

## Medicinal plants and bone healing

### ABSTRACT

Fracture is defined as complete or incomplete separation in the continuity of bone. Fracture healing is a complex physiological process that involves the coordinated participation of hematopoietic and immune cells within bone marrow. In conjunction with vascular and skeletal cell precursors it also includes mesenchymal stem cells which are recruited from the circulation and the surrounding tissues. It is estimated that 80% of the population in developing countries still rely on the traditional herbal medicines. Healing is practiced by people from all levels of society, who live and work in intimate relation with their environment. They range from bone setting, treatment of snake bite and mental disorders. Knowledge of Medicinal plants and their identification should be gained with the help of cowherds, hermits, hunters, forest dwellers and those who gather plants of forest for food. Sushruta Samita Sutrasthanam 36 V.10. Herbs can be effective in reducing swelling, pain and soreness of the fracture and also speedy recovery of function. In the last few decades there has been growing interest in alternative forms of therapy globally. Herbal medicines are currently in demand and their popularity is increasing.

**Keywords:** Bone healing, herbal remedies for bone healing, medicinal plants

### INTRODUCTION

Fracture healing is a complex physiological process that involves the coordinated participation of hematopoietic and immune cells within bone marrow. In conjunction with vascular and skeletal cell precursors it also includes mesenchymal stem cells which are recruited from the circulation and the surrounding tissues. Bone healing or fracture healing is a proliferative, physiological process in which the body facilitates the repair of a bone fracture. It involves complex processes of cell and tissue proliferation and differentiation. Many factors are involved including growth factors, inflammatory cytokines, antioxidants, osteoclast and osteoblast cells, hormones, amino acids, and uncounted nutrients. In general, bone fracture treatment consists of pushing dislocated bone back into place via relocation with or without anesthesia, stabilizing their position and then waiting for the bone's natural healing process to occur.

The treatment of fracture is found in the writing of Sushruta (500 BC) described traction, manipulation, and

immobilization by splint and by special variety of clay and also in the times of Hippocrates in 400–335 BC.

The Egyptian physician used to immobilize the injured limbs using the bandage impregnated with resin just as Plaster of Paris is used today for such cases. Gave detailed account of fracture by giving description of employing extension in the treatment of fracture.

The main principle involved in such treatment is to bring and maintain the ends of broken fragments together so that nature's effort to bridge the gap continues unhampered. In clinical practice, there are many methods and techniques described for the treatment of fracture that would enable it to heal within a reasonable amount of time. During the

### VIBHA SINGH

Department of Oral and Maxillofacial Surgery, K.G. Medical University, Lucknow, Uttar Pradesh, India

**Address for correspondence:** Dr. Vibha Singh,  
A-43, Krishna Nagar, Lucknow,  
Uttar Pradesh, India.  
E-mail: vibhasinghraghuvanshi@gmail.com

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recent past, surgeons laid greater stress on the various mechanical devices which could be quickly applied by close or open method. The bone tissue is one of the very active tissues of the body and its reparative process is so efficient that under ideal condition it can fully restore its normal structure after complete dissolution without leaving behind any trace of earlier injury. The mechanical fixation is only a means of immobilization for healing but it has now been seen that the bone tissue is one of the very active tissues of the body and its reparative process is so efficient that under ideal condition it can fully restore its normal structure after complete dissolution without leaving behind any trace of earlier injury.

## REVIEW OF LITERATURE

Bone healing process is to restore the tissue to its original physical and mechanical properties and is influenced by a variety of systemic and local factors; healing occurs in three distinct and overlapping stages.

In the process of bone healing, several phases of recovery facilitate the proliferation and protection of the areas surrounding fracture and dislocation. The length of the process depends on the extent of injury, and the usual margins of 2 or 3 weeks are given for the preparation of most upper bodily fracture anywhere and 4 weeks lower bodily fractures. The healing process is mainly determined by periosteum. The periosteum is one source of precursor cells which develop into chondroblast and osteoblast that are essential to the healing of bone. The healing process is mainly determined by periosteum. The periosteum is one source of precursor cells which develop in to chondroblast and osteoblast that are essential to the healing of bone. The bone marrow, endosteum, small blood vessels and fibroblast are other source of precursor cells.

