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SURVEY ARTICLE: *ASTHIDHATUKSHAYA*- AN INTERPRETATIVE STUDY ON OSTEOPROSIS CASE

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ABSTRACT

The equilibrium of *Dhatus* is health and their disequilibrium is disease. This disequilibrium may be either *Vriddhi* or *Kshaya*. *Asthidhatukshaya* (decrease in bone tissue mass) is a condition explained in *Ayurveda*, under the heading *Asthdasha Kshayas*. In *Asthi Kshaya* there is diminution of *Asthi Dhatu*. In *Ayurveda Asthi* are formed from the *Ahara Poshya Rasa* by *Dhatus* or directly by *Meda Dhatu* by *Asthivaha Srotas*. These nutrients are computed in *Asthivaha Srotas* by *Dhatvagni* this *Agni* with *Parthiv Bhutagni* transport about hardness and heaviness to this *Poshya Rasa* that form bone. The paper gives a versatile knowledge about the concept of *Asthi Dhatu Kshaya* with clinical example as osteoporosis and oestopenia to depict its practical benefit taking bone mineral density as a guideline.

Keywords: *Ayurveda*, *Asthi Dhatu*, *Aashraya-Ashrayee Bhava*, *Aakash Mahabhuta*, *Asthi-Dhatu Kshaya*, Porous bone, Osteoporosis, T-score, BMD

INTRODUCTION

The main function of *Dhatus* is *Dharana* and *Poshana* of the *Sharira*[1]. *Asthi Dhatu* is fifth among seven *Dhatus*. *Asthi Dhatu* is described as *Kathintam* (hardest) *Dhatu*. Function of *Asthi Dhatu* is compared with the hard core of bark of the tree[2]. The Ayurvedic Principle of *Asharya –Asharyi Bhava* links between *Asthi* and *Vata* are interlinked that leads this study. According to this principle *Asthi Dhatu* is the seat of *Vata Dosha*. *Asthi* & *Vata* are inversely proportional to each other regarding *Vriddhi* & *Kshaya*. *Vriddh Vata* leads to *Kshaya* of *Asthi*[3]. The *Asthi Dhatu* constitutes of *Prithvi* and *Vayu Mahabhuta* in dominance[4]. The *As-*

thi Dhatu is considered as the *Aashraya* for *Vata* because of its *Kharatwa* (hardness) due to *Prithvi Mahabhuta* and *Vata* is *Sushir* (porous) because of its *Aakash Mahabhuta*. So, if there is *Vata Vridhi* that will lead to *Sushirta* in *Asthi Dhatu* causing *Asthi Kshaya*. So it is important to clinically evaluate the features of *Asthidhatukshaya* as the beginning signs of Osteopenia / Osteoporosis. Osteoporosis means 'Porous bones'. One of the important clinical tools to measure amount of bone loss is Bone Mineral Density Test. It generally co-relates with bone strength & helps measuring the density of the bones. It is a non invasive test & is usually reported as T- Score. It helps to diagnose normal bone mass, low bone mass **(**osteopenia**)** and critically low bone mass (osteoporosis).

WHO criteria for T-Score: Normal Bone Mass- +1 to -1, Low bone Mass- -1 to -2.5, Osteoporosis- -2.5 or less.

CONCEPTUAL PART

Ayurvedic concept- *Asthi Dhatu* formation starts in the intra-uterine life. It keeps growing and get nourished by the food just like any other *Dhatu*-[56]. Precursor of *AsthiDhatu* (*Poshak Asthi*) is formed at the time of formation of *Medo Dhatu*. Nutrients of *Asthi* Dhatu (*Poshak Asthi*) reaches the *Asthivaha Srotas* where it is acted upon, by *Asthidhatwagni* and results in formation of *Poshya Asthi Dhatu*, *Asthi-Mala* (*Kesh*, *Loma*, & *Shmashru*), *Updhatu* (*Danta*) and the formation of *Poshak Majja Dhatu*[7].

Asthi Panchbhautikatva[-8–9] *Aakash*- porous cavity inside bone, *Vayu*- flow of blood, nutrients etc, *Agni*- conversion of cartilage into bone, *Jala*- bone marrow, *Prithivi*- constitution of bone.

Asthi Dhara Kala[10-11] :- *Purisha-dhara-Kala* is also called the *Asthidhara Kala*. *Purish Vikriti* and *Agni Vikriti* for e.g. *Malavishtabha*, *Grahani* etc. are relatively common in *Kati-Shula*, *Sandhi-Shula* and *Asthi-Shula* and it is seen that the treatment of *Purish Vikriti* also decreases the intensity of such *Shula*. If *Asthidhara-Kala* is *Purishdhara-Kala* as *Dalhan* suggests, this in between *Sleshmadhara* and *Pittadhara* or *Majjadhara-Kala*. Hence *Asthi* is between two unctuous *Dhatu* and two unctuous-*Kala* as well.

