DHATU SIDDHANTA-
THE THEORY OF TISSUE
FORMATION AND
DIFFERENTIATION
CONTENTS

❑ Background
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❑ Seven tissue elements
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❑ Tissue nutrition
❑ Theories of tissue nutrition
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Health is a dynamic integration of

- Dosha (biological-forces/ bioenergy)
- Dhatu (tissue-systems)
- Mala (metabolic wastes)
- Mind, sensory system and soul
- Bringing equilibrium in dhatu itself is chikitsa

\[ \text{समदोषःसमाग्निश्च समधातुमलक्रियः |} \\
\text{प्रसन्नात्मेग्न्यमिाः स्वस्थ इत्यभिधीयते} \|41|| \\
\text{सूत्रह (Sushrutha)} \]

\[ \text{चतुर्ण भिषगादीनां शस्तानां धातुवैकृते|} \\
\text{प्रवृत्तिर्धातुसाम्यार्थ चिकित्सेत्यभिधीयते|5||} \]
\text{(Charaka)}
ANATOMICAL, PHYSIOLOGICAL AND NUTRITIONAL PERSPECTIVE - DOSHA DHATU MALA MULAM HI SAREERAM

1. Sareera dharanath Dhatavah-
   Dhatavaho deha dharanath
   Supports Anatomical structures of the body

2. Dharana Poshanayor.....dhatu –
   Dadhati-dharayati sareera  samvardhakaan –dhatu
   - Responsible for Nutrition of the body

3. Dadhate va sareera manah prana iti -dhatu
   - Physiology - Dynamic integration and coordination of functions of body systems, mind for the existence of life.
CLASSIFICATION

DHATU

UPA DHATU
SAPTA DHATU - 7 TISSUE ELEMENTS

- Rasa (Plasma, interstitial fluid)
- Rakta (Blood)
- Mamsa (Muscle)
- Meda (Fatty tissue)
- Asthi (Bone)
- Majja (Bone marrow)
- Shukra (Reproductive tissue)
## SAPTA DHATU- PANCHA MAHABHUTA

<table>
<thead>
<tr>
<th>SL.No</th>
<th>Dhatu</th>
<th>Panchamahabhuta</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rasa</td>
<td>Water</td>
</tr>
<tr>
<td>2</td>
<td>Rakta</td>
<td>Fire</td>
</tr>
<tr>
<td>3</td>
<td>Mamsa</td>
<td>Earth</td>
</tr>
<tr>
<td>4</td>
<td>Meda</td>
<td>Water + Earth</td>
</tr>
<tr>
<td>5</td>
<td>Asthi</td>
<td>Earth + Air</td>
</tr>
<tr>
<td>6</td>
<td>Majja</td>
<td>Water</td>
</tr>
<tr>
<td>7</td>
<td>Shukra</td>
<td>Water</td>
</tr>
</tbody>
</table>
CORE FUNCTIONAL ATTRIBUTES OF DHATUS

Rasa – Preenana (Nourishment)

Rakta – Jeevana (enlivening or vitality)

Mamasa- lepana (Overlay or covering)

Meda- Snehana (Lubrication, Unctuousness)

Asthi- dharana (support, retention)

Majja- purana (filling up)

Shukra – Gharba Utapadana (Reproduction)
Physiological concept of digestion and metabolism is based on the concept of Agni - Metabolic fire.

Digestion in stomach & GIT is initiated by major Jatharagni. This can be equated with enzymes, hormones and secretions of digestion.

Nutrition & tissue metabolism is carried out by seven Dhatwagni – at various tissues of body.

Micro-digestion and bio-transformation at cellular, subatomic and elemental levels is carried out by 5 Bhutagni at genetic level.

Therefore from gross to subtle level, digestion, nutrition & metabolism is carried out by 13 types of metabolic fires-Agni.

The status of health and nutrition depends upon the status of Agni.
PRINCIPLE (THEORY) OF TISSUE NUTRITION

KSHEERA DADHI NYAYA
(LAW OF TRANSFORMATION)

- According to this theory poorvadhatus is converted into uttara dhatu as milk is converted into curd, curd into butter & butter into ghrita & ghrita ghrimatanda (upper transparent portion of ghrita).
RASA DHATU
CIRCULATORY FLUID/PLASMA/LYMPH
Etymology and derivation:

- The word ‘rasa’ is derived from the Sanskrit root “ras” having the meaning of taste, to relish, to perceive, to feel, to desire. [Vaidya M.D. (1963): Rasavaha Srotasa Pareeksha, Dept of Kayachikitsa, IPGT &RA, Jamnagar.]

- Rasa is derived from the root ‘gatau’ which means moving. As the nutrient fluid is continuously circulated in our body, it is known as rasa. [Su. Sa. Sutra Sthana 14/13]

Meanings in different contexts

- The word rasa has a wide range of meanings like taste, extract/juice, meat soup, mercury.

