



A PHYSIOLOGICAL REVIEW ON *ASTHI DHATU* IN *AYURVEDA* WITH MODERN PERSPECTIVE

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ABSTRACT

According to *Ayurveda*, the body is made up of seven different types of tissues known as *Sapta Dhatu*. These seven tissues collaborate with one another to ensure that the human body functions perfectly physiologically. One of the seven *Dhatu*s mentioned in *Ayurveda* is *Asthi*. We are attempting to compile information about *Asthi Dhatu* defined in unique texts in this article, covering everything from its formation to nutrition, number, nature, distribution, character, significance, and effects on the body when it deviates from its typical persona or wide variety, such as *Asthi Kshaya* and *Asthi Vriddhi*. *Asthidhara Kala* and *Asthivaha Srotas* are two other aspects of *Asthi Dhatu* that are also discussed. *Asthi* gives strength and stability, maintains posture, supports *Majja Dhatu*, and imparts compactness to the body in addition to shielding internal organs from external shock. *Asthidhara Kala* and *Asthivaha Srotas*, *Asthi Marma*, *Asthi Sara*, *Asthi Pradoshaja Vikara* are some other aspects of *Asthi Dhatu* that are also discussed. In the modern day, bones are the hard connective tissues that make up the majority of vertebrates' skeletons and are made of a collagen-rich natural matrix loaded with calcium, phosphate, and other minerals. Bones protect the body's organs, create red and white blood cells, store minerals, provide structure, help the body function, and provide mobility.

KEYWORDS: *Asthi Dhatu*, *Asthivaha Srotas*, *Dhatu*, Bones.

INTRODUCTION

The human body is composed of *Dosha*, *Dhatu*, and *Mala*, according to *Ayurveda*¹. *Dhatu* is responsible for the structural and operative integrity of the body. *Dhatu* refers to the elements that make up the body and perform numerous physiological tasks. They function as bodily tissues to support and stabilize the body. *Asthi Dhatu*, one of the seven *Dhatu*s, is connected to *Sharira's Dharana*². It participates in movement in conjunction with its joints, as well as with muscles, tendons, and ligaments. The membrane that houses the *Asthi Agni*, which leaves the body in *Pakvashaya*, is known as the *Purisha Dhara Kala*. *Prithvi Mahabhuta* is dominant in *Asthi Dhatu*. *Poshaka* (unstable) *Meda Dhatu* creates *Asthi Dhatu*, which then enters the *Purisha Dhara Kala* and is consumed by the *Asthiagni*³. Teeth are also generated during this process, making them the *Upadhatu* (secondary tissue) of *Asthi Dhatu* in addition to the body's bones. The hair and nails are the *malas* (waste products) of this metabolic process. According to *Ayurveda*, *Dhatu* and *Dosha* both contain *Ashraya Ashrayi Bhava* or *Dosha* is considered to reside there. For *Pitta Dosha*, for instance, the residing sites are *Rakta* and *Sweda*. Like so, *Asthi Dhatu* is where *Vata Dosha* primarily resides. Given this, *Vata Dosha* vitiation is thought to be a significant contributor to the pathophysiology of *Asthi Dhatu Dushti*. Inflammatory and obstructive diseases in the bone are caused by the vitiation of the *Pitta* and *Kapha doshas*, respectively. *Kesha*, *Danta*, and *Nakha Vikruti* are part of *Asthi's Upadhatu* and *Mala Dushti*. So, deformities in these body organs may also result from pathology in *Asthi Dhatu*. To comprehend the underlying pathology of disease, one must have a basic understanding of *Dhatu*. To know

how *Asthi Dhatu* is abnormal, one must first understand how it is normal. These days, early ageing and changes in lifestyle have increased the prevalence of bone-related illnesses. Due to the significant occurrence of *Asthi*-related disorders, it is crucial to correctly diagnose these conditions and integrate their pathophysiology from both an *Ayurvedic* and modern perspective. This will allow for the proper initiation of treatment. In order to better understand *Asthi Dhatu* and bone-related problems from both an *Ayurvedic* and modern perspective, and to prevent and treat the disease, it is being attempted.