ASHRAYA-ASHRAYI SAMBANDHA OF *ASTHI DHATU* AND *VATA DOSHA*:-

Ashraya:- Ashraya means a resting place and that on which anything depends.

Ashrayi:- Ashrayi means resting with and depends on. In this- *Ashraya is "Receptacle"* and the meaning of *Ashrayi is "Resorting"*. According to this the *Vriddhi* of *Dosha* is reflected as *Vriddhi* of *Dushya*, and the *Kshaya* of *Dosha* in reflected us *Kshaya* of *Dushya*. This law is applicable to *Sleshma* and *pitta*, but not in *Vata*. *Ashraya-Ashrayi* relationship is helpful to understand the disequilibrium of *Dhatus* and *Malas*[9]. This is general phenomenon but this law has some exceptions about the relation between *Asthi* and *Vata Dosha*. It means that *Vriddha Vata* has tendency to abide *Asthi*. But it has no capacity to increase *Asthi*. On the contrary *Vriddha Vata* decrease and deteriorates the *Asthi Dhatu* and causes *Asthi Dhatu Kshaya Janya Roga*.

Showing Symptoms of *Asthi Dhatu Kshaya*[12-19]-

Sr.No.	Symptoms of *AsthiDhatukshaya*	*Charak*	*Sushrut*	*A.H*	*A.S*	*Harit*	*Bhela*
1.	*Keshprapatan*	+	-	+	+	-	+
2.	*Lomaprapatan*	+	-	-	+	-	+
3.	*Nakhaprapatan*	+	-	+	+	-	+
4.	*Shmashruprapatan*	+	-	-	-	-	+
5.	*Dwijjaprapatan*	+	-	+	+	-	+
6.	*Shrama*	+	-	-	-	-	-
7.	*Sandhisaithilya*	+	-	-	+	-	-
8.	*Asthishul*	-	+	-	-	-	-
9.	*Anga Bhang (Nakh Dant)*	-	+	-	-	+	-
10.	*Raukshya*	-	+	-	+	-	-
11.	*Asthitoda*	-	-	+	+	-	-
13.	*Asthi bheda*	-	-	-	+	-	-
14.	*Parushya*	-	-	-	+	+	-
15.	*Asthibaddhamansa-Abhilasha*	-	-	-	+	-	-
16.	*Ati Manda Chesta*	-	-	-	-	+	-
17.	*Ruja*	-	-	-	-	+	-
18.	*Vamana*	-	-	-	-	+	-
19.	*Kampana*	-	-	-	-	+	-
20.	*Meda Kshaya*	-	-	-	-	+	-
21.	*Virasya Manda*	-	-	-	-	+	-

Nidana of *Asthi Kshaya*[20-22]*- Aaharaj Nidanas*: *Ruksha Guna* of the *Shuska Mamsa* and *Shaka* increases the *Rukshata* of *Vata Dosha*. The *Snehatwa* of *Medas* and *Majja* dries up due to *Ruksha Guna* of the *Vata Dosha* leading to the improper nourishment of the *Asthi Dhatu* causing *Asthi Kshaya*. This *Gunataha Vriddhi* of *Vata dosha* leads to the *Asthi Dhatu Kshaya* because of *Aahsraya-Ashrayi bhava*. *Gunatha Vriddhi* of *Vata Dosha* is caused due to the increased intake of *Mudga*, *Masura* and *Adhaki* (lentils) resulting in Asthi *Dhatu Kshaya*. Less amount of *Ahara-rasa* is formed due to *Annashana*, Alpaashana and Pramitashana resulting in production of fewer amounts of *Poshak-amsas*. The requirements of the *Dhatus* cannot be fulfilled by such amount of *Poshak-amsas*. So, improper nourishment of the *Dhatus* takes place which leads to *Dhatu Kshaya*. This theory can be substantiated as the contemperory science states that starvation and intake of food which has fewer nutrients (malnourishment) are the causative factors for metabolic diseases of the bones such as Irregular intake of food (*Vishamashana*) and intake of food when the previously taken food is not digested properly (*Adhyashana*) leads to *Agni Dushti* which in turn produces *Ama*. This *Ama*, as said earlier leads to the *Sanhga* in the *Dhatu Poshaka Rasayanis* and inhibits the *Samyak Dhatu Posana Kriya* as a result of which *Asthi Dhatu Kshaya* occurs.