- In the context of body components, the terms like ahara rasa, rasa dhatu are described.
Panchabhatika constitution and properties


Formation and metabolism of rasa dhatu

- Rasa dhatu is formed from essence of food (ahara rasa).

- The ingested food is disintegrated into two parts: essence or useful part (prasada) and waste (kitta).

- The prasada is called as essence of food (ahara rasa). This essence is transformed into a nutrient fluid called ‘rasa dhatu’. [Cha. Sa. Sutra Sthana 28/4].

- It is the ultrafine form of ahara rasa. [Su. Sa. Sutra Sthana 14/3]
- The rasa dhatu is further metabolized by rasa dhatvagni. It is divided into two portions. The first portion forms permanent form (sthayi rasa dhatu) for carrying out physiological functions of nourishment and maintenance of the body.

- The second portion called ‘poshaka rasa’ is carried forward to nourish the next dhatu i.e. rakta. [Cha.Sa. Chikitsa Sthana 15/16]

- During the metabolic process, this rasa is transformed into rakta dhatu by action of ranjaka pitta. It acquires a red colour during this process. This metabolism takes place at yakrit (liver) and pliha (spleen). [Su. Sa. Sutra Sthana 14/4]

**metabolic byproducts and waste products(Upadhatu and mala):**

- Breast milk (Stanya) and menstrual blood including ovum (artava) [Cha. Sa.Chikitsa Sthana 15/17].

- Various secretions and discharges are formed in this process as ‘mala roopa kapha’.
Circulation of rasa dhatu

- The rasa dhatu is circulated through twenty-four vessels (dhamani) originating in the cardiac region.

- The upper and lower part of the body is nourished by ten vessels each. The remaining four nourish lateral parts of the body. [Su. Sa. Sutra Sthana 14/3]

Vyanavayu carries out the circulation of rasa dhatu. [Cha.Sa. Chikitsa Sthana 15/36]

Rasavaha srotas:

- Rasavaha srotas is the transport system of circulating rasa all over the body. It originates from the heart and circulates rasa through ten vessels. [Cha. Sa. Vimana Sthana 5/8]

- The same organs and channels form pranavaha srotas (Respiratory pathway). [Su. Sa. Sharira Sthana 9/12].
Role of rasa dhatu in embryogenesis:

- During embryonic life, rasa dhatu is the only source of nutrition. The fetus gets nutrient fluid (rasa dhatu) through this placental circulation.

- Growth and development depend upon nutrition provided by rasa dhatu. This rasa also nourishes the mother's body and carries out lactation. [Cha. Sa. Sharira Sthana 6/23]

- During embryogenesis, it is responsible for the formation and growth of body parts, sustenance of life and nourishment. [Cha. Sa. Sharira Sthana 3/12]
Importance in diagnosis

▪ Causes of vitiation

▪ Excess consumption of heavy to digest, cold, over-unctuous food, overeating and excessive mental stress cause vitiation of rasavaha srotas. [Cha. Sa. Vimana Sthana 5/13]

▪ Abnormal states

<table>
<thead>
<tr>
<th>Symptoms of decrease of rasa dhatu (rasa kshaya)</th>
<th>Symptoms of increase in rasa dhatu(rasa vriddhi)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Degeneration/depletion of other &quot;dhatu&quot;(Dhatu apachaya/ksheenata)</td>
<td>Diminished digestive power(Agnimandya)</td>
</tr>
<tr>
<td>Dryness of mouth(Mukhashosha/rukshata)</td>
<td>Nausea(Utkleshana)</td>
</tr>
<tr>
<td>Dryness or depletion of body mass (Sharirashosha/rukshata)</td>
<td>Salivation (Praseka)</td>
</tr>
<tr>
<td>Emaciation (Karshya)</td>
<td>vomiting(Chchardi)</td>
</tr>
<tr>
<td>Symptom</td>
<td>Description</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Thirst (Trishna)</td>
<td>Lack of enthusiasm to do work (Alasya)</td>
</tr>
<tr>
<td>Feeling of emptiness (Shunya)</td>
<td>Heaviness in body (Gaurava)</td>
</tr>
<tr>
<td>Tiredness (Shrama)</td>
<td>Whitish discoloration of body (Shvaitya)</td>
</tr>
<tr>
<td>Pain in the heart with a feeling that someone is holding and vigorously shaking the heart (Hrudayaghattana)</td>
<td>Looseness in body parts (Angashaithilya)</td>
</tr>
<tr>
<td>Trembling sensation of heart or tachycardia (Hrutkampa)</td>
<td>Dyspnoea (Shwasa)</td>
</tr>
<tr>
<td>Palpitation (Hrutdrava)</td>
<td>Cough (Kasa)</td>
</tr>
<tr>
<td>Cardiac pain (Hrutshola)</td>
<td>Excessive sleep (Atinidrata)</td>
</tr>
<tr>
<td>Fatigue or tiredness even after doing a small work (Shrama/klama)</td>
<td>--</td>
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</tbody>
</table>
Clinical features of vitiation of rasavaha srotas