AIMS AND OBJECTIVES

1. To study the concept of *Asthi Dhatu* discussed in *Ayurveda* with reference to osseous tissue.
2. To study the concept of *Dhatu* discussed in *Ayurveda*.
3. To study the concept of bones as per modern literature of anatomy.

MATERIAL AND METHODS

All available literature for the conceptual study of *Dhatu*, *Asthi Dhatu* and concept of osseous tissue in various forms like textbooks, handbooks, magazines, original research articles, search engines like Google, academic research databases like PubMed, Google scholar etc.

ASTHI DHATU

Bones are typically regarded as *Asthi*. *Sthayi* and *Poshaka Dhatu* are the two different forms of *Dhatu*. *Sthayi Dhatu* can be used to refer to *Asthi* or bone rather than the entire *Asthi Dhatu*. *Poshaka Asthi*, a liquid form of *Asthi Dhatu* that runs through the *Asthivaha Srotas* and nourishes the *Sthayi Asthi Dhatu*, is another kind of *Asthi Dhatu*. Recent research suggests that the osseous tissue can be viewed as the *Sthayi Asthi Dhatu* and the nutrients, such as calcium, phosphorus, magnesium, etc., that are necessary for the sustenance of the bone tissue, as the *Poshaka Asthi Dhatu*.

ORIGIN OF ASTHI DHATU

Starting with the *Rasa* (fluid) *Dhatu*, each *Dhatu* develops from the layer of prior tissue. Each *Dhatu* serves as a harbinger of the one after it. In the *Dhatu Nirman* sequence, *Asthi Dhatu* is formed by *Meda Dhatu*. With the help of its own *Dhatwagni*, *Prithvi*, and *Vayu Mahabhoot*, *Meda Dhatu* transforms into *Khar* (hard/rough) portion. *Asthi* is the name given to that portion of *Khar*.⁴

NIRUKTI (ETYMOLOGY AND DERIVATION)

The word *Asthi* is a combination of two *Sanskrit* words "as" and "kthin". They together give the meaning "stability".⁵

PARIBHASHA (DEFINITION)

Asthi is a body component which stays for a longer time (*Asyate*) and which takes part in movements (*Kshipyate*) with muscles. It is also termed as the *Sara* (extract) of the body which remains even after the destruction of all other body components.⁶

PRAYAY (SYNONYMS)

1. *Kikasam*: Round structures.
2. *Kulyam*: Tubular or canal like structure.
3. *Svadayitam*: Animals like dogs like it.
4. *Medasteja*: Essence of *Meda dhatu*.
5. *Sara*: Extract of body which remains even after death.
6. *Majjakrit*: Which produces *Majja Dhatu*.
7. *Dehadharakam*: This maintains body skeleton and bears body weight.
8. *Karkaram*: Rough

PANCHABHAUTIKA SANGHATANA, GUNA (FUNDAMENTAL CONSTITUTION AND PROPERTIES)

Fundamental constitution of *Asthi Dhatu* shows predominance of *Prithvi Mahabhuta*. The physical properties of "*Asthi Dhatu*" are *Guru* (heaviness), *Khara* (roughness), *Kathina* (hardness), *Sthula* (bulkiness), *Sthira* (static), with a definite physical form.⁷

UTPATTI AND POSHANA OF ASTHI DHATU (METABOLISM AND DEVELOPMENT)

The *Asthi Dhatu* is formed from its precursor *Meda Dhatu*. The nourishing portion of *Meda Dhatu* and constituents of *Ahara Rasa* are transformed into *Asthi Dhatu* by action of *Asthi Dhatvagni*. *Agni Mahabhuta* and *Vayu Mahabhuta* play a major role in the solidification and roughness of *Asthi* by acting upon *Prithvi Mahabhuta*. Porosity in bones is due to actions of *Vayu* and *Akasha Mahabhuta*.⁸

UPADHATU AND MALA (METABOLIC BY PRODUCTS AND WASTE PRODUCTS)

During the process of metabolism and development of *Asthi Dhatu*, *Nakha* (nails) are formed as the metabolic by products.⁹ *Sharangadhara* considered *Danta* (teeth) only as metabolic by product of *Asthi Dhatu*.¹⁰ *Kesha* (scalp hair) and *Loma* (body hair) are waste products of metabolism of *Asthi Dhatu*.¹¹

SANKHYA (QUANTITY)

There are total 360 well-formed *Asthi* in human body.¹² *Sushruta* opines the total number as 300.¹³ Currently, most sources state that there are total 270 bones in human body at the time of birth. Many bones fuse together and form 206 separate bones.

