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**RESEARCH ARTICLE**

# REVIEW ARTICLE ON HYPERCHOLESTEROLEMIA (MEDOROGA) IN AYURVEDA AND ITS MANAGEMENT

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**ABSTRACT**

Cholesterol is an important building block in the formation and repair of cell walls, function of nerve tissue, and the production of hormones such as testosterone, estrogen, and the stress hormone, cortisol. It is important to understand that fat tissue (cholesterol) in itself is not bad, and is actually essential for the body to function properly. The mixing of ama with fat tissue is the main cause of imbalanced cholesterol as per Ayurveda. When meda dhatu mixes with ama, it changes the quality of fat tissue and the quality of cholesterol, making it unhealthy rather than healthy. High cholesterol raises our risk for heart disease, heart attack. In Ayurvedic perspective, the production of cholesterol does not necessarily need to be lessened, but it needs to be balanced. When the digestion is balanced and healthy, then the body produces .the right amount of cholesterol, in the right proportion to nourish the body. Balanced diet, proper lifestyles, exercise, yoga, balanced Agni (digestion & metabolism) play important role in prevention of hypercholesterolemia.



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## INTRODUCTION

Cholesterol is one of many lipids found throughout the body. Cholesterol is an important building block in the formation and repair of cell walls, function of nerve tissue, and the production of hormones such as testosterone, estrogen, and the stress hormone, cortisol. Cholesterol is a waxy steroid metabolite found in the cell membranes and transported in the blood plasma of all animals. The majority of cholesterol identified in our bloodstream is not from our diet, but instead produced in our own liver. The liver produces approximately 3000 mg of cholesterol in a 24 hour period which is more than enough for the average person. What we consume is simply "extra." Once produced within the liver, cholesterol circulates within the blood stream and combines with proteins to form lipoproteins. Hypercholesterolemia, or high cholesterol, occurs when there is too much cholesterol in the body. High cholesterol raises our risk for heart disease, heart attack, and stroke. When there is too much cholesterol circulating in the blood, it can create sticky deposits (called plaque) along the artery walls. Plaque can eventually narrow or block the flow of blood to the brain, heart, and other organs.

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Blood cells that get caught on the plaque form clots, which can break, loose and completely block blood flow through an artery, causing heart attack. It is important to understand that cholesterol is not mentioned in the Ayurvedic tradition. Rather, the Ayurvedic texts discuss Meda Dhatu (lipid tissue) and explain how to maintain healthy quantity and quality of fat tissue in the body. When Meda Dhatu is balanced and healthy, that subsequently helps to maintain balanced cholesterol. The mixing of Ama with fat tissue is the main cause of imbalanced cholesterol as per Ayurveda. When Meda Dhatu mixes with Ama it changes the quality of fat tissue and the quality of cholesterol, making it unhealthy rather than healthy. It is important to understand that fat tissue (cholesterol) in itself is not bad, and is actually essential for the body to function properly.

## MATERIALS AND METHODS

Cholesterol is required to build and maintain membranes. About 20–25% of total daily cholesterol production occurs in the liver. Other sites of high synthesis rates include the intestines, adrenal glands, and reproductive organs. It regulates membrane fluidity over the range of physiological temperatures.

Cholesterol reduces the permeability of the plasma membrane to protons (positive hydrogen ions) and sodium ions. Within the cell membrane, cholesterol also functions in intracellular transport, cell signalling and nerve conduction. Within cells, cholesterol is the precursor molecule in several biochemical pathways. In the liver, cholesterol is converted to bile, which is then stored in the gallbladder. Bile contains bile salts, which solubilise fats in the digestive tract and aid in the intestinal absorption of fat molecules as well as the fat-soluble vitamins, Vitamin A, Vitamin D, Vitamin E, and Vitamin K. Cholesterol is an important precursor molecule for the synthesis of Vitamin D and the steroid hormones, including the adrenal gland hormones cortisol and aldosterone as well as the sex hormones progesterone, estrogens, and testosterone, and their derivatives. Some research indicates that cholesterol may act as an antioxidant According to the lipid hypothesis, abnormally high cholesterol levels (hypercholesterolemia); that is, higher concentrations of LDL and lower concentrations of functional HDL are strongly associated with cardiovascular disease because these promote atheroma development in arteries (atherosclerosis). This disease process leads to myocardial infarction (heart attack), stroke, and peripheral vascular disease. LDL particles are often termed "bad cholesterol" because they have been linked to atheroma formation. On the other hand, high concentrations of functional HDL, which can remove cholesterol from cells and atheroma offer protection and are sometimes referred to as "good cholesterol". These balances are mostly genetically determined but can be changed by body build, medications, food choices, and other factors. The report of National Cholesterol Education Program, Adult Treatment Panel suggests that the total blood cholesterol level should be: < 200 mg/dL normal blood cholesterol, 200– 239 mg/dL borderline-high, > 240 mg/dl high cholesterol.