Viharaj Nidanas: *Balavad-vigraha* and *Bharvahana* are some of the causes for *Urah Kshata* resulting in *Abhighat Janya Vata Vriddhi*. This in turn leads to *Asthi Dhatu Kshaya*. Excessive indulgence in *Vyayama*, *Adhyayana*,

Pradhaavana, *Langhana*, *Plavana* and *Pratarana* (swimming) leads to *Vriddhi* in the *Chala Guna* of the *Vata Dosha***.** This *Gunataha Vriddhi* of *Vata Dosha* leads to *Asthi Kshaya* because of *Ashraya-Ashrayi bhava*. Excessive indulgence in these *Nidanas* will again lead to *Ruksa Gunataha Vriddhi* of *Vata* leading to *Asthi Kshaya*.

Dharana of *Aadharaniya Vegas* such as *Mutra*, *Purisha*, *Adho-Vata* etc., causes obstruction in the normal *Vata Gati* (*Maragavrodha*) and leads to *Vata prakopa*. This *Prakupita Vata* causes *Asthi Kshaya*.

Manasika Nidanas: which causes *Vata Prakopa*, *Chinta*, *Shoka*, *Bhaya* and *Krodha* are explained. These results in improper digestion of *Aahara*. This leads to improper nourishment of the *Dhatus* and obstruction in the *Asthi Dhatu Poshaka Rasayanis* causing *Asthi Kshaya*[23].

In old age, *Rasa* is not capable of nourishing the body. According to modern science also, degenerative changes in bones takes place in older age leading to decrease in bone mass (*Asthi Kshaya*).

SAMPRAPTI OF *ASTHI KSHAYA*- *Asthi Kshaya* is a disease in which normal genesis of *Asthi Dhatu* is disturbed, leading to *Kshaya* of *Asthi Dhatu*. As told by *Acharaya Charak*, *Dhatu Kshaya* and *Margavarana* are the causes for *Vata Prakopa* i.e vitiation of *Vata* takes place from either wasting of *Dhatus* or obstruction in passage. *Dhatu Kshaya* is *Sara Kshaya* and *Margavarana* is *Vega Pratibandha*, which leads to *Vata Prakopa*[24]. Owing to the *Ashraya-Ashrayi Bhava* between *Asthi* and *Vata*, the *Prakopa* of the *Vata Dosha* is said to be the causative factor for *Asthi Kshaya*. Hence the *Nidanas* explained under the heading of *Vata Prakopa* are *Dhatu Kshaya Karaka* and *Margavarana Karaka*.

Obstruction of normal *Gati* of *Vata* (*Vyana Vata*) occurs due to the *Margavarana*. By this the *Aahara rasa Vikshepa* (*Rasa Samvahana*), *Dhatu Vyuhana* and *Agni Samirana* functions of *Vyana* are affected. As a result of this, the *Aahara* Rasa containing the *Posakamsas* will not be able to reach the *Dhatus* and nourish the *Sthayi Dhatus* as a result Dhatu *Kshaya* occurs.

It can be said that *Dhathu Kshaya Karaka* and *Maragavarana Karaka Nidana Sevana* causing the *Prakupita Vata* to fill the *Riktata* in *Ashtivaha* Srotas which are devoid of *Snehadi Gunas* and cause *Asthi Kshaya*.

So, *Vata Prakopaka Nidanas* along with the *Sroto Pradusaka Nidanas* of *Meda*, *Asthi*, *Majja* and *Purisavaha Srotas*, *Agni Dushti* i.e. *Jatharagni*, *Parthivagni*, *Tejasagni*, *Vavayagni* and *Asthyagni* along with *Manasika Nidanas* altogether form a complex mechanism of pathogenesis of *Asthi Kshaya*.

*Samprapti Ghataka***:** *Dosa - Vata Pradhana (Vyana, Samana), Pitta (Pachaka), Kapha (Sleshaka)***,***Dusya - Asthi its Up-Dhatu and Mala, Meda and Majja.***,***Agni - Jatharagni-Mandya, Bhutagni- Parthiva, Tejasa and Vavayagni Mandya***,***Ama - Jatharagni Mandya Janya, Bhutagni Mandya Janya and Dhatwagni Mandya Janya Ama.*

Srotas - Medovaha, Asthivaha, Majjavaha and Purishavaha Srotas.,Sroto Dusti Laxana - Sangha.,Udbhava Sthana - Ama-Pakwasaya (Kostha).,Sanchara Sthana - Sarva Rasayanis.,Vyakta Sthana - Asthi Dhatu, its Up-Dhatu and Mala. Adhishthana - Asthi Dhatu.,Roga Marga - Madhyama. Roga Prakirti - Chirakari.