TYPES OF ASTHI

There are five types of bones in human body.¹⁴

1. *Kapalasthi*: These are flat in nature. Literally it means bone which covers and protects the brain. *Asthi* present in the *Janu*, *Nitamba*, *Amsa*, *Ganda*, *Talu*, *Shankha*, *Vankshana* and *Madhyashira* are known as *KapalaAsthi*.
2. *Valayasthi*: These are round in shape or particularly hemi circle in shape. *Asthi* in *Pani*, *Pada*, *Uru*, *Parshva* and *Prustha* are *Valayasthi*. Some commentators don't agree with it as they count some other bones in this category as *Pada*, *Hasta*, *Griva* and *Prishsta*.
3. *Tarunasthi*: These are soft in nature. Literally it means which have either not fully developed i.e., ossified. Also, the bones of child have come under same scenario. *Asthi* present in the *Ghrana*, *Karna*, *Greeva* and *Akshikuta* are called as *Tarunasthi*. *Bhoja* also added *Kantha* in list.
4. *Nalikasthi*: These are long like tubes and hollow from within. They are reed shaped. *Asthi* which are left from above description is listed in this type. Commentators like *Dalhana* and *Bhoja* have specified some of bones like *HastaAnguli*, *PadaAnguli*, *PadaTala*, *Kurcha*, *BahuAsthi*, *JanghaAsthi* etc in examples of this type.
5. *Ruchakasthi*: The bones which are different from all and are utilized to chew food and enjoy the taste. These are for taste sensation. The *Dashanas* are known as *Ruchakasthi*. These are 28 or 32 in all. So, here *Ruchaka* i.e., *Danta* (teeth) is also regarded as *Asthi* along with various other stiff parts.

TIME SPAN

The *Asthi Dhatu* is formed on 6th day from the *Ahara Rasa* (nutrient fluid).¹⁵ However, *Sushruta* opines that the *Asthi Dhatu* is formed in a time span of twenty days.¹⁶

KARMA (FUNCTIONS)

The important function of *Asthi Dhatu* is providing structure and support to the body. It also nourishes the successor *Majja Dhatu*.¹⁷ Furthermore, according to modern physiology, bone tissue also performs the following tasks: mechanical, facilitates hearing, facilitates movement, protects internal organs, and it indirectly contributes to the creation of formed parts.

ASTHISARA (CHARACTERISTICS OF BEST QUALITY OR ESSENCE)

The persons with *Asthi Sara* have prominent *Parshni* (heels), *Gulpha* (ankles), *Janu* (knee Joint), *Aratni* (elbows), *Jatru* (collarbones), *Chibuka* (chin), *Shira* (head), *Parshva* (flanks), joints, bones and teeth. These people have a robust and firm body, are long-lived, and are very active and enthusiastic.¹⁸

ASTHIVAHA SROTAS

The *Moola Sthana* of *Asthivaha Srotas* are *Meda Dhatu* and *Jaghana*.¹⁹

ASTHIDHARA KALA (LAYER OF BONE TISSUE)

Kala is the layer in outer coverings of body observed in sagittal section. The inner layer of large intestine is *Purishadhara Kala* that holds fecal matter, has relation with the layer *Asthidhara Kala*.²⁰

ASTHI SANGHATA (CONFLUENCE OF BONES)

The places where many bones are present are called confluences. The confluences of bones are fourteen in number. They include *Gulpha* (ankle), *Janu* (knee), and *Vankshana* (groin) in lower limbs and their counter parts *Manibandha* (wrist), *Kurpara* (elbow) and *Kaksha*(axilla) in upper limbs on each side. One is in the *Trika* (lower back) and the other on the *Shira* (skull).²¹

ASTHI MARMA (VITAL POINTS)

There are eight vital points formed from bones.²² These are *Katikataruna* (vital spots on both sides of the vertebral column above and near the pelvic crest), *Nitamba* (vital points above the two pelvic bones meeting the flank), *Amsaphalaka* (vital points on scapula- one on each side of the vertebral column in the upper back region) and *Shankha*(vital spots on each side between the outer end of the brow and the ear).²³

DISEASES OF ASTHI DHATU

Asthi Kshaya and *Asthivridhhi Lakshanas* are considered under *Asthyashraya Vyadhis*.