**Concept of Cholesterol in Ayurveda:** Meda is defined as the one which performs the function of *Snehana.* It is a specific type of *Dhatu* originated from *Mamsa Dhatu*[i].The *Sthana* of *Medo Dhatu* is *Vapavahan* and the site of accumulation of *Meda Dhatu* in abdominal cavity, which is also known as *Tailavartika*.[ii] In Other Word *Vasa* are the fat content of the *Mamsa Dhatu* and that are qualitatively similar to *Medodhatu* so that it is understood that Compositions of *Medo Dhatu are Prithvi* and *Apa Malabutas.* So *Medo Dhatu* is *Atisnigdha, Guru, Picchila, Mridu, Sandra* and *shweta.* The total quantity of *Medo Dhatu* is *2 Anjali* and that of *Vasa* is 3 *Anjali*.[iii]

**Karma of Medo Dhatu**

***Snehana:*** *Sneha* quality helps to maintain the lustre of skin, eyes, hairs and various body organs.

***Sweda****: Sweda* is *Mala* of *Medo Dhatu* is a by-product of the catabolism of the later.

***Asthi Pushti:*** Another function of *Medo Dhatu* is nourishments of subsequent *Dhatu* i.e. *Asthi* and its *Upadhatu* and *Sandhi*. It lubricates the *Asthi* and *Sandhi* thus minimizing their friction.

***Dridhattva*****:** *Medo Dhatu* provides strength to the body this can be understood as the visceral fat cushions the organs protecting them from any trauma, *Snauyu* the *Upadhatu* of *Medo* provides support to *Asthi* and S*andhi.*

***Poshya Medo Dhatu* and *Poshaka Medo Dhatu*:**

*Poshaka Medodhatu* is *Asthy*i in nature, which is circulating in the whole body along with *Rasa, Rakta, dhatu* to give the nourishment to *Poshya Medodhatu*, the *Sthai* or *Poshya Medodhatu* is derived from the *Poshaka Medo Dhatu* by the action of *Medodatvagni*, it is immobile in nature and is stored in the *Medodharakala*, situated in *Udara* and *Anuasthi.*[iv] *Sphika, Stana and Udara* is also sites of deposition of *Medo Dhatu* as seen in *Atisthoulya.*[v] It is also found that central abdominal fat and visceral fat are more metabolically important than other fat depots being strongly associated with insulin resistance and Hypercholesterolemia.[vi] The capillaries of the perinepheric tissue and Omentum are considered as *Medovaha Srotas*.[vii]

***Medovaha srotas:*** *Srotas*(channels) which provide nutrition to the *Medo Dhatu*, by carrying nutrient material up to the site of *Medo Dhatu* can be consider as *Medovaha srotas*, these *Srotas* carry only *Asthayi Medo Dhatu* which is to undergo transformation to form the *Sthay*i *Medo Dhatu*. The channels through which nutrition to the adipose tissue is transported are to be named as *Medovaha Srotas*.[viii]

***Moola* of *Medovah Srotas:*** The word *Moola* is explained by *chakarpani* as the site of origin, *Srotomoola* as the organs which may be directly related to the formation,origin or circulation of *Dhatus,* the *Moola* of *Medovaha srotas* must related to the structures which serve as important sites related to *Medo Dhatu.*

*Charaka - Vrikka* and *Vapavahana*[ix]
*Sushruta -Vrikka* and *Kati*[x]
*Vagbhata -Vrikka* and *Mamsa*[xi]

***Vrikka*:** *Vrikka* which formed by *Prasad Bhaga* of *Rakta and Medas*, which are two in number are one of the *Koshtangas*.[xii] *Vrikka* corresponds to the Kidneys according to the Modern sciences. *Vrikka* provides nourishment to the *Medo Dhatu* present in the abdominal region[xiii]. All *Acharyas* consider *Vrikka* is *Moola* of *Medovah Srotas*; it may be relation with fat metabolism. The peri-renal fat is never known to under emaciation even after several days of fast and is it is known to be lipolysed only on severe corollary in the body which may be one of reason to consider *Vrikka* as a *Moola Sthana*.[xiv] High BMI found in obesity is a common, strong and potentially modifiable risk factor in end stage renal disease.[xv] By such study we can say that there may be relation with kidney and fat.

***Vapavahana:*** *Vapavahana* is present in the abdominal cavity[xvi], it is one among the *Koshtanga.* It is correlated with Omentum, where the maximum fat is stored. *Bhavamishra* has said that most of the fat deposition occurs in the abdominal region[xvii].