Two basic types of fracture healing are the primary or direct fracture healing and secondary or indirect fracture healing. The primary fracture healing occurs with minimal callus formation. It is direct attempt of bone to reestablish its continuity and thus requires direct contact of cells in the cortex. The majority of fractures heals by secondary or indirect healing. It occurs in four phases hematoma formation, early inflammatory, repair, and late remodeling phase.<sup>[1]</sup>

Phase of fracture healing there are three of fracture healing phases.

1. Reactive phase—fracture and inflammatory phase, granulation phase

2. Reparative phase—cartilage callus phase, lamellar bone deposition phase
3. Remodeling phase—to remodeling to original bone counter.

In the early inflammatory stage, a hematoma develops within the fracture site during the first few hours and days. Inflammatory cells and fibroblasts infiltrate the bone under prostaglandin medication, those results in the formation of granulation tissue, ingrowths of vascular tissues, and migration of mesenchymal cells. The primary nutrient and oxygen supply of this early process is provided by exposed cancellous bone and muscle. The use of anti-inflammatory or cytotoxic medication during the 1<sup>st</sup> week may alter inflammatory response and inhibit bone healing. During repair stage, fibroblast begins to lay down a stroma that helps support vascular in growth progress; a collagen matrix is laid down while osteoid is secreted and subsequently mineralized which leads to the formation of a soft callus around repair site. In terms of resistant to movement, this callus is very weak in the 1<sup>st</sup> 4–6 weeks of the healing process and required adequate protection in the form of bracing or internal fixation. Eventually, the callus ossifies forming a bridge of woven bone between the fractured fragments. Alternatively, if proper immobilization is not used ossification of callus may not occur and an unstable fibrous union may develop instead. Fracture healing is completed during remodeling stage in which the healing bone is restored to its original shape, structure, and mechanical stress placed on the bone. As the fracture site is exposed to an axial loading force, bone is generally laid down where it is needed and reabsorbs from where it is not needed. Adequate strength is typically achieved in 3–6 months.<sup>[2]</sup>

The clinical impact of fracture is significant pain, disability, and deformity. If the fracture union is not achieved, the patient may suffer long-term disability. There are two ways to improve the fracture healing, development of implants, and improvement of bone quality to speed up and improve callus formation.

Fracture healing not only needs surgery, slings braces, or any other device but also needs proper nutrition and overall health; this is because broken bones can repair themselves naturally. The treatment is needed just to assist the natural healing process.

Hunter (1779) studied the growth and repair of bone and concluded that the bone is formed by capillaries, vascularization of clot occur in between broken ends of bones which is the initial step in the formation of callus and these vessels originate from periosteum.

John Goodsir in the 19<sup>th</sup> century reported that living cells units called bone corpuscles which are present underneath the periosteum were responsible for osteogenesis.

Phemister (1951) stated that when bone is fractured, it is usually necessary to employ mechanical means to reduce and maintain the fragments in position, but the healing of fractures is governed by biological principles with which mechanical measure must be coordinated.

Guarniero R *et al.* (1992) assessed the effect of nutrition on fracture healing in controlled animal model; the results showed protein nutrition support on the healing of long bone fractures.

Chen *et al.* (2009) showed that for a small- and medium-sized fractured gap, the nutrient supply is sufficient for bone healing; and for a large-sized fractured gap, nonunion may be induced either by deficient nutrition supply or by inadequate mechanical condition.

In the literature, herbs are described speeding up bone formation without any side effect and relatively low cost.

Ayurveda or ayurvedic medicine is a system of traditional medicine native to India. In Sanskrit, the word *Ayush* means longevity and *Veda* meaning related to knowledge or science. The earliest literature on the Indian medical practice appeared during The Vedic period in India in the mid-second millennium. The Susruta Samhita and Charak Samhita are great encyclopedias of medicine compiled during BCE to 500 CE. They are among the foundational works of Ayurveda. There are many drugs of plant origin which have been described and used in Ayurveda medicine for fracture repair.

The knowledge of the medicinal value of plants and other substances and their use goes back to the earliest settlers. Today, traditional medicine practice is again coming in a new form for the well-being of the patients.

Recent archeobotanical excavation gives evidence for the use in the middle Gangetic region of medicinal plants since 2<sup>nd</sup> millennium BC that are still used by the ayurvedic physician and folk healers. The spirit of scientific enquiry influencing the intellectual word since the time of Buddha led to old belief system being questioned and tangible proof being sought after.