• Aversion towards food, anorexia, altered sense of taste, nausea, heaviness in the body, drowsiness, body ache, fever, blackouts, anemia, tiredness (angavasada), emaciation, diminished agni. [Cha. Sa. Sutra Sthana 28/9-11]

• In addition to the above features, the following features are observed after injury to rasavaha srotas:
  - Emaciation(Shosha), crying due to pain(akroshana), vertigo(bhramana), bending(vinamana), confusion(mohana), trembling(vepana) and death. [Su. Sa. Sharira Sthana 9/12]
Management of diseases:

- **Conditions including increase in rasa dhatu:**

  - Fasting and other reduction therapies (Langhana) - principle of treatment [Cha. Sa. Sutra Sthana 28/25]

  - In the context of dhatugata jwara, for the management of rasadhatugata jwara, therapeutic emesis (vamana) and fasting (upavasa) are mentioned as the treatment choices. [Cha. Sa. Chikitsa Sthana 3/315]

- **Conditions including decrease in rasa dhatu:**

  - In the conditions like emaciation including tuberculosis (rajayakshma or shosha), nourishment therapy (tarpana) is indicated. The treatment regimen includes a variety of meat soups and juices. [Cha. Sa. Chikitsa Sthana 8/149-172]
In view of modern physiology, the rasa dhatu includes plasma, interstitial fluids and lymph.[1]

The rasa dhatvagni is related to glucose metabolism, circulation in portal vein, the formation of white blood cells.[2]

Some researchers opine that the clinical conditions of an increase in rasa dhatu can be considered as acidosis or hypercalcaemia or chronic liver diseases. Whereas the conditions of decrease in rasa dhatu correlates with alkalosis or hypokalaemia or hypocalcaemia or hyponatremia or hypomagnesemia.[3]

References


RAKTA DHATU
(BLOOD/VASCULAR TISSUE)
Rakta dhatu is a body component similar to blood tissue. Its important function is to give life or maintain vitality (jivana). Body fluid (rasa dhatu) after acquiring ‘red’ color is termed as “rakta” (blood).

The word ‘Rakta’ is derived from Sanskrit root “ranj”, meaning—to dye or colour, to affect or move, to excite/glad/charm/delight.

In general physiology, shonita/rakta denotes blood tissue (rakta dhatu). The term ‘jeevarakta’ denotes fresh blood. [Su. Sa. Sutra Sthana 14/8]
Panchabhautika constitution and properties

- The Rakta dhatu is constituted with the dominance of agni mahabhuta and all other mahabhuta.

- Properties: peculiar smell (vistrata), liquidity (dravata), red color (raga), pulsation (spandanam) and lightness to get circulated (laghuta) due to Prithvi, jala, teja, vayu and akasha mahabhuta are respectively. [Su. Sa. Sutra Sthana 14/9]

- Rakta dhatu is neither too hot nor too cold (anushna-sheeta), sweet (madhura), heavy (guru). It can get affected by the same substances that provoke pitta dosha. [Su. Sa. Sutra Sthana 21/17]
Formation and metabolism of rakta dhatu

- The rakta dhatu is formed from its predecessor rasa dhatu. The nourishing portion of rasa dhatu and constituents of nutrient fluid (ahara rasa) are transformed into rakta dhatu by action of ranjakapitta (type of pitta responsible for colour pigments). [Cha. Sa. Chikitsa Sthana 15/28] This process takes place in liver and spleen. [Su.Sa.Sutra Sthana 14/4-5]

- The pure blood is formed as per the suitable conditions at the place of living, season, and adaptation. [Cha. Sa. Sutra Sthana 24/3]

- Location: रक्तवहे द्वे, तयोर्मूलं यकृत्प्लीहानों रक्तवाहिन्यश्च धमनयः | (Sushruta.sha 9/12)

- The adipose tissue (meda dhatu) present in long and big bones is known as marrow (majja). That present inside the small bones is termed as red marrow (sarakta meda). [Su. Sa. Sharira Sthana 4/13]
Metabolic by products and waste products (Upadhatu and mala)

- Tendons (kandara) and veins (sira) are formed as the metabolic byproducts (upadhatu). [Cha. Sa. Chikitsa Sthana 15/17].