***Kati:*** Maximum fat is accumulated at *Kati Pradesh*, hence it may be consider as *Moola* of *Medovaha Srotas.*

***Mamsa:*** *Masma Dhatu* is *Poshak* of *Medo Dhatu* so that *Mamsa Dhatu* serves as Prerequisite for *Medo Dhatu* formation.

**Pathophysiology of *Medo Dhatu:*** For the formation of *Dhatu* four factors are essential viz., *Jatharagni, Bhutagni, Vayu*, and *Srotas.*

**Table No.1 Ahara and Aushada Rupi Pathya in Medoroga**

| Sr. No. | *Ahara & Aushadha* | *Pathya* | *Apathya* |
|---|---|---|---|
| 1 | *Shukadhanya* | *Shyamaka, Kodrava, Yava*<br>*Kanga, Kodrava, Shyamaka* | *Shali, Shashtika, Vrihi, Godhuma, Yavaka* |
| 2 | *Shamidhanya* | *Mudga, Rajamasha, Kulattha, Chanaka, Masura, Adhak*<br>*Masura, Nishpava* | *Masha, Makushta, Tila, Shimbhi, Atmagupta, Uma ,Priyangu* |
| 3 | *Mamsa Varga* | *Vishkira, Vartika, Lava* | *1.Prasaha- go, ushtra, vanara, Babhru*<br>*2.Anupa-Mahisha*<br>*3Vaisaya-Kurma, Karkataka*<br>*4.Varichara-Hamsa, Balaka, Baka*<br>*5.Aja*<br>*6.Vishkira*<br>*7.Varaha* |
| 4 | *Shakavarga* | *Changeri, Mandukaparni, Kuchela, Avalguja, Patola, Vasa, Kembuka, Nimba, Kathillaka, Karavellaka, Kusumbha, Amlika*<br>*Karavellaka, Vartaka, Mulaka, Pindalu, Lashuna* | *Upadika, Kumuda, Utpala*<br>*Changeri, Kasamarda, palandu* |
| 5 | *Phalavarga* | *Bilva, Jambu, Badara, Gangeruki, Bimbi, Ingudi, Tinduka, Bhibhitaka, Dadima, Vrikshamla, Matuluga, Karchura*<br>*Vrikshamla, Peelu, Matuluga, Amlika* | *Mridvika, Amrataka, Parushaka, Draksha, Badara, Karkandhu, Nikkucha, Panasa, Mocha, Vatama,Mukula, Nikucha, Urumana, Priyala, Slesmataka, Ankota* |
| 6 | *Madyavarga* | *Jagala, Arishta, Pakvarasa, Madhu, Amlakanji* | *Sura, Madira, Gauda, Maireya, Madhulika* |
| 7 | *Jalavarga* | *Hemanta Rtu jala* | *Varsha Rtu jala, Anupa desha jala* |
| 8 | *Gorasavarga* | *Avishkira, Aushtra kshira* | *Varsha Rtu jala, Anupa desha jala* |
| 9 | *Taila Varga* | *Sarshapa taila* | *Eranda taila* |
| 10 | *Harita Varga* | *Shunti* | *Palandu* |
| 11 | *Kritanna varga* | *Laja* | *Veshvara ,Pruthuka, Rasala* |
| 12 | *Aushadha Varga* | *Trikatu, Gomutra, Shilajatu, Lohabhasma, Agarulepa, Agnimantha swara*<br>*Hingu, Triphala, , Eranda,*<br>*Ardraka, Bilwa, Kashmarya, Tarkari, Patala, Tinduk* | *Lavana, Samudra lavana, Pippali*<br>*Brimhana, Anuvasana basti, Snehana* |

**Table No. 2 Pathyapathya Vihara in Medoroga**

| Sr. No. | *Pathya Vihara* | *Apathya Vihara* |
|---|---|---|
| 1 | *Jagarana* | *Sheetal Jala Snana* |
| 2 | *Nityabhramahana* | *Divasvapna* |
| 3 | *Ashvaarohana* | *Avyavaya* |
| 4 | *Hastyavarohana* | *Avyavaayana* |
| 5 | | *Adhyashana* |
| 6 | | *Asana such* |

**Table No. 3. Manas Sambhandhi Pathyapathya in Medoroga**

| Sr. No. | Pathya | Apathya |
|---|---|---|
| 1 | Chinta | Achintana |
| 2 | Shokha | Harshanityatva |
| 3 | Krodha | Manasonivritthi |