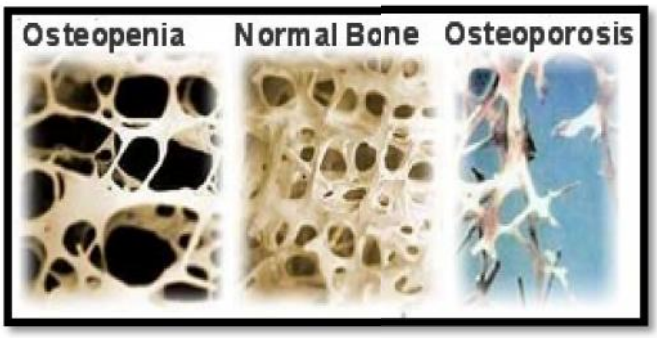
MODERN CONCEPT-

Applied Physiology of bone- Bones are rigid dense form of connective tissue mainly made up of minerals. There are many disorders of the skeleton (bone), the more prominent being are *Osteopenia* **&** Osteoporosis. These two are related diseases but with varying degree of bone loss.

OSTEOPENIA:

Refers to having bone mineral density that is below normal levels but not low enough to be classified as osteoporosis. Bone mineral density is an indication of the level of minerals in the bones which shows their strength and density. The word Osteopenia is comprised of two words Osteo means bone and penia means poverty. So, Osteopenia is a term used to describe low bone density. According to WHO, the reading of T-Score ranges between -1.1 to -2.4. Osteopenia is not a disease, but a term used by the epidemiologists at Mayo Clinic to describe low bone mass. They said that it didn't have any particular diagnostic or therapeutic significance but once being diagnosed with, it requires further monitoring. Preventive measures should be taken since osteoporosis may develop if bone density loss increases. Osteoporosis is defined as bone mineral density 2.5 standard deviation or more below. Osteoporosis is a disease that breaks down the tissue in our bones, making them fragile and more likely to break. If we make a BMD slope, normal would be at top, osteoporosis at the bottom and osteopenia would fall somewhere in between. A study in Journal of American Medical Association in 2001 reported that a 50 year old women with T-Score of -1 has 16% chance of fracturing a hip while with T-Score of -2 has 27% and -2.5 has 33% chances. But there is not a huge difference between say -2.3 and -2.5 although the former would be labelled Osteopenia and the latter Osteoporosis. "The label matters less than the no." These distinctions are to some extent arbitrary lines in the sand. (As published in Harvard Health Letter in 2003). However as one's height and weight varies with genetics, it is believed that bone mass also varies. The thicker one's bones are by about age 30, the longer it takes to develop Osteopenia/ Osteoporosis.

Diagram Showing Comparison between Normal Bone, Osteopenia and Osteoporosis



According to WHO, Osteoporosis is also operationally defined as a bone density that falls 2.5 SD below the mean, or also referred to as a T- score of -2.5. Histologically, it is characterized by a decrease in the number & size of the trabeculae with normal width of the osteoid seams.

Comparison of Spongy Bone Tissue Showing Bone Mass in a Normal Young Adult and the Adult Showing Osteoporosis

NORMAL BONE

OSTEOPOROTIC BONE

EPIDEMIOLOGY: The actual prevalence of osteoporosis is unknown as it is asymptomatic. It is estimated to affect >10 million individuals in USA but only 10 - 20% are diagnosed. It is a global dilemma that is expected to increase in significance with the growing elderly population as bone tissue is progressively lost. It affects both sexes but women are more prone to have osteoporosis due to loss of ovarian function at menopause. Caucasian race (white Americans of Asian origin) is found to be more prone to osteoporosis.

PATHOPHYSIOLOGY: The basic cause behind osteoporosis is that bone resorption outpaces bone formation. Also due to depletion of calcium from the body in urine, sweat etc results in bone loss. Normal age related changes in bone remodeling as well as other extrinsic & intrinsic factors also exaggerate this process. There are major pathogenetic reasons for low bone mass. Each can have genetic and environmental causes-Failure to achieve optimal peak bone mass-To maintains skeletal strength, to repair micro damage within the skeleton, to supply calcium from the skeleton to maintain serum calcium level. This is largely genetically determined but affected by lifestyle. The process of remodeling may be induced by micro damage to the bone.

CLASSIFICATION OF OSTEOPOROSIS: Clinically osteoporosis has been classified into PRIMARY & SECONDARY Osteoporosis. Primary- Involutional
-Post menopausal (Type I), Senile (Type II), Idiopathic. Secondary- Genetic (inheritable disorders of connective tissue), Nutritional, Endocrinal, Iatrogenic (prolonged drug administration), Disorders with associated osteoporosis.

Osteoporosis that is caused or exacerbated by other disorders or medication exposures is referred to as Secondary Osteoporosis.