- Various pigments and acidic secretions are formed as waste during this process. These are termed as malarupa pitta. [Cha. Sa. Sutra Sthana 15/5]

Physiological aspects

- Channels of transportation and transformation of rakta dhatu (raktavahasrotas): originates from liver and spleen. [Cha. Sa. Vimana Sthana 5/8]

- From there it gets circulated through arteries (dhamani). [Su. Sa. Sharira Sthana 9/12].

Functions

- Giving life and sustaining vitality (Jeevana), enhancing complexion (varna prasadana), nourishing successor muscle tissue and other components (mamsa dhatu poshana) [Su. Sa. Sutra Sthana 15/5]
Importance in diagnosis

- The formation of blood is affected by following

Dietary causes

- Habitual intake of spoiled or unsuitable food and/or liquids
- overeating
- acidic or pungent liquor and other similar drinks
- too much salty, alkaline substances
- sour and pungent food
- meat of aquatic and marshy animals, burrowing animals
- excessive intake of curd
- sour whey (curd-water), vinegars and other sour fermented liquids
- consuming food with opposite properties
- Frequent indigestion
- taking meal during indigestion
Environmental factors

Due to natural conditions in autumn season.

[Cha. Sa. Sutra Sthana 24/5-10]

Lifestyle factor

- excessive sleeping during the day especially after taking liquids, unctuous and heavy food
- excessive anger
- excessive exposure to the sun and the wind
- suppression of the natural urges like vomiting
- avoidance of blood-letting in prescribed time (autumn)
- too much exertion, Injury, heat
Abnormal states

□ Clinical features of decrease

□ Symptoms of decrease of rakta are roughness of skin, cracks, dullness, and dryness of skin. [Cha. Sa. Sutra Sthana 17/65]. In addition, craving for sour food, liking for cold substances, looseness of blood vessels is also observed. [Su. Sa. Sutra Sthana 15/9].

□ Clinical features of increase

□ Reddish discolouration of eyes and other body parts and fullness of veins are considered as the signs of increase of rakta dhatu. [Su. Sa. Sutra Sthana 15/10].

Diseases due to vitiation of Rakta and Raktavaha srotas

□ Skin diseases

□ Inflammatory conditions

□ Bleeding disorders
**Principles of management of diseases of rakta dhatu:** [Cha. Sa.Sutra Sthana 24/18].

- Excessive vitiation of rakta dhatu, in patients with good strength - therapeutic purgation (virechana), bloodletting (rakta mokshana)

- Mild to moderate severity of disease and in patients with low strength, pacification therapies (shamana) - therapeutic fasting (upavasa) and management on the lines of bleeding disorders (raktapitta).

- In case of hyperpyrexia (jwara), the dosha located in rakta dhatu are treated with pouring of medicated liquids (seka) and ointment application (pradeha). [Cha. Sa. Chikitsa Sthana 3/316].

- In case of poisoning, the spread of toxins is arrested by applying cooling external application (pradeha and alepa) and pouring medicated liquids (seka). [Cha. Sa. Chikitsa Sthana 23/42-43] It shows pacifying actions on vitiated rakta and pitta. [Su. Sa. Sutra Sthana 18/3]
### Physiological effect of various tastes on blood [Cha. Sa. Sutra Sthana 26/43]

<table>
<thead>
<tr>
<th>Rasa (taste)</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sour (amla rasa)</td>
<td>Vitiates blood (raktam dushayati)</td>
</tr>
<tr>
<td>Salty (lavana rasa)</td>
<td>Increases volume (raktam vardhayati)</td>
</tr>
<tr>
<td>Pungent (katurasa)</td>
<td>Breaks the blood clots/anti-coagulant (shonitasanghatam bhinatti)</td>
</tr>
<tr>
<td>Bitter (tiktarasa)</td>
<td>Depletes the quantity of blood by absorbing fluid portion (raktam shoshayati)</td>
</tr>
<tr>
<td>Astringent (kasha rasa)</td>
<td>Pacifies vitiated blood (Raktaprabhama)</td>
</tr>
</tbody>
</table>

- E.g. Sour substances are known to vitiate blood, hence the patients with disorders due to vitiation of blood are advised to avoid sour substance. Instead, they are advised to consume bitter and astringent substances. The substances with pungent taste can be used to prevent coagulation.
MAMSA DHATU-
MUSCLE TISSUE
- Mamsa literally means flesh or meat. "Mamsa dhatu" is a body component that denotes muscular tissue.

- As the name suggests, it is a bulky tissue and denotes the status of nutrition. Due to its solid-state, it provides proper size, shape and dimension to the body.

**Fundamental constitution (panchabhautika sanghatana) and properties**

- Vayu, jala and agni mahabhuta play major role in the formation of "mamsa". [Cha. Sa. Chikitsa Sthana 15/29] After formation, it has predominance of prithvi mahabhuta.