**Table No.4 Similarities in Dyslipidemia and Ayurveda[28]**

| Etiological Factors | |
|---|---|
| According To Modern | According To Ayurveda |
| Intake of high fat diet | *Medyanna Atisevan* |
| Lack of exercise | *Avyayam* |
| Sedentary life style | *Divaswapna* |
| Genetic predisposition | *Bijaswabhava* |
| Clinical Features | |
| Excessive deposition of fat in abdomen, waist, buttock etc | Sphik, udara, parshva ,sthanapradeshi Atimedovriddhi |
| Excessive appetite | Kshudatimatra |
| Exertional dyspnoea | Kshudrashwasa |
| Excessive perspiration | Atisweda |
| General weakness | Dourbalya |
| Complications | |
| Decreased life expectancy | Aushohrasha |
| Mechanical disabilities | Javaprodha |
| Loss of immunity | Alpaprana |
| Cardiovascular &cerebrovascular Diseases | Vata Vikara |

***Agni:*** *Agni* is responsible for all metabolic activities in the body, it is responsible for increase and decrease of *Dhatu*[xviii], *Jatharagni* is the prime metabolic principal mainly responsible for giving strength to the *Bhutagnis* as well as the *Dhatvwgnis*.[xix]

***Jatharagni:*** *Jatharagni* is synonym of *Pachak Pitta*, The *Pachaka Pitta* dose digestion of all kinds of ingested foods. The main characteristic of *Jatharagni* is to cause *Sanghatabeda* or disintegration of bigger molecules of food to make it ready for absorption .Absorption being an active phenomenon is helped by *Jatharagni*. It does two functions, digestion and absorption. It is prerequisite for digestion by *Bhutagnis* and *Dhatwagnis. Jatharagnipaka* can be referred as the action of lingual lipase and gastric lipase present in the saliva and stomach respectively. Both enzymes split the fats into fatty acids and glycerol which can be understood as *Sanghatbheda* of ingested lipid. The partially digested food from *Amashaya* moves to the *Grahani* where it undergoes emulsification by the bile salt to prepare it for the action of water soluble enzymes. The emulsified fat is then split into fatty acids and glycerol under the influence of pancreatic and intestinal lipases. These are taken up by the epithelial cells of the intestine to from new triglycerides and are released as chylomicrons in the lymph.

**The *Avasthapaka* occurs by *Jatharagni*, which starts from mouth.**

- ***Madura Avasthapaka.*** Saliva present in the mouth aids the digestion by splitting the fats by lingual lipase; the duration of this stage takes place for a prolonged period in fat digestion which leads to increased synthesis and secretion of *Kapha Dosha* which is produced during the stage.
- ***Amla Avasthapaka-*** The secretion of hydrochloric acid by gastric glands and activity of gastric lipase, in the duodenum pancreatic juice is capable of digestion of triglycerides; there is also action of enteric lipase for splitting of triglycerides.
- ***Katu Avasthapaka-*** means the phase of absorption of fatty acids and glycerol from the intestine .This requires the formation of specialized water soluble spheres consist in of partially digested fats and bile salts known as micelles.

*Jatharagni* also activates *Bhutagnis* by supplying them with properly formed substrate which constitutes the second level of digestion.

***Bhutagnipaka:*** Action of *Bhutagni* occurs on the substrate after the action of *Jatharagni* and completes the process of intestinal digestion of lipids. The *Bhutagni* assimilate the digested food for the action of *Dhatvagnis*. The lipid being *Apa* and *Prithvi Mahabhuta* dominant are acted upon by *Apyagni* and *Parthivagni* in the intestine. Dr. C. Dwarkanath has stated that the *Bhutagnipaka* occurs in liver.[xx] According to Chakarapani this Paka result in transformation of attributes of each group and assuming new qualities of *Vilkshana Guna.*[xxi]Thus the digested portion of the lipids which are dominant in *Aap* and *Prithvi Mahabhuta*, Also he has correlated *Parthivagni* with bile salt and *Aapyagni* with the intestinal and pancreatic lipase.[xxii] Thus the action of liver is to breakdown fats derived from plants and animal sources to their elemental from and rebuild them in the body as organism specific lipids.