In the Indo-Gangetic and lower Himalayan region, tribal and wandering healers learned physician ascetic and yogic tradition such as Buddhism and Jainism and philosophical school such as Samkhya, Vaisheshika, and Nyaya all

contributed to emergence of a formal scientific culture of healing that became Ayurveda. Charak Samhita and Sushruta Samhita physicians to seek help from cowherds forest dwellers for procuring medicinal plants.<sup>[3]</sup>

Anti-inflammation is one of the key principles in the treatment of fracture as well as traditional bone setters' avocations. It controls the swelling and relieves the pain from the fracture site and the surrounding tissues which promote overall healing during inflammation; there is increased production of various mediators such as arachidonic acid metabolites and cytokines. Besides, there is confirming evidence stating that nitric oxide (NO) produced by inducible nitric oxide synthase (iNOS) plays one of the important roles in inflammatory disorders such as rheumatoid arthritis. Therefore, the chemical that inhibits the NO production by iNOS in macrophages would be potential treatment to reduce inflammatory response.

The ultimate gain of bone repair is to restore the bone strength of the injured bone to its original level without fracture or defect. The assessment of bone strength during fracture or defect in preclinical studies is essential to evaluate the effectiveness of an intervention on bone repair.<sup>[4]</sup>

## NATURAL REMEDIES FOR BONE HEALING

Bone healing using plants and their extract and poultice together with splint without cast is widely practiced in traditional medicine.

In the recent years, there is revival of interest in traditional system of medicine. Medicinal plants are a major source of biodynamic compounds of therapeutic value.

*Cryptolepis buchanani* (Ganglong, family *Asclepiadaceae*) is a climbing tree widely used in folk medicine in Southeast Asia. It is a medicinal plant growing in moist and swampy areas; it is a climber on some trees that can climb up to 200 m. The plant locally in Arunachal Pradesh is known as Ganglong and used traditionally for the treatment of bone fracture. Sometimes, it is also found as creeper on ground. Traditionally, the plant, mainly, its root, stem, and leaves are used for the treatment of bone fracture by tribal people in Arunachal Pradesh.

The local herbal practitioner detects the nature of the fracture by placing his/her hand on the injured portion which is developed over long years of practice. According to the nature of fracture, different parts of the plant are used in different modes such as local application and systemic use. Local application is made by making paste of herb with

mustard oil on the banana leaves for 1 week and can be extended according to need. For systemic use instead of mustard oil, 200 ml of milk is added 100 g of paste; after proper mixing, it is given orally three times daily for 5 days.<sup>[5]</sup>

*C. buchanani* also showed antibacterial activities.<sup>[6]</sup> The analgesic, anti-inflammatory, and chondroprotective activity of *C. buchanani* extract is also reported in literature. *C. buchanani*, stem has been found to relieve muscle pain and joint pain. Laupattarakasem *et al.* have studied anti-inflammatory activity of 50% methanol extract B2 and leukotriene B4 which are the product of COX and 5-lipoxygenase pathway, respectively. It also inhibits tumor necrosis factor-alpha, release from liposaccharides stimulated human monocytes cells line.<sup>[7]</sup> The extract of *C. buchanani* is found to be significantly active against *Bacillus subtilis* and *Pseudomonas aeruginosa*; however, they did not show significant inhibitory activity against *Escherichia coli* in lower concentration.<sup>[8]</sup>

The ethanolic extract of *C. buchanani* showed hepatoprotective effect on acetaminophen-induced hepatotoxicity. The presence of alkaloids and flavonoids in the ethanol extract of *Cryptolepis Buchnani* these molecules are reported to have hepato protective activity. Ethanolic extract of leaf extract of *C. buchanani* significantly protects against liver injuries as well as oxidative stress resulting in increased serum biochemical parameter such as serum glutamate oxalate transaminase, serum glutamate pyruvate transaminase, and serum alkaline phosphatase. The reduced level of superoxide dismutase, catalase glutathione, glutathione peroxidase, and glutathione-S-transferase in acetaminophen-treated rats was significantly increased by treatment with the extract.<sup>[9]</sup>

*Cissus quadrangularis* (Harjor, family *Vitaceae*) has been known for its bone healing properties for many centuries; it has been prescribed by the bone setters in the crude form both external as well as internal as decoctions. It has been found to be rich in Vitamin C.