- The physical properties of "mamsa dhatu" are bulkiness (sthula), stable (sthira), heavy (guru), rough (khara), hard (kathina) and smooth (shlakshna). [Dwarkanath C. Introduction to Kayachikitsa. Chaukembha Orientalia. Varanasi; 1996. Third edition.pg.322]
Metabolism and Development

- The mamsa dhatu is formed from its predecessor blood (rakta dhatu). The nourishing portion of blood (rakta dhatu) and constituents of nutrient fluid (ahara rasa) are transformed into mamsa dhatu by action of factors responsible for its metabolism (mamsa dhatvagni), vayu, jala and tejas mahabhuta. [Cha. Sa. Chikitsa Sthana 15/29]

- It gets solid fleshy bulk due to prithvi mahabhuta. This mamsa dhatu is differentiated later into ligaments (snayu) during fetal development. [Ka. Sa. Sharira Sthana 2/2]

- The development of mamsa dhatu is enhanced by anabolism in the fifth month of gestation. [Cha. Sa. Sharira Sthana 4/21]
Metabolic byproducts and waste products (Upadhatu and mala)

- During the process of metabolism and development of mamsa dhatu, muscle fat (vasa) and six layers of skin (tvacha) are formed as the metabolic byproducts (upadhatu). [Cha. Sa. Chikitsa Sthana 15/17]

- Various secretions in ear and nostrils are waste products of metabolism of mamsa dhatu. [Cha.Sa. Sutra Sthana 15/18]

Functions

- Covering and protection (Lepana)

- Providing strength to the body and nourishment to its successor adipose tissue (meda dhatu) are additional functions. [Su. Sa. Sutra Sthana 15/5].

- Provides support for various movements and protection to the inner organs.

- sustaining the strength of the body (bala) to perform physical activities.
Assessment

- Examination of mamsa dhatu – flexion (akunchana), extension (prasarana), abduction (utkshepana), adduction (apakshepana) circumduction (chakra gati). Vyana vata is responsible for carrying out this function. [Cha.Sa.Chikitsa Sthana 28/9]

- Mamsa dhatu is known for its pure quality of stability (sthirata)- Muscle tone

Causes of vitiation

- Dietary causes

  Excessive consumption of food that increases secretions and causes obstruction (abhishyandi), bulkiness, heaviness after digestion

- Lifestyle causes

  Day time sleep
### Action of different rasa(tastes) on mamsadhatu  [Cha. Sa. Sutra Sthana 26/43]

<table>
<thead>
<tr>
<th>Rasa</th>
<th>Action on mamsa dhatu</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sweet (madhura)-proportionate use</td>
<td>Promotes growth (mamsa vardhana)</td>
</tr>
<tr>
<td>Sour (amla)-excess use</td>
<td>Causes inflammation (mamsam vidahati)</td>
</tr>
<tr>
<td>Salty(lavana)- excess use</td>
<td>Causes sloughing (mamsam kushnati)</td>
</tr>
<tr>
<td>Pungent (katu)-excess use</td>
<td>Scraping (mamsam vilikhati), reduces bulk of muscles</td>
</tr>
<tr>
<td>Bitter (tikta)-excess use</td>
<td>Absorbs moisture (mamsam shoshayati), reduces the elasticity of muscles</td>
</tr>
</tbody>
</table>
**Abnormal states**

**Signs of decrease**

- Decrease in circumference and skinfold thickness of hips, neck and belly due to loss of the muscle mass and wasting of buttocks, cheeks, thighs, chest, axillae, calves

- Dryness, Pricking pain, Debility, Fatigue

- Decreased tone of blood vessels especially in the arterial walls [Cha. Sa. Sutra Sthana 17/65]

**Signs of increase**

- Increase in circumference and skinfold thickness of buttocks, cheeks, lips, penis, thighs, arms and calves

- Heaviness of the body

- Extra muscular growth or Hypertrophied musculature [Su.Sa.Sutra Sthana 15/9,24]
Clinical features of vitiation of channels of transport and transformation of mamsa dhatu- Granuloma or polyps (adhimamsa), tumorous growth or myoma (arbuda), piles, goiter etc.

The disorders of mamsa dhatu should be treated with purification (shodhana), surgery (shastra) , application of alkali (kshara) and cauterization (agni karma)

[Cha. Sa. Sutra Sthana 28/26]

In fever (jwara) affecting mamsa and meda dhatu, therapeutic purgation (virechana) and fasting (upavasa). [Cha. Sa. Chikitsa Sthana 3/316]

When vata gets occluded by mamsa and meda dhatu, purgation, evacuative enema and palliative measures should be administered. [Cha. Sa. Chikitsa Sthana 28/93]

Dietary modifications, vyayama (exercise)
MEDO DHATU-ADIPPOSE TISSUE
Meda dhatu is the body component which indicates fat in general and adipose tissue. Its important function is to oleate or lubricate (snehana).