Cholesterol is primarily synthesized within the body (endogenous) production in the liver from acetyl CoA through the HMG-CoA pathway. Similarly the liver also synthesizes phospholipids, triglycerides (from fatty acids and also from the excess of carbohydrates and proteins) and other categories of lipids. This synthesis of different categories of body lipids by liver which are easily assailable within the body cells may be known as the action of *Bhutagnis.*

***Dhatwagnipaka****:* The *Sarabhaga* of *Annarasa* of the ingested food which is the result of action of both *Jatharagni* and *Bhutagni* is absorbed from the *Amashaya* and distributed throughout the body by means of the *Dhamnis*, after the action of *Bhutagnis*[xxiii], like this *Medo dhatu* formed by the action of *Medodhatwagni*. *Chakarpani* has mentioned two types of *Dhatus* Viz, *Asthayi Dhatu* and *Sthayi Dhatu* After the action of *Dhatwagni, Asthayidhatu* is precursors of the *Sthayi dhatu* and are circulated in the body with *Srotas, Sthayi Dhatu* of *Medo Dhatu* can be correlated with Adipose Tissue and it also refers with *Baddha Medas* and *Asthayi bhaga* of *MedoDhatu* with lipoproteins synthesis in the liver, also refers with *Abaddha Medas*. When *Dhatvagni* function is decreased then quantitative synthesis of dhatu is increased. Whereas when its function is increase hence it increases by its qualitative (A H Su 11, 34). Same can be applied to *Medo Dhatu*, which leads to *Atisthoulya* or *Karshya.* In case of decrease in function of *Medodatwagni* the quantity of *Asthayi* or *Abaddha Meda* increases and is called as Hypercholesterolemia.

***Vayu****: Samana Vayu* is vitiated in *Amashaya*, which responsible for *Medo Roga* and also *Vyana Vayu.* Is main transport Vehicle for the circulation of *Ahara Rasa* in the body, The vitiation of *Vyana Vayu* results in disease pertaining to the entire body and it is responsible for circulation of lipoproteins throughout the body.

***Srotas:*** The channels in the body are called as *srotas*, which does the transportation of *Asthayi Dhatu* to the formation of *Sthayi Dhatu*. When any reformative place (*Khavgunya*) in the place *(Su Su 24/10)* same pathogenesis taking place in hyperlipidemia.

***Ashraya-Ashryaee Bhava* of *Medas:*** *Kapha* and *Medas* having *Ashraya-Ashryee Bhava, Kapha is Ashraya and Medas* is *Ashrayee.*

***Medo Dhatu Mala:*** *Sweada is Mala of Medo Dhatu.*

***Meda Upadhatu:*** *Snayu* is the *Upadhatu* of *Meda.*

## MEDOROGA

*Sthoulya, Medoroga* and *Medodosha* have been described to be synonyms to one another. The term *Medoroga* was first used by *Acharya Madhavakara* to define obesity and related lipid complications. Only *Adhamalla* while commenting on *Sharangdhara Samhita*, tried to differentiate between the two types of *Medo Roga*. [xxiv]

- ***Medo Roga:*** Adiposity including its clinical features (*Sthaulya*).
- ***Medo Dosha:*** Lipid disorders where *Meda* acts as an etiological factor in the genesis of other diseases.
- **Concept of *Meda*:**

**Two type of *Meda* are described**

- ***Baddha Meda* (Bounded/unmovable):** The fat which is not mobile and is stored in the form of fat at various places (fat deposits/Omentum/muscle in the body)
- ***Abaddha Meda* (unbound able/movable):** The fat which is mobile and circulate in the body along with blood in the form of lipids (cholesterol, Triglycerides, LDL, HDL, VLDL etc).

**NIDANAPANCHAKA**

***Nidanas* (Hetu) of *Medoroga:***

*Nidanas* of *Medoroga can be categorized in two groups Bhaya Karanas* means taking *Meda* (fat) diet, another is *Abhyantara Karanas* means Dosha, *Dhatu, Mala,* and *Srotas* etc. All *Nidanas* described by *Acharyas* can be classified in four categories as explained under:

- *Aharatmaka Nidana*
- *Viharaatmaka Nidana*
- *Manas Nidana*
- *Anya Nidana*

Factors like *Avyayama, Divaswapa*, excessive consumption of *Medya Ahara* and *Varuni* lead to *Medovaha Srotodushti* causing a state of *Khavaigunya* in the *Meda Dhatu*.

**Purvaroopa (Premonitory Signs):** These *Purvarupa* are those signs and symptoms, which appears during the process of *Sthanasamasharya* by the vitiated *Doshas* and *Dooshyas*. The knowledge of *Purvarupa* is important for differential diagnosis and to treat the disease in its beginning so that disease can be controlled easily and cannot develop further. In the context of *Medoroga, Purvarupa* are not mentioned separately and so the initial manifestations of *Medoroga* related symptoms can be considered. *Medovaha Srotodushti Lakshanas* which are also mentioned as *Prameha Purvarupas* can also be considered as *Purvarupa of Medoroga* as there is similarity in *Samprapti* of *Prameha* and *Medoroga* by the involvement of *Bahudrava Shleshma* and *Abaddha Meda*. So *Shleshma Sanchya*, *Purvarupas* of *Prameha*, *Medovaha Srotodushti Lakshanas* and symptoms related to *Medodushti* like *Atinidra*, *Tandra*, *Alasya, Visrashariragandha*, *Angagaurava, Shaithilya* etc. can be considered as *Purvarupa* of *Medoroga* as well as *Prameh Purvrupas* viz. coated feeling of teeth, burning sensation of hands and feet, excess of thirst, sweet taste of mouth can be considered *Purvarupas* of *Medoroga*.[xxv]

According to *Madhavnidan, in Purvarupa*stage, there is increase of Medo *Dhatu* mainly at abdominal area.