PRIMARY OSTEOPOROSIS

	Post Menopausal (Type I)	Age- Related (Type II)
Epidemiologic factors		
Age	55 to 75	>70 (F); >80 (M)
Sex Ratio (F/M)	6:1	2:1
Bone Physiology or Metabolism		
Pathogenesis of uncoupling	Increased osteoclastic activity ; resorption	Decreased osteoblast activity ; formation
Net bone loss	Mainly trabecular	Cortical and trabecular
Rate of bone loss	Rapid/ short duration	Slow/ long duration
Bone density	>2 standard deviation below normal	Low normal (adjusted for age and sex)

Clinical Signs		
Fracture sites	Vertebral (crush), distal forearm, hip (intracapsular)	Vertebrae (multiple wedge), proximal humerus and tibia
Other Signs	Tooth loss	Dorsal kyphosis
Laboratory values		
Serum Calcium	Normal	Normal
Serum phosphorus	Normal	Normal
Alkaline phosphatase	Normal (with fracture)	Normal (with fracture)
Urine calcium	Increased	Normal
PTH function	decreased	Increased
Renal conversion of 25(OH)D to 1,25(OH)2D	Secondary decrease due to PTH	Primary decrease due to decreased responsiveness of 1-α-OHase
Gastrointestinal calcium absorption	Decreased	Decreased

Signs & Symptoms- is totally asymptomatic in the initial stage as low bone mass it doesn't cause any symptoms so it is called as 'SILENT THIEF'. Pain (due to fractures), General Debility, Muscular Weakness, Loss of appetite, Constipation, Osteo- Arthritis, Tenderness, Kyphosis and Scoliosis.

Diagnosis- Various bio- chemical markers are available for the diagnosis of osteoporosis but the awareness of people regarding osteoporosis is quite less. Radiological assessment is very much helpful for the diagnosis of Osteoporosis. A couple of years back X-Ray was the only method for the assessment of bone quality and quantity. X-Ray of proximal femur (AP view) was taken to assess Singh's Index (grading Osteoporosis on the trabecular pattern of the proximal end of the femur). But as the biotechnology advanced more sophisticated and accurate methods for measuring Bone Mineral Density have been developed. Bone Mineral Density is a medical term normally referring to the amount of mineral matter per square centimeter of bones. BMD helps predict the risk of a future fracture of the bone, measures the amount of bone mass, and also monitors the effectiveness of treatment. Bone density (or BMD) is used in clinical medicine as an indirect indicator of osteoporosis and fracture risk. It is used to estimate the strength of the bones. Bone mass later in life is determined by the peak bone mass acquired during adolescence and the subsequent rate of bone loss. Low peak bone mass results in a higher risk of osteoporosis. A high peak bone mass provides a larger reserve later in life.

BMD increases during childhood until the peak bone mass are achieved around the age of 18 to 20 years. Thereafter, bone mass stabilizes and then decreases progressively in both men & women after 35 to 40 years of age with a steeper decline in women after the menopause.

Bone Mass & Fracture Risk- BMD is measured by a procedure called Densitometry, often performed in the radiology or nuclear medicine departments of hospitals or clinics. The measurement is painless and non-invasive and involves low radiation exposure. This test is an easy and reliable test that measures the density or thickness of bones. The absolute amount of bone as measured by BMD test generally co-relates with bone strength and its

ability to bear weight. Commonly measurements are made over lumbar spine (at the level of L_1 - L_4) or upper part of hip but forearm may also be scanned. BMD test is a type of non-invasive test as the scan uses ultrasound waves which produce no radiations like X-rays.

Types of B.M.D-While there are many different types of BMD tests, all are non-invasive. Most tests differ in which bones are measured to determine the BMD result. These tests include: Dual-energy X-ray Absorptiometry (DXA or DEXA), Quantitative computed tomography (QCT), Qualitative ultrasound (QUS), Single photon Absorptiometry (SPA), Dual photon Absorptiometry (DPA), Digital X-ray radiogrammetry (DXR), Single energy X-ray Absorptiometry (SEXA).

The test works by measuring a specific bone or bones, usually the spine, hip, and wrist. The density of these bones is then compared with an average index based on age, sex, and size. The resulting comparison is used to determine risk for fractures and the stage of osteoporosis in an individual. DEXA is currently the most widely used, but ultrasound has been described as a more cost-effective approach to measure bone density.

PROCEDURE OF B.M.D- A bone mineral density (BMD) scan is usually done in the special radiology department or clinic by a technologist. For a DEXA Scan, the patient has to lie on their back on a padded table with clothes on. One may need to lie with legs straight or with lower legs resting on a platform built into the table. The machine will scan the bones and measure the amount of radiation they absorb. The DEXA technique scans the hip and lower spine, takes about 20 minutes to perform. Portable machines **(**P-DEXA**)** can measure bone density in the wrist or forearm. These machines are portable units that can be used in a doctor's office. Qualitative Ultrasound is usually done at health fairs like camps. Testing at least two different bones each time is the most reliable way of measuring BMD. It is best to test the same bones and to use the same measurement technique and BMD equipment each time.