The word "meda" is derived from Sanskrit root medas[meda-asun]. It means to lubricate or oleate or to provide unctuousness.

**Panchabhattika constitution and properties**

- Meda dhatu has dominance of prithvi, jala and agni mahabhuta.
- It possesses properties like unctuousness (snigdha) and heaviness(guru).

**Physiological aspects**

- Formation and metabolism

  Meda dhatu is formed from the unctuous portion of mamsa dhatu by action of factors responsible for metabolism of meda(medadhatvagni). [Cha. Sa Chikitsa Sthana 15/29-30]
Forms of meda dhatu:

1. **Structural component (poshya meda dhatu):** It is the form, that is stored in the layer of meda (medodhara kala).

   - It is also called fixed or stored fat (baddha medas).

   - This portion is located mainly in the omentum and responsible for the nutrition of meda dhatu itself in case of starvation.

2. **Circulating component (poshaka meda dhatu):**

   - This form is circulated with nutrient fluid or plasma (rasa dhatu) and blood (rakta).
     
     - It is free and unbound (abaddha medas).

   - This provides lubrication and unctuousness wherever needed. This form is vitiated in the pathogenesis of obstinate urinary disorders including diabetes (prameha)

[Cha.Sa.Nidana Sthana 4/7]

- Origin: Pelvic region, Kidneys and Omentum

Functions

- Meda dhatu is responsible for functions of lubrication (sneha), sweating (sweda), stability (dridhatwam), and nourishment of bone tissue (asthipushti). [Su. Sa. Sutra Sthana 15/5]

Importance in diagnosis: Causes of vitiation

- sedentary lifestyle including lack of physical exercise, daytime sleep, excessive consumption of fatty food, and alcoholic drinks. [Cha. Sa. Vimana Sthana 5/16]
Abnormal states

Decrease: cracking sound in the joints, lassitude in eyes, exhaustion, decreased abdominal girth or thinning, splenomegaly, feeling of emptiness in joints. dryness and craving for fatty food and meat. [Cha. Sa. Sutra Sthana 17/66], [Su. Sa. Sutra Sthana 15/9]

Increase: excessive unctuousness of body, increased abdominal girth (abdominal obesity), increased size of flanks, cough, dyspnoea and bad body odour. [Su. Sa. Sutra Sthana 15/14]

Diseases: Madhumeha (diabetes mellitus), Obesity

Management: Nourishing therapy (brimhana) and oleation therapy (snehana) - decrease of meda dhatu.

Drying therapy (rukshana) and scraping therapy (lekhana) - increase in meda dhatu.

[Cha.Sa.Sutra Sthana22]
Diseases due to vitiation of medadhatu [Cha. Sa. Sutra Sthana 21/21-22]

▪ Food and drinks that alleviate vata dosha and reduce kapha dosha and meda dhatu (fat),

▪ Therapeutic enema processed with drugs of sharply acting, dry and hot properties,

▪ Dry powder massage (udwartana)

Current research

▪ An observational study assessing the qualities of excellence of medadhatu(sarata) in 60 individuals showed significantly positive relationship with values of lipids. The data showed that persons showing excellent qualities of meda dhatu have normal to high values of HDL (high-density lipoproteins), comparatively low values of LDL (low-density lipoproteins), and serum cholesterol. [Ankush Gunjal (2013) : A Clinico-experimental Study on Triphaladi Granules in Apathya Nimittaja Prameha (Type 2 Diabetes mellitus), Department of Kayachikitsa, I.P.G.T. & R. A., Jamnagar.]
ASTHI DHATU-
BONE TISSUE
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 extract (sara) of the body which remains even after the destruction of all other body components. [Su.Sa.Sharira Sthana 5/21-22]

- Fundamental constitution of asthi dhatu shows predominance of Prithvi mahabhuta.

- The physical properties of "asthi dhatu" are heaviness (guru), roughness (khara), hardness (kathina), bulkiness (sthula), static (sthira), with a definite physical form (murtimanta).
Metabolism and Development

- The asthi dhatu is formed from its predecessor adipose tissue (meda dhatu). The nourishing portion of adipose tissue (meda dhatu) and constituents of nutrient fluid (ahara rasa) are transformed into asthi dhatu by action of factors responsible for its metabolism (asthi dhatvagni).