**Premonitory Symptoms of Hypercholestremia:**

Modern science also does not give much information regarding premonitory symptoms of hypercholestremia. So, high lipid levels, low metabolic rate, weight gain and its related initial or mild symptoms can be taken as premonitory symptoms.

**Rupa (Clinical Manifestation):** *Acharya Charaka* has mentioned eight main Rupa of *Medoroga*.

- ***Ayushorhas*- Reduced life span:** *Purva Dhatu* is responsible for noushiment of *Uttar Dhatu*. In *Medoroga* due to *Srotorodha* only *Medodhatu* get nourished and other *Dhatu* cannot nourish properly leads to *Ayushorhas*. As persons suffering from Hyperlipidemia in longer leads CVD, their life span is less.
- ***Javoparodha*-Early sign of senility:** Because of abnormality and malformation of *Dhatus*, Due to their *Shaithilya (*flabbiness), *Sukumarya* (delicacy) and *Guruta* (heaviness), early sigh of senility are seen.
- ***Kruchra Vyavayata*-Difficulty in sexual intercourse:** Due to malfunctioning of *Dhatus* nourishment of *Indriya* hampers resulting in lack of sexual desire. *Vrushan* (testis) the main site of *Shukravaha Srotas* is formed from *Medha* and *Kapha*, vitiation of *Medha* and *Kapha* leadsto vitiation of testes and *Shukra* formation.
- ***Daurbalya*-Fatigue:** *Rasa Dhatu's* main function of *Preenan* i.e. proving nourishment to the other *Dhatus*, is affected which leads to *Daurbalya.*
- ***Daurgandhya*-Foul body odor:** Due to *Adika Sweda* which is *Mala* of *Meda* leads to *Daurgandha*. This bad odor is observed in mouth, body parts, urine, feces, sweat etc.
- ***Swedabadh*-Excessive perspiration:** Due to *Kapha, Sansarga* of *Meda*, *Vishyanditva* (liquidification) of *Meda*, *Guruttva* of *Meda, Vyayama Asahattva* (unable to exercise) is resulting and lead to *Swedabadh*.
- ***Atikshudha*-Increase in hunger:** Excessive accumulation of *Meda* causes obstruction in the way of *Vata* leads to *Agnisandhukshan* in *Koshtha.* This *Teevra Agni*digests the food fast and thus excessive hunger is seen in *Medoroga*. Due to increased cortisol secretion, the intense digestive power and hyperactive *Koshtha, Vata bring* about excessive appetite & hunger. This is due to excess tissue needs of nutrition.
- ***Atitrushna*-Increase in thirst**: Excessive thirst is said to be due to *Tikshnagni* and aggravated *Vayu*to be the main cause. The *Teekshna Agni* and *Ruksha Guna* of *Vayu* lead to *Talushosha.*

**Samprapti (Pathogenesis):** *Samprapti* is main process of manifestation and spread of the disease, starting from the *Dosha Dushti* itself. *Medoroga* is *Dushya* dominant disorder. *Dalhana* the commentator of *Sushruta Samhita* explained *Samprapti* in detail, while commenting on *Sushruta* version of *Samprapti*. He gave three reasons, by which he tried to explain, why only *Meda i*s going to increase.[xxvi]

- *Vishishta Aharavash* at (use of specific dietary and lifestyle factors)- The use of specific dietary factors like *Atimadhura, Atisnigdha Ahara* and life style factors like *Avyayama,Divaswapa* etc. lead to a *Jathargni dushti* which results in diminished digestive power. This further leads instigates the formation of *Ama Anna rasa* and subsequent *Ama Rasa Dhatu*. The *Ama Rasa Dhatu* leads to *Medodhatvagnimandya.* The above consumed factors due to their affinity for *Medo Dhatu* cause a direct increase in the *Asthayi Medo Dhatu*.
- *Adrishtavashat* (hereditary, genetic factors) - A genetic preponderance leading to *Khavaigunya* in the *Medovaha Srotas. Avarana* of *Vata* by *Medo Dhatu* attributable to secondary conditions like Diabetes mellitus, Hypothyroidism also results in a state of *Khavaigunya.*
- *Medasavritta Margatvat* (secondary conditions like DM etc) A genetic preponderance leading to *Khavaigunya* in the *Medovaha Srotas. Avarana* of *Vata* by *Medo Dhatu* attributable to secondary conditions like Diabetes

mellitus, Hypothyroidism also results in a state of *Khavaigunya.*

**Management of Hypercholesterolemia through Ayurevda:** The basic principles of treatment for hypercholestraemia can be categorized in three groups:

- Nidana Parivarjana (Avoidance of causative factors)
- General principles of management, which include
  - Apatarpanachikitsa
  - Sodhanachikitsa
  - Samanachikitsa
- Pathya&Apathya (Modified Diet & Life Style).

Hypolipidemic drugs/lipid regulating drugsaccording to Ayurveda, (charak) lekhan drugs can be correlated to hypolipidemic drugs .lekhan drugs are described in lekhniyamahakshaya.

**Nidana Parivarjana (Avoidance of causative factors):** Causative factor which are mentioned above should be avoided so that it will be helpful to treat that condition. As Acharya Shusruta says in uttar sthan before deciding any treatment proper prevention should be taken.

**Samanya Chikitsa (General principles of management):** *Medoroga* (Hypercholesterolemia) is a *Santarpanjanya Roga*as stated earlier, hence *Samanya Chikitsa* is *Apatarpan*.
*Ullekhana, Raktamokshana, Vyayama, Upavasa, Dhuma, Swedana, Sakshaudra Ahara, Abhayaprasha, Rukshanna Sevana*, different types of *Churnas* and *Pradehas* can all be employed as *Aptarpana Chikitsa*.

**Apatarpanachikitsa:** *Kapha Dosha* and *Medo Dhatu* are the main factors vitiated in the pathogenesis of Hypercholesterolemia; its *Vishesha Chikitsa* refers to the measure leading to the reduction of the previous two. Since the treatment of two diseases *Sthaulya* and *Prameha* aim in the reduction of excessive *Kapha Dosha* and *Medo Dhatu*, these can also be considered as the line of treatment for the *Vriddha Asthayi Medo Dhatus.*

In the *Chikitsa* of *Sthaulya Acharya Sushruta* has indicated the use of *Shilajatu, Guggulu*, *Gomutra, Triphala, Loharaja, Rasanjana, Madhu, Yava, Kordusha, Shyamaka, Uddalaka*, use of *Virukshana* and *Chedaniya Dravyas, Vyayama* and *Lekhana Basti*. *Acharya Sushruta* has suggested common treatment for *Kustha, Prameha, Sthaulya* and *Shotha*. He has mentioned nine drugs which are effective in the *Dushti* of *Medadhatu* in *Kushtha Roga Chikitsa* which can serve as a guideline for the treatment of Hypercholesterolemia. These are seen to be more effective after *Samshodhana Chikitsa, Acharya Sushruta* has also described a unique regimen in *Prameha Chikitsa* which can be effectively employed in the management of Hypercholesterolemia. He has stated different activities depending on the requirements of the patient for causing maximum physical efforts like exercises, travelling on chariots, walking long distances. He has also given advised to walk a distance of 100 *Yojana* and follow dietary restrictions. Thus it can be seen that the role of physical activity was appreciated even in the ancient times. Also *Acharya Charaka* has appreciated the role of physical activity conditions due to over nutrition. This can also be considered to be the *Nidana Viparita Chikitsa* of Hypercholesterolemia. Physically active people tend to have higher HDL ("good" cholesterol) levels. Research suggests that regular aerobic exercise can help increase HDL levels. Even moderate exercise reduces the risk of heart attack and stroke. It is has also been recently proven that people with an active lifestyle have a 45% lower risk of developing heart disease than sedentary people.

**Sodhanachikitsa**

- Bahya- Udvartana; Kolakulathadi, triphala
- Abhyantara- Virechana/ Basti
- Lekhana Basti

**Samana chikitsa**

**Drugs of Lekhniyamahakshaya:** Musta, kutha, haridra, daruharidra, vacha, ativisha, katurohini, chirbilva, hemvati, chitrak, According to Shusruta, varunadigana acts as kaphamedhohar. Other hypolipidemic drugs;- vidanga, agnimantha, gugglu, aamlaki, haritaki, vibhitaki, rasone, vacha, arjuna, shigru, madanphala, parisha, karvellaka, kulatha,. Some pharmacological and clinical studies reported in Ayurvedic and other herbs are described below;

**Triphla:** (Aamlaki (Embilica officinalis), Haritaki (Terminalia chebula), Vibhitaki (Terminalia belerica)) One study which evaluated the herbal formulation TPL in mice showed that the body weight was found to be reduced when compared with the control animals (Rasool *et al*., 2000). Gallic acid is a phenolic compound of TPL which is selected as a bioactive marker due to its easy availability, and its anti-obesity property (Sharma *et al*., 2009). Accordingly, a randomized, double-blind, placebocontrolled, clinical safety and efficacy trial at Shahed University in collaboration with Endocrinology and Metabolism Research Institute (EMRI) has being conducted for evaluation of the activity of TPL in obesity implementation (unpublished data).

