorus and PTH Hormone were not having significant fluctuations. This indicates that the process of fracture healing or osteoblastic activity was initiated earlier and it was at its peak at the end of 3rd week in Group-A. Hence it can be concluded that the drug *Cissus Quadrangularis* is having influence on accelerating the Fracture healing process and further it helps in reducing period of immobilization and early rehabilitation.<sup>(10)</sup>

#### **Mode of action of *Cissus quadrangularis* (Asthisrinkhala)-**

*Cissus quadrangularis* is a vine that grows in Africa and major parts of Asia. This plant is considered as one of the most frequently and popularly used medicinal plants in Japan, and is also used in traditional African and Ayurvedic medicine. All parts of the plant were used for medicinal purpose and popularly called as asthisamharaka (which prevents the destruction of bones i.e., Bone setter). It is a rambling shrub, which is basically an edible plant and referred as Hadjod (Hindi). It belongs to the family Vitaceae. *Cissus* is propagated using cuttings and blossoms in the month of June-December (Udupa and Prasad, 1962). Ayurvedic drug *Asthisrinkhala* have Calcium content and it have good effect on *Asthidhatu*, *Asthisikshaya* i.e. Osteoporosis.

#### **Ras Panchak**

- Rasa - Katu,
- Madhura Guna – Laghu, Ruksha, Sara
- Vipak – Madhur
- Virya – Ushna
- Doshgnata - kapha vataghna, pitta wardhak

*Asthisamharaka* are sweet (Madhura) and pungent (katu) in taste (rasa), in post digestive effect ( Vipak) is madhur and has hot (ushna) potency (Virya). By the combination of madhur and katu tastes, it reduces vata and kapha dosha.

#### **According to API-**

- Properties- Dipan, Vatshleshmahara, Asthi Sandhankar, Chakshushya, Vrushya
- Indication- *Asthichyuti*, *Krumi*, *Arsha*, *Asthibhang*

#### **Modern Aspect-**

Taxonomic Position :

- Kingdom – Plantae
- Subkingdom – Viridiplantae
- Division – Magnoliophyta
- Subdivision – Tracheophyta
- Class – Magnoliopsida
- Order – Vitales
- Family – Vitaceae
- Genus – *Cissus*
- Species – *C. quadrangularis*

#### **Pharmacological Studies:**

- Anti inflammatory activity - Flavonoids are inhibiting the inflammatory process. They are inhibitor of lipooxygenase especially luteolin, which is compound of *C. quadrangularis* L. is known to be inhibitor. The antiinflammatory activity of  $\beta$ - sit sterol was demonstrated to have an inhibitory effect on edema induced by both carrageens and arachidonic acid. It is suggested that *C. quadrangularis* L. is dual inhibitor of arachidonic acid metabolism.
- Anti Osteoporotic activity - *C. quadrangularis* L. has been reported in Ayurveda for its anti-osteoporotic activity. The phytoestrogen rich fraction (IND- HE) from the aerial parts of plant shows its activity. Plant contains phytoestrogen and triterpenoids. The phytoestrogen steroids isolated plant shows influence on early regeneration and quick mineralization of bone. The ethanolic and petroleum ether extract of *C. quadrangularis* L. shows prominent effect. Various studies confirms the anti-osteoporotic activity and phytoestrogen rich fraction (IND- HE) of *C. quadrangularis* L. increased blood calcium level, Vitamin D<sub>3</sub>, Serum estrogen, bone mineral density and bone mineral content. There is significant increase in bone thickness, bone density and bone hardness. it also significantly inhibits the anti-anabolic effect and exerts some beneficial effects on recovery of bone mineral density. The ethanolic extract of *C. quadrangularis* L. shows ethanol extract of the plant had definite anti-osteoporotic effect.<sup>(11)</sup>

#### **Mode of action of *Boswellia serrata* (Shallaki)-**

*Boswellia serrata* is an Indian medicinal plant commonly known as Salai guggul having medicinal history since Ayurvedic era. The oleo-gum-resin of this plant finds wide application in traditional Ayurvedic medicine as a therapeutic. The active constituents of the resin are pentacyclic triterpenes referred to as BAs. They are extensively studied for their anti-inflammatory, anti-tumour, immunomodulatory activities etc.<sup>(12)</sup>