- Agni mahabhuta and vayu mahabhuta play a major role in the solidification and roughness of asthi by acting upon prithvi mahabhuta components of adipose tissue (meda dhatu). [Cha. Sa. Chikitsa Sthana 15/30]

- Porosity in bones are due to actions of vayu and akasha mahabhuta. [Cha. Sa. Chikitsa Sthana 15/30]

Metabolic by products and waste products (Upadhatu and mala)

- Teeth and nails (nakha) [Su. Sa. Sutra Sthana 46/529]

- Scalp hair (kesha) and body hair(loma) [Cha.Sa. Sutra Sthana 15/18]
Functions

▪ The important function of asthi dhatu is providing structure and support to the body. It also nourishes the successor bone marrow tissue (majja dhatu). [Su. Sa. Sutra Sthana 15/5]

▪ **Causes of vitiation of asthi dhatu (asthivahasrotas)** [Cha. Sa. Vimana Sthana 5/17]

▪ The following are causative factors for the vitiation of channels for transport and transformation

  Dietary causes

▪ Excessive consumption of food that aggravates vatadosha. This includes the dietary items which possess properties like light to digest (laghu), dry (ruksha), cold (sheeta), rough (khara), highly penetrating or subtle (sukshma), mobile (chala).

▪ Lifestyle causes like Excessive physical exercise

▪ Excessive jerks to the body or jerky movements

▪ Excessive pressure on bones.
Abnormal states

▪ Signs of decrease
loss of scalp and body-hair, beard, nails and teeth
fatigue
loose joints
pain in bones
dryness
breaking of teeth and nails


▪ Signs of increase
extra tooth and bony growth [Su. Sa. Sutra Sthana 15/14]
Clinical features of vitiation of channels of transport and transformation on asthi dhatu

The features of the vitiation of asthi dhatu are visible on teeth (danta), hairs (kesha) and nails (nakha). Extra growth of bones (adhyasthi) and teeth (adhidanta), splitting (bheda) and severe pain in teeth and bones (shula), discoloration (vivarnata), abnormalities of body hair (kesha), nail (nakha) and beard (shmarshru). [Cha. Sa. Sutra Sthana 28/16]

Fracture of bone

- Constant and severe pain
- Discomfort in any posture or position
- Weakness
- Swelling [Su. Sa. Sutra Sthana 25/39]
Therapeutic and conservative management

- The disorders of asthi dhatu are treated with panchakarma, especially enema prepared with bitter drugs, milk, and ghee (tiktaksheerabasti). [Cha. Sa. Sutra Sthana 28/27]

- The qualitative and quantitative decrease in bone tissue is managed by the supplements having similar properties. E.g. the calcinated powder of eggshell (kukkutandatwakbhasma), calcinated powder of goat bones (ajasthibhasma), coral (pravalbhasma), Mukta bhasms (Pearl).

- Surgical management
<table>
<thead>
<tr>
<th>Concept of Asthi dhatu</th>
<th>Bone tissue</th>
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</thead>
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<tr>
<td>Role of Prithvi mahabhuta in asthi dhatu</td>
<td>Minerals including inorganic salts like calcium phosphate and calcium sulphate make the matrix more dense</td>
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<tr>
<td>Role of adipose tissue (meda dhatu)</td>
<td>Marrow adipose tissue (MAT) is stored in bones.</td>
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<tr>
<td>Composition of Asthi dhatu</td>
<td>Support cells, namely, osteoblasts and osteocytes; Remodeling cells, namely, osteoclasts; Non-mineral matrix of collagen and noncollagenous proteins called osteoid, with inorganic mineral salts deposited within matrix</td>
</tr>
<tr>
<td>Factors responsible for transformation and metabolism of bone (asthi dhatu agni)</td>
<td>Factors responsible for skeletal metabolism: Calcitropichormones, Parathyroid hormone (PTH), Calcitonin (CT), Vitamin D ([1,25(OH_2)D]), PTHrP, other hormones, gonadal and adrenal steroids, Thyroid hormones, Growth factors and cytokines</td>
</tr>
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<tr>
<td>Formation of asthi dhatu</td>
<td>Processes of bone formation, bone resorption and remodeling</td>
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<td>The factors responsible for skeletal metabolism are responsible for longitudinal and radial growth of bone up to the age of skeletal maturity (18 to 25 years)</td>
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<td>Disorders of channels of transport and transformation on asthi dhatu – extra growth of bones</td>
<td>osteoma, osteoid osteoma, osteochondroma, osteoblastoma, enchondroma, giant cell tumor of bone, aneurysmal bone cyst, leukemia</td>
</tr>
</tbody>
</table>
MAJJA DHATU - BONE MARROW
- Majja literally means the marrow. Majja dhatu is the body component similar to bone marrow, the soft organic material that fills the cavities of the bones.

- Panchabhautika constitution and properties: There is a predominance of jala mahabhuta, It possesses unctuous (snigdha) and soft (mridu) properties.