**Agnimantha (Premna obtusifolia):** The drug Agnimantha is having katu tikta rasa, rukshanguna, ushanvirya, katuvipka .On the basic of the quality of the drug, The pharmaco dynamic action is considered .the drug is consisting of katu and tikta rasa, which consisted of vayu and agni and vayu and aakash mahabhuta, respectively due to the predominance of akash, vayu and agni, the kaphagets subsided subsequently, therukshaguna counteract kapha.katu rasa directly combat Sthaulya and tikta rasa acts on meda .therefore, both the rasa (tikta & katu) are responsible to encounter Sthaulyadirectly. Agnimantha (Premnaobtusifolia R.Br) showed significant therapeutic value in the treatment of obesity. It gave encouraging result, when administered with scheduled diet and exercise. It is necessary to mention here that the drug is effective on LDL HDL ratio .which is known as atherogenicindex. In respect to LDL HDL ratio, the drug was significant after treatment of 6 and 9 months this Drug was effective on cholesterol HDL ratio after treatment of 6 and 9 months. Hence, the drug is effective for the treatment of obesity. (5)

**Guggulu (Commiphoramukul)** The use of guggulu in the treatment of obesity has been mentioned in Susruta Samhita, Astangahridayaand in charaksamhita. The resin of the Commiphoramukul tree has been used in ayurvedic medicine for more than 2000 years to treat a variety of ailments. Studies in both animal model and humans have shown that this resin termed gumguggulu can decrease elevated lipid levels. The

stereoisomers E&Z-guggulsterone have been identified as the active agents in thisresin. Recent studies have shown that these compounds are antagonist ligands for the bile acid receptor farnesoid Xreceptor (FXR), which is an important regulator of cholesterol homeostasis.

**Arjuna (Terminaliaarjuna):** The drug arjunais having lagurukshaguna, kshaya rasa, katuvipaka, seetvirya, on the basic of quality of drug, the drug acts as medhohar (6). Clinical evalution of this botanical medicine indicates it can be of benefit in the treatment of coronary artery diseases, heart failure, and possibly hypercholesterolemia. Terminalia's active constituents include tannins, triterpenoids aponins (arjunicacid, arjunolic acid arjungenin, anrjunglycosides) flavonoids (arjunone, arjunolone, luteolin), gallic acid, ellagic acid, phytosterols, calcium, zinc. Ayurvedic texts have described Arjuna as " Hriddya", which means something beneficial to the heart .

**Shigru (Moringa oleifera):** The drug sigru is havinglagurukshatikshanguna, katutikta rasaushanvirya, katuvipaka. on the basic of quality of drug, shigru is used in lekhan karma. Three varieties of moringa explained in Ayurvedic text books –Shyama (black variety), Shveta (white variety) and Rakta (red variety it is also called as Madhushigru). Black variety of shigru is the most common .It is good for heart, Cardic tonic It helpful to decrease fat and obesity.

**Parish (Thespesia populnea):** The drug is having lagurukshaguna, kashaya rasa, seetvirya, katuvipaka on the basic of quality of drug, the drug acts as medhohar.

**Aralu (Ailanthus excelsa):** The drug is having rukshaguna, tiktakashaya rasa, seetvirya, katuvipaka .on the basic of qulitiy of drug, the drug is used in lekhan karma.

- Vyoshadi guggulu
- Amritadhguggulu,
- vidangadhlauha,
- Tyushnadhlauha ,
- Vidangadichurna,
- Trimurtirasa,
- Triphlaguggulu ,
- Medoharguggul,
- Kaishor guggul,
- Triphala,
- Lashuna
- Arjuna
- Amlaki
- Sarpagandha
- Navakguggulu
- Lohaaristha,
- Shilajatu (Asphalt)
- Rasanjana
- Loharaja
- Haridra- *Curcuma*
- Shigru- *Moringa olifera*
- Nirgundi- *Vitex nigundo*
- Vidanga- *Embelia ribes*
- Agnimantha- *Premna integrifolia*
- Udumbara- *Ficus*
- Musta- *Cyperus rotundus*
- Lashuna- Garlic etc can be used in
- samanachikitsha.

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