ASTHI KSHAYA LAKSHANA

Asthischool (joint and bone pain), *Nakhabhang* (brittle and easily breakable nails), *Dantabhang* (weak, loose teeth which can easily fall off), *Kasha*, *Lomashmashru Patana* (loss of hairs of scalp, skin and beard), *Dwija Patana* (loss of teeth), *Shrama* (exertion) and *Sandhishaihilya* (subluxation of joint) are the symptoms of *Asthi Kshaya*.²⁴

ASTHIVRIDDDHI LAKSHANAS

Adhyasthi (extra pointed bone growth over bone or calcification) and *Adhidanta* (growth of extra teeth or hyperdontia) are the symptoms of *Asthi Vridhhi*.²⁵

ASTHI PRADOSHAJA VIKAR

Adhyasthi, *Adhi Danta*, *Danta Bheda*, *Asthibheda*, *Danta Shula*, *Asthisshula*, *Asthi Toda*, *Vivarnata*, *Kesha Loma Dosh*, *Shamshru Dosh* and *Kunakha*.²⁶

MODERN REVIEW²⁷

The skeleton of the majority of vertebrate animals is made up of bones, which are stiff organs. Bones safeguard the body's other organs, manufacture formed elements, store minerals, give the body structure and stability, and allow for motion. The internal and external structures of bones are intricate and occur in a range of shapes and sizes.

BONE TISSUE, or osseous tissue, is a particular kind of connective tissue. Internally, the bone has a structure resembling a honeycomb that contributes to the bone's rigidity. Numerous varieties of bone cells make up bone tissue. The development and mineralization of bone is facilitated by osteoblasts and osteocytes. The resorption of bone tissue is facilitated by osteoclasts. The lining cells that create a barrier on the bone surface are modified (flattened) osteoblasts. Ossein, an organic component of the mineralized matrix of bone tissue comprised primarily of collagen, and different salts make up the inorganic bone mineral component. Bone tissue is

mineralized tissue of two types, cortical bone and cancellous bone. Other types of tissue found in bones include bone marrow, endosteum, periosteum, nerves, blood vessels and cartilage. Ossification is the scientific term for the process of bone production. These two processes: intramembranous ossification and endochondral ossification—take place throughout the fetal period of development. Endochondral ossification involves the production of bone from cartilage, whereas intramembranous ossification involves the formation of bone from connective tissue.

DISEASES OF BONE

- Osteoporosis
- Fractures
- Rickets and osteomalacia
- Osteomyelitis
- Paget disease
- Bone tumor, etc.

DISCUSSION & CONCLUSION

The word *Asthi* means bone. Bone provides the body a sturdy aspect. *Dhatu* is the Ayurvedic term for tissue. *Rasa, Rakta, Mamsa, Meda, Asthi, Majja*, and *Shukra* are the seven *Dhatu*s. They can be understood anatomically as being made up of plasma, blood, muscle, fat or adipose tissue, bone, bone marrow, and seminal fluid. Understanding the fundamental pathology of the disease requires having a basic understanding of *Dhatu*s. These seven *Dhatu*s play a key role in both the pathophysiology of all diseases in the body and the body's immune system. *Panch Mahabhootas* are another component of these *Sapta Dhatu*s. Any disruption in the balance of any *Dhatu* can cause a particular disease. For instance, in the context of *Asthi Dhatu*, when *Vedana Lakshana* worsens due to *Asthi Dhatu Kshaya*, it is recognized by modern science as osteoarthritis. Following the *Meda Dhatu* is the *Asthi Dhatu*. Here, the *Dhatu* is understood using all of the literature that is available, and understanding the *Asthi Dhatu* is extremely helpful when thinking about the bones in anatomy. Treatment of *Asthi Dhatu* diseases and their clinical manifestations benefits from knowing the notion of *Asthi Dhatu*.