CALCULATION OF B.M.D- Bone density is the amount of bone tissue in a certain volume of bone. Bone mineral density (BMD) is a test that measures the amount of calcium in a special region of bones. It helps predict the risk of a future fracture of the bone, measures the amount of bone mass, and also monitors the effectiveness of treatment.

Average BMD of an individual can be calculated as: Average BMD = BMC/W [g/cm^2]

Where BMC= Bone mineral content= Width at the scanned line

Average Bone Mineral Density of a healthy individual is as follows:

In Males- Around 3.88$g/cm^{2,}$ In Females- Around 2.90g/cm^2

DEXA Spine Bone Density- 1000g/cm^2 (*Bonnick, Sydney Lou. Osteoporosis, the Hand Book. Third edition*)

DEXA Spine Bone Density- 1000g/cm^2 - 1200g/cm^2 (*The Skeletal System. Oxford Text Book of Medicine. Third edition, Third volume*). Individuals with a BMD lower than 1.0 g/cm^2 need certain care.

INTERPRETATION OF B.M.D- The results of a bone density test are expressed either as a "T" or a "Z" score.

T-scores represent numbers that compare the condition of your bones with those of an average young person with healthy bones. It is the bone mineral density at the site when compared to the young normal reference mean. It is a comparison of a patient's BMD to that of a healthy thirty-year-old of the same sex and ethnicity.

Z- score instead represent numbers that compare the condition of your bones with those of an average person your age. The Z-score is the comparison to the age-matched normal and is usually used in cases of severe osteoporosis. This is the number of standard deviations a patient's BMD differs from the average BMD of their age, sex, and ethnicity. It is most useful when the score is less than 2 standard deviations below this normal. Of these two numbers, the T-score is usually the most important. T-scores are usually in the negative or minus range. The lower the bone density T-score, the greater is the risk of fracture.

Normal bone density- People with normal bone density have a T-score between +1 and -1. People who have a score in this range do not typically need treatment, but it is useful for them to take steps to prevent bone loss, such as having adequate amounts of calcium and vitamin D and doing weight-bearing exercise.

Low bone mass (osteopenia)- Low bone mass (osteopenia) is the term healthcare providers use to describe bone density that is lower than normal but that has not yet reached the low levels seen with osteoporosis.

People with Osteopenia have a T-score between -1.1 and -2.4. People with low bone mass are usually advised to take steps to prevent osteoporosis. Sometimes that includes taking medications.

SURVEY AREA- AIMS & OBJECTIVES:

To describe the importance of *Asthi Dhatu* in Ayurveda. To examine signs and symptoms of *Asthidhatukshaya* according to *Ayurveda.* To study variation in BMD in cases of *Asthidhatukshaya*. To study physiological variation in BMD according to age.

PLAN OF WORK-

A random survey study. 100 volunteers were chosen randomly to rule out the symptoms of *Asthidhatukshaya*. B.M.D of the volunteers was done by the Qualitative Ultrasound machine.

CRITERIA FOR ASSESSMENT:

INCLUSION CRITERIA:

Patients belonging to both sexes. Patients of age group 31-70 years. Patients with classical signs of *Asthidhatukshaya.*

SUBJECTIVE CRITERIA:

For features of *Asthidhatukshaya* taken are- *Kesha Prapatana* (Falling of hairs),*Danta Bhagna* (Cracking of teeth)**,** *Nakha Bhagna* (Cracking of nails)**,** *Asthi Shoola* (Pain in bones)**,** *Sandhi Shoola* (Pain in joints)**,** *Shrama* (Tiredness).

Most of the signs and symptoms of *Asthidhatukshaya*, described in *Ayurveda*, are subjective in nature and to give results objectively and for statistical analysis, multi-dimensional scoring system was adopted. Score was given according to the severity of symptoms. Absence of symptoms – 0,Mild degree of symp-

toms – 1 ,Moderate degree of symptoms – 2 , Severe degree of symptoms – 3. To assess *Asthidhatukshaya* described in *Ayurveda* and according to the scoring adopted, the volunteers with 0-6 score were found to have *Mild Asthidhatukshaya*, 7-12 score were found to have Moderate *Asthidhatukshaya* and 13-18 score were found to have Severe *Asthidhatukshaya.*

OBJECTIVE CRETERIA:

The objective parameter taken is Bone Mineral Density (B.M.D) test. B.M.D of the volunteers was done by the Qualitative Ultrasound machine 'OSTEO' provided by the Meyer and Canvarzys Pharmaceuticals. The machine measures the bone density of the Calcaneum bone of the right foot and expresses its reading as T-Score.