It is also used as a diet in some parts of India and Sri Lanka. It is commonly known as Asthisamhari is a succulent of family *Vitaceae* commonly found throughout hotter part of India. It can be cultivated in the plains coastal areas jungle and wasteland up to 500 m elevation. Plant flowers in June and December. Plant material occurs as pieces of varying lengths stem quadrangular 4 wing internodes. The surface is smooth, glabrous, buff-colored with greenish tinge. The angular portion is reddish-brown, no taste, and no odor. The whole plant including all parts stem leaves roots is documented to possess medicinal properties.

The roots and stems are most useful for healing of fracture of bones. The stem is bitter; it is given internally and applied topically in broken bones; used in the complaint of back and spine. The plant has been documented in Ayurveda for the treatment of osteoarthritis, osteoporosis rheumatoid arthritis.

The plant has other important medicinal properties; it is useful in asthma, burns, and wound bite of poisonous insect.

The plant is useful in helminthiasis, anorexia, dyspepsia, colic, flatulence, skin disease, leprosy, hemorrhage convulsions, eye diseases, piles, and anemia.

#### Traditional uses

The roots and stems are most useful for healing of fracture of the bones. The stem is bitter; it is given internally and applied topically in broken bones, used in complaints of the back and spine. A paste of stem is useful for muscular pains. The plant has been documented in Ayurveda for the treatment of osteoarthritis, rheumatoid arthritis, and osteoporosis. The stem juice of the plant is used to treat scurvy, menstrual disorders, otorrhea, and epistaxis. The use of sap with tamarind has been reported in East Africa for the treatment of gonorrhoea. The herb is fed to cattle to induce flow of milk. The ash of plant is useful as a substitute for baking powder. A paste of stem is given in asthma, burns, and wounds, bites of poisonous insects and for saddle sores of horses and camels. A decoction of shoots with dry ginger and black pepper is given for body pain the infusion of plant is anthelmintic. Leaves and young shoots are powerful alternatives, dried and powdered; they are administered in certain bowel infections connected with indigestion. The plant is useful in helminthiasis, anorexia, dyspepsia, colic, flatulence, skin diseases, leprosy, hemorrhage, epilepsy, convulsion, hemoptysis, tumors, chronic ulcers, and swellings. The stout, fleshy quadrangular stem is traditionally used for the treatment of gastritis constipation, eye diseases, piles, and anemia. The stem boiled in limewater it forms a preserve useful as a stomachic; The Rongas of East Africa apply the pounded stem to wounds.

#### Pharmacological uses pharmacological uses

The first scientist who has studied Harjor was Chopra who showed in 1932 that experimentally induced fracture in dog was healed faster by giving Harjor through oral route; it is not just healing the fracture but relieves pain having analgesic effect and it may counteract the cortisone delayed effect on the bone recovery.<sup>[10]</sup>

It has antioxidant, antimicrobial, and antibacterial activity, its bone-healing activity.

Following the folk and traditional uses of the plant, it has been investigated scientifically in animal model to validate the potential of the plant in cure of variety of ailments.

#### Antioxidant and free radical scavenging activity

The methanol extract of *C. quadrangularis* exhibits strong antioxidant and free radical scavenging activity *in vitro* and *in vivo* systems mainly due to the presence of  $\beta$ -carotene.

#### Antimicrobial and antibacterial activity

Methanol extract (90%) and dichloromethane extract of stems possess antibacterial activity against *Staphylococcus aureus*, *E. coli*, and *P. aeruginosa* and mutagenicity against Salmonella microsome. Antimicrobial activity has also been reported from stem and root extract. The alcoholic extract of aerial part was found to possess antiprotozoal activity against *Entamoeba histolytica*. The alcoholic extract of the stem showed activity against *E. coli*. Methanol and dichloromethane extracts of whole plant were screened for *in vitro* antiplasmodial activity.

Bone-healing activity of Harjor in human is reported in literature by Singh *et al.* and Singh *et al.*

Ethanol extract 95% of whole plant possess antiosteoporotic activity in rat model. Harjor is not just halting the fracture but relieves the pain having analgesic effect, and it may counteract the cortisone delayed effect on the bone recovery; the stem has a high content of natural calcium, phosphorus, Vitamin C, and beta-carotene. It interferes with the mucopolysaccharides and collagen metabolism. Phytochemical analysis revealed also a high content of phytosterols which possess anabolic activity which is important in bone repair and the presence of beta-sitosterol, triterpene stilbene derivatives resveratrol; several scientific studies reported its anti-inflammatory, antiulcer, and antioxidant properties.