REFERANCE

1. Vaidya Jadavji Trikamji Acharya, *Susruta Samhita of Susruta, With Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Sutrasthan, Chapter-15/3, Doshadhatumala Kshayavridhi Vidnyan, Chaukhambha Orientalia, Varanasi, VIth Edition, 1997; 67.*
2. Pandit Bhisagacharya Harishastri Paradkar Vaidya, *Astangahrdayam by Vaghbata with The Commentaries Sarvangasundara of Arundatta And Ayurveda Rasayana of Hemadri, Sutrasthana, Chapter 11/4, Doshadividyaniam Adhyaya, Krishnadas Academy, Varanasi, Reprint, 2000; 183.*
3. Vaidya Yadavji Trikamji Acharya, *Charak Samhita of Agnivsha elaborated by Charak and Drdhabala with the Ayurvedadipika commentary by Shri Chakrapanidatta, Chikitsa Sthana, Chapter 15/31, Grahani Chikitsa, Chaukhamba Surbharati Prakashan, Varanasi, 2011; 515.*
4. *Charaka Samhita with Vidyotini hindi commentary by Pt. Kashinath Shastri & Dr. Gorakhanatha Chaturvedi, Part-1&2, Published by Chaukhambha Bharti Academy Varanasi, 22nd Edition 1996, Chikitsa Sthana 15/16,pg 456.*
5. Jha Srujan. *Shabdakalpadruma online application.*
6. Vaidya Jadavji Trikamji Acharya, *Susruta Samhita of Susruta, with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Sharirasthan, Chapter-5/21-22, Sharirsankha Vyakaran Sharir, Chaukhambha Orientalia, Varanasi, VIth Edition, 1997; 366.*
7. Dwarkanath C. *Introduction to Kayachikitsa. Chaukhambha Orientalia. Varanasi; 1996. Third Edition, 322-323.*
8. Vaidya Yadavji Trikamji Acharya, *Charak Samhita of Agnivsha elaborated by Charak and Drdhabala with the Ayurvedadipika commentary by Shri Chakrapanidatta, Chikitsa Sthana, Chapter 15/30-31, Grahani Chikitsa, Chaukhamba Surbharati Prakashan, Varanasi, 2011; 515.*
9. Vaidya Jadavji Trikamji Acharya, *Susruta Samhita of Susruta, with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Sutrasthan, Chapter-46/529, Annapanvidhi Adhyaya, Chaukhambha Orientalia, Varanasi, VIth Edition, 1997; 253.*