STATISTICAL ANALYSIS: To reach the final result and conclusion the data that has generated during the study was subjected to statistical analysis. The 'Graphical representations' are applied wherever possible.

OBSERVATIONS AND RESULTS-

The different features observed in individual 100 volunteers who were selected for the clinical observational study were recorded in the proforma after proper history taking, and measuring their Bone mineral density based on inclusion and exclusion criteria. After completion of the study the observations were analyzed, tabulated and presented in the form of graphs as following

Table 1: Showing Total No. Of Male & Female Volunteers

TOTAL No. OF VOLUNTEERS	No. OF MALE VOLUNTEERS	No. OF FEMALE VOLUNTEERS
100	30	70

Table 2: Showing No. Of Volunteers According To Age

Sr.No	AGE GROUP (IN YEARS)	No. OF VOLUNTEERS	%
1.	31 - 40	28	28%
2.	41 - 50	29	29%
3.	51 - 60	24	24%
4.	61 - 70	19	19%

Table 3: Showing No. Of Male And Female Volunteers In Each Age Group

Sr.No	AGE GROUP (IN YEARS)	TOTAL No. OF VOLUNTEERS	No. OF MALE VOLUNTEERS	No. OF FEMALE VOLUNTEERS
1.	31 - 40	28	10	18
2.	41 - 50	29	9	20
3.	51 - 60	24	3	21
4.	61 - 70	19	8	11

Table 4: Showing No. Of Volunteers According To Occupation

Sr.No	Occupation	No. Of Male Volunteers	No. Of Female Volunteers	Total	%
1.	Housewife	0	48	48	48%

2.	Service	9	9	18	18%
3.	Self-Employed	6	6	12	12%
4.	Business	9	7	16	16%
5.	Retired	6	0	6	6%
	Total	30	70	100	100%

Table 5: Showing No. Of Volunteers According To Diet

Sr.No	NATURE OF DIET	No. OF VOLUNTEERS	%
1.	Vegetarian	60	60%
2.	Non- vegetarian	15	15%
3.	Mixed	25	25%

Table 6: Showing No. Of Volunteers According To *Prakriti*

Sr.No	*PRAKRITI*	No. OF VOLUNTEERS	%
1.	*Pitta-Kaphaj*	32	32%
2.	*Pitta-Vataj*	15	15%
3.	*Vata-Pittaj*	38	38%
4.	*Kapha-Pittaj*	12	12%
5.	*Kapha-Vataj*	30	30%
6.	*Vata-Kaphaj*	3	3%