The role of Harjor in mandibular fracture healing is reported by Singh, *et al.* and proved that it accelerates fracture healing and biochemical marker osteopontin was also analyzed it was significant.<sup>[11-13]</sup>

It has wide margin of the safety, the intramuscular, or systemic administration of Harjor extract has been reported to facilitate healing of fractured bone by hastening all the phases of recovery, fibroblastic phase, collagen phase, and osteochondral phase. Although Harjor stimulates all the cells of mesenchymal origin, namely, the fibroblast the chondroblast, and osteoblast, the maximum effect is on osteoblast proliferation. The bony deposition and periosteal reaction was more in treated animals than in control.

In the early phase of healing, the greater accumulation of mucopolysaccharides supplies more raw material for repair; whereas in the later phase, earlier disappearance of mucopolysaccharides indicates the more rapid utilization of these raw materials for the repairing of bone. Antiulcer activity, analgesic, anti-inflammatory, and stimulatory activity of the plant is also reported in the literature. These are because of flavonoids, especially luteolin and beta-sitosterol present in the extract and ability to reduce the enzyme myeloperoxidase (MPO), indicating a reduction of neutrophils, influx in the inflamed tissue. Harjor has been found to have acetylcholine action on the isolated in the animal studies.

#### Antiulcer activity

Methanol extract showed significant antiulcer activity in experimentally induced ulcer in rat model by decreasing gastric secretions and by enhancing glycoprotein levels. Methanol extract produces healing effect on aspirin-induced gastric mucosal damage in rats through its antioxidative mechanism. Triterpenoids and  $\beta$ -sitosterol present in methanol extract possess antilipid peroxidating effect and thus prevent gastric damage.

#### Analgesic, anti-inflammatory, and stimulatory activity

Methanol extract possesses analgesic, anti-inflammatory, and venotonic effects associated with hemorrhoids; anti-inflammatory activity is due to flavonoids, especially luteolin and by  $\beta$ -sitosterol.  $\beta$ -sitosterol present in methanol extract has ability to reduce the enzymes MPO indicating a reduction of neutrophils influx in the inflamed tissue. Calcium oxalate, carotene, tetraterpenoids,  $\beta$ -sitosterol, amyirin, and anabolic ketosteroids are responsible for the acceleration of healing and possess anti-inflammatory and analgesic activity. The ethanol extract exhibits protective effect on neutrophils mediated tissue injury induced by aspirin in rats 34. Methanol extract (90%) and dichloromethane extract of stems possess anti-inflammatory activity against COX-2. The stimulatory effect of the extract is probably due to vitamins and is greater than that of the anabolic hormone durabolin.

#### Central nervous system activity

The root extract possesses central nervous system depressant activity indicated by decrease in exploratory behavior. Methanol extract of roots contains saponins which show potent sedative.<sup>[14]</sup>

There are some other plants which are reported in the literature for their properties which are helpful in bone healing.

*Bambusa arundinacea* (Bamboo, family *Poaceae*), commonly known as bamboo, causes decrease inflammation thereby

helping in fracture healing. It has benzoic acid, traces of cyanogenic glycoside, and silicon substances which help in fracture healing. It also has calcium phosphorus and zinc. Oral or topical application of paste of stem or leaves is used in fracture healing.

*Coelogyne cristata* Lin. (family *Orchidaceae*) has osteosynthesis stimulatory properties due to its astringent and hemostatic action and stimulatory properties and the presence of various trace minerals. It contains mainly calcium phosphorus, zinc, and beta-sitosterol.

*Symphytum officinale* (knit bone, family *Boraginaceae*) removes the inflammation surrounding the fracture. It induces the union of affected part and contains allantoin, a crystallize substance, used in orthodox medicine to encourage epithelial formation in ulcer and wound.

*Salvia miltiorrhiza* (Dan Sheng, family *Lamiaceae*) causes the early formation of dense callus, and microscopic examination has also revealed the increased activity of osteoblast. Dan sen could improve mandibular bone fracture.