Boswellic acids (BAs) are the main bioactive constituent of Boswellia serrata gum resin that belongs to the pentacyclic triterpene family. BAs show anti-inflammatory action by inhibition of leukotriene synthesis via 5-lipoxygenase (Ammon et al. 1993). They also show anti-cancer activities<sup>(13)</sup>

#### **Ras Panchak of Boswellia serrata-**

- Rasa : Tikta, Madhura and kashaya rasa
- Guna : Ruksha, Laghu, Tikshna
- Vipaka : Katu
- Virya : Ushna

According to classics, Shallaki has potent vata-kaphahara properties.

Symptoms of vata vriddhi improved due to Shallaki as it has ushna virya, and according to some classics, due to tikshna guna it acts as vata shamak. Shallaki. also increases dhatvagni by its tikta rasa, leading to proper nutrition of dhatus, whereas improvement of the symptoms of vata kshaya is due to rasayana (immunomodulator) and brihamniya prabhava of Shallak.<sup>(14)</sup>

#### **Mode of action of Mimosa (Lajjalu)-**

Mimosa has sweet, astringent and acrid taste and exhibits several direct anti-vata properties which are the major reasons for selecting the plant for scientific validation

#### **Ras Panchak of Mimosa pudica**

- Rasa : Tikta, kasaya
- Funa : Laghu, Ruksha
- Virya : sheeta
- Vipaka : Katu
- Karma : Grahi, kaphahara, pittahara <sup>(15)</sup>

#### **Discussion-**

In Saptha dhatus, Asthi dhatu is included in 5th position. Sharir Dharana is the function of Asthi. It is the hardest and strongest Dhatu. Asthi Dhatu and diseases related to it has been mention in old literatures. So we have choosen the Asthi-kshaya, disease of Asthi Dhatu which is correlated with Osteoporosis in modern science. It is most common condition found in elderly growing population. Females are more prone to these condition due to post-menopausal.

The reduction of Asthi Dhatu in Asthi Kshaya which means decreased in density of bone tissue. Through Ashrayashrayi bhaava Vata Dosha and Asthi Dhatu inversely proportional each other. Asthi-kshaya lakshana are Asthi and Sandhi pain, Doubalya, Kesh, Roma, Nakha, Danta Vikara and Pata, Rukshata, tenderness etc. It is a Kashta Sadhya disease.

Both Asthishrinkhala and shallaki are Madhur Rasatmak, Guru, Snigdha, helps in Balya, Bruhniya, Snehana, Dhatuposhak, Sandhaniya Karma and helps In Shaman Of Vitiated Vata Doshas. Lajjalu is tikta kshaya in rasa which help in sthamban. Asthishrinkhala Been Sheeta Veerya, It's Dhatuposhak, Balya And Reduces Rukshata By Its Guru Guna.

According To Modern Review, Cissus Quadrangularis Contains Flavonoides, Vitamin C, Phytosterol, Ketosteriods, Tetracyclic, Tryterpinoids, Calcium.

Active constituent is KETOSTERIODS in Asthishrinkhala i.e helps in antagonist to glucocorticoid receptor and promotes good bone health, increases intramuscular creatinine levels, anabolic steroid properties for healing of fractures.

Asthishrinkhala has been mentioned in various formulations for improvement of bone loss, stops bone degeneration same as with shallaki and lajjalu.

#### **CONCLUSION:-**

Ayurveda has given ample importance to Asthi Sharir by describing it as Saara (base) of body. Prospects of management principles mentioned in Ayurveda are evident from the fact that along with the general principles of fracture management an additional stress has been given on the local application of various Lepa & Pariscechan upon the fracture site along with number of herbal & herbo-mineral preparations mentioned for the internal usage.

This study shows that a Trial can be conducted with the combination of these three herbal medicine to check effective results in osteoporosis, fracture and pain management.

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