Graph 1: SHOWING FEATURES OF ASTHIDHATUKSHAYA IN VOLUNTEERS

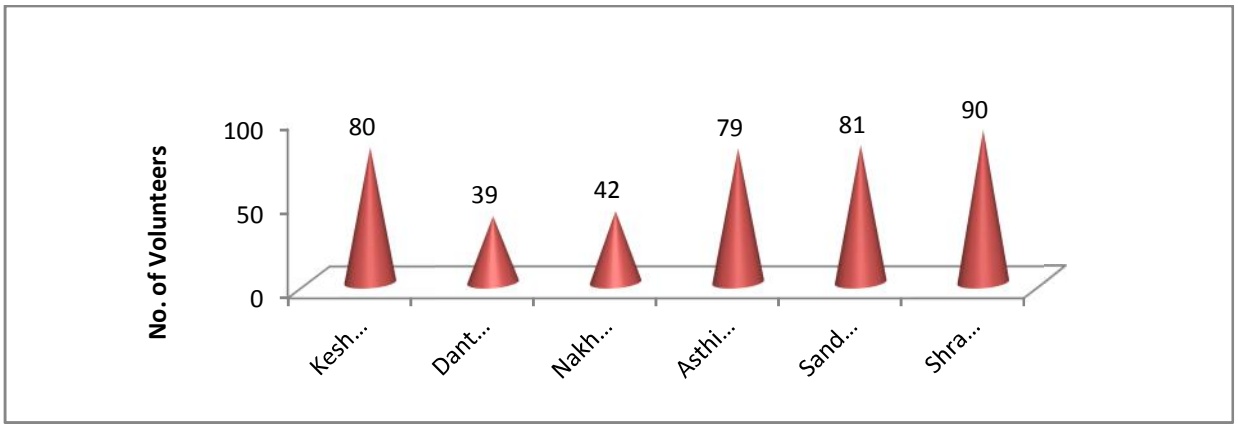


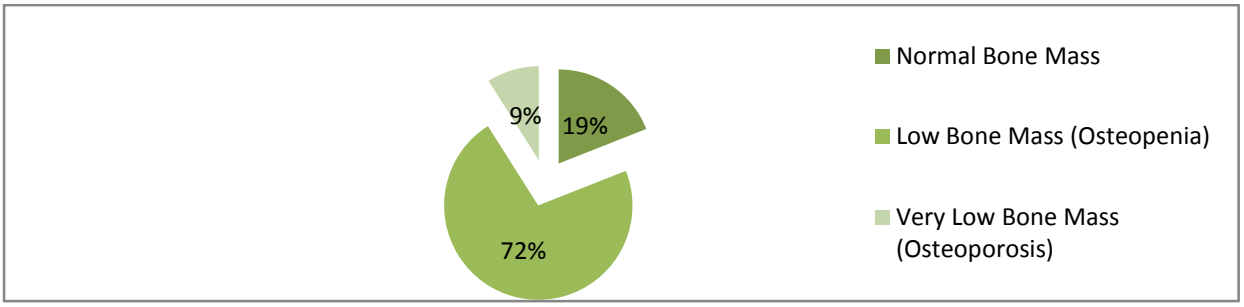
Table 7: Showing Total No. of Volunteers with *Asthidhatukshaya* In Different Age Groups

SR. No	AGE GROUP	NO *ASTHID-HATU KSHAYA*	MILD *ASTHIDHATU KSHAYA*	MODERATE *ASTHID-HATU KSHAYA*	SEVERE *ASTHIDHA-TU KSHAYA*
1.	31-40 Yrs	11	12	5	0
2.	41-50 Yrs	5	10	10	4
3.	51-60 Yrs	3	8	12	1
4.	61-70 Yrs	1	6	8	4

Table 8: Showing Total No. 0f Male and Female Volunteers With Asthidhatukshaya

Sr. No	VOLUNTEERS WITH	TOTAL No. OF VOLUNTEERS	No. OF MALE VOLUNTEERS	No. OF FEMALE VOLUNTEERS
1.	No Asthidhatukshaya	20	9	11
2.	Mild Asthidhatukshaya	36	14	22
3.	Moderate Asthidhatukshaya	35	5	30
4.	Severe Asthidhatukshaya	9	1	8

Graph 2:- SHOWING BONE MASS ACCORDING TO T-SCORE IN VOLUNTEERS-



During the survey study maximum number of volunteers i.e. 72% were found to Osteopenic, 19% were found to have normal bone mass and only 9% were found to have osteoporosis.

DISCUSSION

It is mentioned in *Atharva Veda* that the *Kshaya* of *Asthi* later spreads to the *Mamsa*, causing it to undergo depletion. The term *Asthidhatukshaya* itself denotes that it is formed from two words *Asthi* and Kshaya meaning the depletion of the *Asthi Dhatu*. In modern science the term Osteoporosis is derived from Osteon and Porosis a Greek and Latin word respectively meaning bone tissue and full of pores, respectively. Hence the condition *Asthidhatukshaya* may be co-related with osteoporosis of the modern science. In osteoporosis also there will be decrease in the bone tissue leading to increased susceptibility to fractures. In the present clinical study 100 volunteers were randomly chosen in the B.M.D camps conducted and out of them 9 were found to be osteoporotic but maximum 71 volunteers were found to be Osteopenic and rest 20 were found to have normal bone mass Volunteers with the following symptoms mentioned in classics for *Asthidhatukshaya* were taken.

The study conducted was a **single group Observational study.**

The ratio of incidence of osteoporosis in men to women is 1:4. Hence the higher incidence of *Asthidhatukshaya* /osteoporosis in women is justified.

Age-Here the age group was divided in two four groups, and we find that 28 volunteers (28%) were from the age group 31 to 40, and 29 volunteers (29%) in age group 41-50, 24 volunteers (24%) in age group 51-60 and 19 volunteers (19%) fall in the age group 61-70. Maximum number of volunteers were observed in 40-50 years of age, which is an early *Vata* predominated age.

CONCLUSION

The prevalence of Asthidhatukshaya is more in people aged above 40 years. Peak bone mass is attained by the age of 30 years. Afterwards bone resorption and formation go hand in hand. Approximately at the age of 40 years, bone resorption exceeds formation leading to osteoporosis. Sushruta has called the age of 40 and above as the age of Parihaani. The risk even increases with the onset of menopause which is a physiological transition period of hormonal imbalance. Asthidhatukshaya is more prevalent in the persons with Vata predominant Prakriti, because Vata is the responsible Dosha for Asthidhatukshaya. Among the Vikritis of Asthi Dhatu, Osteoporosis is a progressive systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue with a consequent increase in bone fragility and susceptibility to fractures.

FURTHER SCOPE- this study oversight on bigger sample size so that adequacy of this Ayurvedic point proves its efficacy. If it possible than assessment of bio-chemical markers of Bone density should be done.

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