Equisetum species (Horsetail, family *Equisetaceae*) contains considerable amount of calcium and other constituents. It is believed to be useful in healing of the bone fracture and connective tissue injury.

*Terminalia arjuna* (family *Combretaceae*) contains tannins, arjunic acid, arjunantin, calcium carbonate, and sodium chloride. The bark has hemostatic properties. Powder of bark is used orally for bone fracture treatment.

*Ehretia cymosa* (family *Boraginaceae*) is used to cover fractured area or for joint dislocation, the healing is accelerated as compared to no treatment.

*Griffonia simplicifolia* (family *Leguminosae*) roots and leaves are used to treat bone fracture. It is also used in congestion, sedative and for appetite suppressant for the weight loss. *Cassia occidentalis* (*Fabaceae*) are the plants used for healing of bone fracture.

*Cicuta maculata* (family *Apiaceae*) decoction of the plant is used to treat bruises, sprains, sore joints, or broken bones.

*Curcuma domestica* (family *Zingiberaceae*) root powder paste and ghee is applied locally.

Dipsacus species (family *Dipsacaceae*) is native of Eurasia and Africa which also promotes bone healing process. Osyris

wightiana wall (family *Santalaceae*) paste of root is plastered to promote bone healing.

*Tinospora cordifolia* (family *Menispermaceae*) stem paste is used as a bandage for the treatment of bone fracture and dislocation of bone.

*Uvularia perfoliata* (family *Uvulariaceae*) is used widely to treat fractures externally and internally.<sup>[15]</sup>

*Cedrus deodara* (family *Pinaceae*) occurs in North Western Himalaya from Kashmir to Gardhwal; its preparation is used in fracture of bone, noise in ear, and deafness. It has analgesic properties; hence, it is used in chronic inflammatory arthritis (traditional knowledge on the medicinal plants of Ayurveda CIMAP.

*Mesua ferrea* (in Hindi) is known as Nagkesar (family *Clusiaceae*); its preparation is used in fracture of bone and diseases of nervous system.

*Acacia arabica* (Babool, family *Mimosaceae*) is used in fracture and muscle spasm such as trismus. It is used in inflammatory arthritis.

*Commiphora weightu* (family *Burseraceae*) is known as Guggule in Hindi; its preparation is used for the treatment of fracture and dislocation of bones stiff joint.

*Piper longum* (family *Piperaceae*) is also known as Piplie; it is used in fracture of the bone and sciatica pain.<sup>[16]</sup>

The study done at CDRI, Lucknow, reported that *Pholidota articulata* and *C. cristata* (*Orchidaceae*) are the popular plant used in Uttarakhand for healing of bone by the local residents.

*Pholidota articulata* is known as bone-joining plant in Kumaon region. It is preferred by 82% of the people, followed by *Ulmus wallichiana* 73% and *C. cristata* 50%. Chemical profile showed the presence of 13 known chemical moieties (flavonoids) is known for treatment of bone-related disorders and validates the medicinal use for bone healing. These plants are also reported in other parts of India for treatment of fractured bone.

Sharma *et al.* reported bone healing plants which are used in Uttarakhand, India, in folk tradition. These plants are used in folk medicine during the treatment of fractures the mode of administration for all plants by application of paste around the fractured parts of the body followed by proper setting

of the bone with the help of expert bone setters. Fractured part was supported by gentle support with cardboard. Length of the treatment was varied 3–6 weeks depending on the fractures.

The plants *Pholidota articulata*, *C. cristata*, and *Vanda cristata* are from the family *Orchidaceae*; chemical profile of these plants shows the presence of 13 flavonoids known for treatment of bone related disorders.

The bark of *U. wallichiana* has been investigated for the novelty of its phytochemical composition and pharmacological action for bone healing.

The plants which are listed in this study are *Betula utilis* D. Don (bark) known as Bhoi family *Betulaceae*, *Boehmeria Wedd* Bark Known as Gheti, family *Urticaceae*, *Cassia tora* seeds and leaves known as Chakunda family *Caesalpinioideae*, *Coelogyne cristina* Lindley known as Hadiojen family *Orchidaceae*, *C. buchmanii* known as Dhadhi bel *Asclepiadaceae*.