10. Pandit Parasurama Sastri Vidyasagar, Sarngadhara Samhita By Pandit Sarngadharacharya, Purvakhanda, Chapter 5/15, Kaladikarvyan naam, Chaukhamba Orientalia. Varanasi, IVth Edition, 2000; 46.
11. Vaidya Yadavji Trikamji Acharya, Charak Samhita of Agnivsha elaborated by Charak and Drdhabala with the Ayurvedadipika commentary by Shri Chakrapanidatta, Chikitsa Sthana, Chapter 15/18-19, Grahani Chikitsa, Chaukhamba Surbharati Prakashan, Varanasi, 2011; 515.
12. Vaidya Yadavji Trikamji Acharya, Charak Samhita Of Agnivsha Elaborated By Charak And Drdhabala With The Ayurvedadipika Commentary By Shri Chakrapanidatta, Sharir Sthana, Chapter 07/06, Sharir Sankha Sharir Adhayaya, Chaukhamba Surbharati Prakashan, Varanasi, 2011; 337.
13. Vaidya Yadavji Trikamji Acharya, Susruta Samhita of Susruta, with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Sharir Sthan, Chapter-5/06, Sharir Sankhavyakaran Adhyaya, Chaukhamba Orientalia, Varanasi, VIth Edition, 1997; 364.
14. Vaidya Jadavji Trikamji Acharya, Sushruta Samhita with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Gayadasa, Sharir Sthan, Chapter-5/20, Sharir Sankhavyakaran Adhyaya, Chaukhamba Orientalia, Varanasi, Reprint, 2017; 366.
15. Vaidya Yadavji Trikamji Acharya, Charak Samhita of Agnivsha elaborated by Charak and Drdhabala with the Ayurvedadipika commentary by Shri Chakrapanidatta, Chikitsa Sthana, Chapter 15/20-21, Grahani Chikitsa, Chaukhamba Surbharati Prakashan, Varanasi, 2011; 515.
16. Vaidya Jadavji Trikamji Acharya, Susruta Samhita of Susruta, with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Sutra Sthan, Chapter-14/14, Shonitavarnaniya Adhyaya, Chaukhamba Orientalia, Varanasi, VIth Edition, 1997; 62.
17. Vaidya Jadavji Trikamji Acharya, Susruta Samhita of Susruta, with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Krishnadas Academy, Varanasi, Reprint-1998, Sutrasthan, Chapter-15/4-1, Doshadhatumala Kshaya Vriddhi Vidnyan, 67.
18. Vaidya Yadavji Trikamji Acharya, Charak Samhita of Agnivsha elaborated by Charak and Drdhabala with the Ayurvedadipika commentary by Shri Chakrapanidatta, Viman Sthana, 08/107, Rogbhishagjitiya Adhayay, Chaukhamba Surbharati Prakashan, Varanasi, 2011; 278.
19. Vaidya Yadavji Trikamji Acharya, Charak Samhita of Agnivsha elaborated by Charak and Drdhabala with the Ayurvedadipika commentary by Shri Chakrapanidatta, Viman Sthana, Chapter 5/8, Strotoviman Adhayay, Chaukhamba Surbharati Prakashan, Varanasi, 2011; 251.
20. Vaidya Jadavji Trikamji Acharya, Susruta Samhita of Susruta, with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Kalpa sthan, Chapter-4/40, Sarpadashtavishavidnyaniyam, Chaukhamba Orientalia, Varanasi, VIth Edition, 1997; 574.
21. Vaidya Jadavji Trikamji Acharya, Susruta Samhita of Susruta, with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Sharir Sthan Chapter-5/16, Sharir sankha vyakarn, Chaukhamba Orientalia, Varanasi, VIth Edition, 1997; 365.
22. Vaidya Jadavji Trikamji Acharya, Susruta Samhita of Susruta, with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Sharir sthan, Chapter-6/4, Prateyakkarma Nirदेश Shaarira Sankha Vyakha, Chaukhamba Orientalia, Varanasi, VIth Edition, 1997; 370.
23. Vaidya Jadavji Trikamji Acharya, Susruta Samhita of Susruta, with Nibandha Sangraha Commentary of Dalhanacharya and Nyayachandrika Panchika of Sri Gayadasa, Sharir Sthan Chapter 6/7, Prateyakkarma Nirदेश Shaarira Sankha Vyakha, Chaukhamba Orientalia, Varanasi, VIth Edition, 1997; 370.
24. Pandit Bhisagacharya Harishastri Paradkar Vaidya, Astangahrdayam by Vaghbata with the commentaries Sarvangasundara of Arundatta and Ayurveda Rasayana of Hemadri, Krishnadas Academy, Varanasi, Reprint 2000, Sutrasthana 11/18, Doshadividnyaniyam Adhyaya, 185.
25. Pandit Bhisagacharya Harishastri Paradkar Vaidya, Astangahrdayam by Vaghbata with the commentaries Sarvangasundara of Arundatta and Ayurveda Rasayana of Hemadri, Krishnadas Academy, Varanasi, Reprint 2000, Sutrasthana 11/11, Doshadividnyaniyam Adhyaya, 184.
26. Vaidya Yadavji Trikamji Acharya, Charak Samhita of Agnivsha elaborated by Charak and Drdhabala with the Ayurvedadipika commentary by Shri Chakrapanidatta, Sutra Sthana, 28/16, Vividha Shitapitiya Adhyaya, Chaukhamba Surbharati Prakashan, Varanasi, 2011; 179.
27. <https://en.wikipedia.org/wiki/bone>