**Formation and metabolism of majja dhatu**

- During metabolism, vata dosha produces hollowness inside the asthi dhatu. These hollow cavities are filled by adipose tissue (meda dhatu) which in turn called as Majja dhatu. [Cha. Sa. Chikitsa Sthana 15/31-33]
**Functions**

- Providing unctuousness (snehana), strength (bala), filling of bone cavity (asthi poorana) and nourishment of its successor shukra dhatu (shukra pushti).  
  [Su. Sa. Sutra Sthana 15/5]

**Causes of vitiation**  
[Cha. Sa. Vimana Sthana 5/18]

Dietary causes: Excess and frequent consumption of incompatible food (viruddha ahara)

Exogenous causes

- crushing injury

- excessive discharge causing pressure

- trauma

- compression
Abnormal states

Signs of decrease

▪ atrophy of bone tissues
▪ weakness/giddiness
▪ lightness of bones (porosity of bones or decreased bone density)
▪ susceptibility to vata dominant disorders / frequent vata disorders
▪ depletion of semen formation
▪ pain in bones and joints
▪ constant dull pain and emptiness of bones
▪ dimness of vision


Signs of increase

▪ heaviness in eyes
▪ heaviness in entire body
▪ formation of carbuncles/ with broad base on joints/synapses which are difficult to cure

Principles of management of diseases

▪ The diseases of vitiation of Majja dhatu - food and medicines having sweet and bitter taste.

▪ Exercise and body purification treatments in proper dose and time are also indicated. [Cha. Sa. Sutra Sthana 28/28]

▪ When the doshas causing fever (jwara) are in bone tissue (asthi dhatu) and marrow(majja dhatu), decoction enema (niruha basti) and unctuous enema (anuvasana basti) are indicated. [Cha. Sa. Chikitsa Sthana 3/317]

▪ The diseases due to aggravation of vata - medicated ghee, oil, muscle fat, and bone marrow obtained from animal bones are used either as oral administration, enema or external applications like massage. [Cha. Sa. Chikitsa Sthana 3/317]

▪ Internal administration of animal bone marrow(majja)
SHUKRA DHATU-REPRODUCTIVE TISSUE
Shukra literally means semen, sperm, lucid or clear.

In human physiology, Shukra dhatu is a body component having reproductive capacity. It is generally equated with semen.

Shukra dhatu is described to be of two forms in Ayurveda:

One is responsible for fertilization of ovum and thus embryogenesis.

Second one is formed from predecessor, the tissue that fills the bony cavities (majja dhatu). This in turn circulates all over the body both in males and females.

Reproduction is the function of this second form of shukra too.

Therefore, it seems that the first form of shukra stands for the semen in general: and, the second form of shukra stands for hypothalamic-pituitary-gonadal axis, hormones that circulate all over the body.
· Shukra is constituted by four elements-vayu, agni, prithvi and jala(four mahabhuta) in equal proportion. [Cha.Sa.Sharira Sthana 2/4]

**Formation and metabolism of shukra dhatu**

· During metabolism, the unctuous part of predecessor majja dhatu is transformed into shukra dhatu. The marrow is present in bones. Minute pores are created on bone by the action of vayu and akasha mahabhuta.

· The shukra dhatu oozes out from these minute pores after action of factors responsible for the metabolism of shukra dhatu (shukra dhatu agni).

· The second form is present in testicles.
Causes of vitiation [Cha. Sa. Vimana Sthana 5/19]

Dietary causes

▪ Consumption of incompatible food, excessive consumption of dry, bitter, astringent, salty, sour, hot food.

Psychological causes

▪ Anxiety, distress, distrust, apprehension, rage

▪ Excessive or complete abstinence from sexual activity

Other causes

▪ Excess exercise, senility, emaciation due to other diseases, suppression of natural urges and injury [Cha. Sa. Chikitsa Sthana 30/139]
Abnormal states

- Symptoms of increase and decrease of shukra dhatu

Principles of management

- Virility enhancing food and drinks which promote strength and semen are beneficial. Therapeutic purgation (virechana) is indicated in the case of obstruction in the passage of semen. [Cha. Sa. Chikitsa Sthana 28/94]

- Aphrodisiac therapies (vajikarana)

- The medicines pacifying bleeding disorders (rakta-pittahara) and those indicated in the management of disorders of the female genital tract (yoni vayapat) are prescribed in vitiation of shukra dhatu.

- Ghee (sarpi), milk (payas), meat soup (mamsarasa), shali rice, barley (yava), shashtika rice, and especially therapeutic enema (basti karma) are advised in the disorders of semen. [Cha. Sa. Chikitsa Sthana 30/152]
The aim of Ayurveda is to bring equilibrium of dhatus and thus maintaining health.

- To understand the pathogenesis of a disease.
- Diagnosis through Ayurveda
- To select the specific treatment procedure

THANK YOU