*Cuscuta reflexa* Roxb (Akash bel family *Cuscutaceae*), Jungle Regia Akbrot *Juglandaceae*, *Neolitsea pallems* (bark) known as Chirar family *Lauraceae*, *Phalidom ariculata* known as Hadiojen family *Orchidaceae*, Pinuz raxburghit resin is used known as Chir family *Pinaceae*, *Rheum austral* known as Dolu family *Polygonaceae*, *Sinarundinariafalcata* (leaves) known as Ringal family *Poaceae*, *Taxus baccata* (bark) known as Thuner family *Taxaceae*, *U. wallichiana* planchon known as Chamormou family *Ulmaceae* and *Vanda cristata* known as Rasna family *Orchidaceae*.<sup>[17]</sup>

*Piper sarmentosum* (family *Piperaceae*) enhances fracture healing in osteoporotic fracture. Estai *et al.* reported in animal study that plant shows enhancement in the fracture healing in osteoporotic rat.<sup>[18]</sup>

*Cannabis sativa* (Bhang, family *Cannabaceae*) - A nonpsychotropic compound of cannabinoid cannabidiol (CBD) can help in healing of bone fracture and speed up the process; it is reported by Natalya M Koganl *et al.* As per the study done on the rat at Israel, they found that CBD alone makes bone stronger. Researchers had previously discovered cannabinoid receptors within human bodies stimulated bone formation and inhibited bone loss. According to Gabet, the human body is equipped with a cannabinoid system that is involved with the regulating both vital and nonvital system. This is why the psychogenic compound in marijuana tetrahydrocannabinol (THC) has an effect on the human brain. They tested CBD alone as well as CBD with THC on group of rats with fractured femora.

Researchers at Tel Aviv University had previously discovered cannabinoid receptors within human bodies stimulated bone formation and inhibited bone loss. This led them to investigate whether cannabis, or the compounds found within it, could help bones to heal. According to Gabet, the human body is equipped with a cannabinoid system that is involved with regulating both vital and nonvital systems. This is why the psychogenic compound in marijuana, THC, has an effect on the human brain. The researchers tested CBD alone, as well as CBD with THC, on groups of rats with fractured femora. They found CBD and THC sped up the healing of the rats after 8 weeks of treatment. CBD alone was nearly as effective at helping the bones to heal. The clinical potential of cannabinoid-related compound is simply undeniable. According to them, it is clear that it is possible to detach a clinical therapy objective from psychoactive of cannabis CBD is the principle agent in the study was primarily anti-inflammatory and has no psychoactivity.

DOI: 10.1002/jbmr. 2513 American Society for Bone and Mineral Research.<sup>[19]</sup>

There are other herbs used in European countries such as comfrey, *Symphytum uplandica*; it should not be confused with potentially toxic wild variety (*S. officinale*) nor with the native herbs known as wild comfrey (*Cynoglossum virginianum*) that is native of the USA. It is used in the form of tea as an aid in fracture healing.

Horsetail is a herb in the silicon which can be boiled and made into tea in the early stage of fracture healing.

*Arnica (Arnica montana)* is also herb which is reported to help in bone healing.

Plants which has been described to be good and healing remedy is so and disease while now it is found to be harmful or toxic the scientist have to go deeper in their research to find out why it is so. We cannot simply discard ancient records. The plants are exposed to chemicals which are thrown daily into the atmosphere by man's style of living the plants exposed to these chemicals during adaption for survival and may lose their original medicinal properties or may become toxic and less effective.

In recent years, ethnobotanical and traditional uses of natural compounds, especially of plant origin, received much attention as they are well tested for their efficacy and generally believed to be. The holistic approach in science is gradually replacing the reductionism or purely analytic tradition which studies system only after dividing them into their smallest possible part.<sup>[10]</sup>

Scientifically defined, a drug is a substance which changes the character of protoplasm since all herbs do so we call them “Natural medicines.”

## CONCLUSION

There is need of open mindedness from both the modern as well as ayurvedic medical community to correlate and utilize all the scientific developments and ayurvedic concepts of understanding the mysteries of human body. The holistic approach in the science is gradually replacing the reductionism or purely analytic tradition which studies systems only after dividing them into their smallest possible parts. These herbs have helped the human race to survive on earth for thousands of years while modern drugs are phenomenon of less than a century. Today, time has come when all the medical scientists have to think on these lines for better future health and survival of humanity.

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